Artificial Intelligence and Student-Teacher Interaction in Online Learning

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Abstract - Artificial intelligence (AI) systems offer effective support for online learning and teaching, including personalizing learning for students, automating teachers' routine tasks, and powering adaptive assessments. However, while the opportunities for AI are promising, the effect of AI systems on the interactions between students and teachers are still elusive. In online learning, student-teacher interaction has a profound effect on students' satisfaction and learning outcomes. The study used the qualitative approach and was participated in by fifty-two (52) participants, composed of teachers and students. Findings show that participants envision adopting AI systems in online learning can enable personalized student–teacher interaction at scale but at the risk of infringing social boundaries. Although AI systems have been positively recognized for improving the quantity and quality of communication, for providing timely, personalized support for large-scale settings, and for improving the feeling of connection, there were concerns about responsibility, work, and feedback. From the discussion, AI has fostered the improvement of instructional communication, engagement, and support towards optimal learning. With the utilization of AI in online learning, student-teacher interaction becomes engaging and intuitive, innovative, and creative towards an improved overall standard of education.

Keywords: Artificial intelligence, Student–teacher interaction, Online learning

Introduction
The opportunities for artificial intelligence (AI) in online learning and teaching are broad [1, 2, 3], ranging from personalized learning for students and automation of teachers' routine tasks to AI-powered assessments [4]. AI helps teachers save time answering students' simple, repetitive questions in online discussion fora, and instead teachers can dedicate their saved time to higher-value work [5]. AI analytics allows teachers to understand students' performance, progress, and potential by decrypting their clickstream data [6, 7, 8].

While the opportunities for AI are promising, students and teachers may realize the impact of AI systems negatively. For instance, students may observe indiscriminate collection and analysis of their data through AI systems as a privacy breach [9, 10]. The behavior of AI agents that do not consider the risk of data bias or algorithmic bias can be perceived by students as discriminatory [11, 12]. Teachers worry that relying too much on AI systems might compromise the student's ability to learn independently, solve problems creatively, and think critically [13]. It is important to examine how students and teachers perceive the effect of AI systems in online learning environments[14].

The AI in Education (AIEd) community is increasingly exploring the impact of AI systems in online education. Roll and Wylie (2016) call for more involvement of AI systems in the communication between students and teachers, and in education applications outside school context. Popenici and Kerr [4] investigated the impact of AI systems on learning and teaching, and uncovered potential conflicts between students and teachers, such as privacy concerns, changes in power structures, and excessive control. Indeed, student–teacher interaction plays a crucial role in online learning. Kang and Im [15] demonstrated that factors of student–teacher interaction, such as communication, support, and presence, improve students' satisfaction and learning outcomes. The student–teacher interaction further affects students' self-esteem, motivation to learn, and confidence in facing new challenges. Guilherme [16] predicted that AI systems would have "a deep impact in the classroom, changing the relationship between teacher and student." More work is needed to understand how and why various forms of AI systems affect student–teacher interaction in online learning [17].

Conceptual Framework
Kang and Im [15] proposed a framework for student-teacher interaction in online learning environments relevant to the utilization of AI through the following key factors: *Communication*- the instructional communication (Q & A) between students and teachers about topics directly related to learning contents; *Support* – the instructional management by the teacher, including supporting learning materials and providing feedbacks directly related to learning contents; and *Presence* – the connectivity between students and teachers during the online learning process.

Purpose of the Study
The study was conducted amid the COVID-19 pandemic. Students and teachers have heightened awareness about the importance of online learning. The aim was not to evaluate specific AI technologies, but instead, to explore areas where AI systems positively contribute to student-teacher interaction in online learning pertinent to communication, support, and presence.

I. METHODOLOGY

The study made use of the qualitative approach to research, with the phenomenology as the research design. Through the phenomenological method, the participants' experiences are probed. Fifty-two (52) participants, composed of teachers and students, were interviewed to identify the benefits and challenges of AI in student-teacher interaction in online learning. Thematic analysis along the conceptual framework was employed to identify the common themes that encompassed the responses of the participants.

Results and Discussion

The central theme of participants' responses, which stood out repeatedly in the study, was that adopting AI systems in online learning enable personalized teacher-student interaction along communication, support, and presence.

Table 1 Summary of the Students' and Teachers' Assessment on AI Systems in Online Learning

Factor of Student-Teacher Interaction	Effects of AI Systems	Students' Assessment	Teachers' Assessment
Communication	Quantity and Quality	Students believe that the anonymity afforded by AI would make them less self-conscious and, as a result, allow them to ask more questions.	Teachers believe that AI could help answer simple, repetitive questions, which would allow them to focus on more meaningful communication with students.
	Responsibility	Students worry that AI could give unreliable answers and negatively impact their grades.	Teachers predicted conflicts between students and the instructor due to AI-based misunderstandings or misleadingness.
Factor of Student-Teacher Interaction	Effects of AI Systems	Students' Assessment	Teachers' Assessment
Support	Timely	Students believe that AI would support personalized learning experiences, particularly with studying and group projects.	Teachers believe AI could be effectively leveraged to help students receive timely personalized support.
	Work	Students observed that standardized support from AI might have a negative influence on their ability to learn effectively.	Teachers are wary of the fact that too much support from AI could take away students' opportunities for exploration and discovery.
Presence	Connection	Students believe that AI can address privacy concerns and support student-teacher connections by providing social interaction cues without personal camera information.	Teachers believe that the addition of AI would help them become more aware of students' needs.
	Feedback	Students are uncomfortable with the assessment of their unconscious behavior, such as eye tracking or facial expression analysis, because it feels like surveillance.	Teachers were negative about relying on AI interpretation to understand students' social interaction cues.

Table 1 shows that students and teachers expect that AI systems benefit student–teacher interaction in online learning in terms of improving the quantity and quality of communication, enabling timely personalized support for students at scale, and giving them a feeling of improved connectivity. However, at the same time, students and teachers were concerned that AI systems could create responsibility, work, and feedback issues in online learning.

1. Communication

In online learning environments, communication refers to questions and answers between students and the instructor about topics directly related to learning contents, such as instructional materials, assignments, discussions, and exams[15]. Students and teachers expect AI systems will positively impact the quantity and quality of communication between them but bears the risk causing miscommunication and responsibility issues.

1.1 Quantity and quality

Students believe that the anonymity afforded by AI would make them less self-conscious and, as a result, allow them to ask more questions. In online learning environments, students are generally afraid to ask questions to their teachers during class. Students believe that AI removes self-consciousness that typically exists in instructional communications. As a result, AI systems would nudge them to ask more questions in online learning. On the other hand, teachers believe that AI could help answer simple, repetitive questions, which would allow them to focus on more meaningful communication with students. Answering repetitive questions from students takes a huge amount of time. Teachers reflected that the time saved from tedious tasks, such as answering administrative questions, could allow course teams to focus on more content-based questions. Through AI, teachers can communicate more meaningfully with students by helping them to focus more on new questions or use their time for more comprehensive questions.

1.2 Responsibility

Although students believe AI systems would improve the quantity and quality of instructional communication, they worry that AI could give unreliable answers and negatively impact their grades. In particular, students are concerned about how teachers would react if something went wrong because they trusted the AI. Consequently, teachers predicted conflicts between students and the teacher due to AI-based misunderstandings or misleadingness. For example, a conflict could arise from potential discrepancies between answers from AI and the teacher. The concern is the quality of the response, given that there can be ambiguity in the way the students post questions. Teacher can foster opportunities to cast off doubts and clarify misunderstandings in the lesson.

2. Support

In an online learning environment, support refers to the instructor's instructional management for students, such as providing feedback, explanations, or recommendations directly related to what is being taught [15]. Students and teachers expect a positive impact from AI systems in terms of enabling timely personalized support for students, but they expect a negative impact in that excessive support could reduce student's work and ownership of learning.

2.1 Timely

Students believe that AI would support personalized learning experiences, particularly with studying and group projects. Students affirm that AI could help them engage in teacher-independent activities like team study and group projects. In some cases, the sense of personalization led students to describe the systems as if they could fulfill roles as members of the team. Subsequently, teachers believe AI could be effectively leveraged to help students receive timely personalized support. Teachers appreciated how immediate feedback afforded by AI could help students study and effectively understand gaps in their knowledge, particularly at times when they would be unavailable. Similarly, AI could support students who would otherwise be learning asynchronously. Furthermore, AI systems could be supportive of student engagement because they are getting real-time answers.

2.2 Work

Even though students appreciated the support that they could potentially receive from AI, students perceived that standardized support might have a negative influence on their ability to learn effectively. They pointed out that AI can set an arbitrary pace for a student to follow, despite the fact that the learning experience should involve learning about oneself and going at one's own pace. Similarly, they focused on how AI could detract from the fact that experiences with schoolwork can help students later in life by giving them a false sense of security in doing projects. On the Instructors' side, they are similarly wary of the fact that too much support from AI could take away students' opportunities for exploration and discovery. They were concerned that students could lose opportunities to learn new skills or learn from their mistakes.

3. Presence

In online learning environments, presence refers to a factor that makes students and instructors perceive each other's existence during the learning process [15]. Students and teachers expect the impact of AI systems to be positive in terms of giving them a feeling of improved connectivity, and feedback problems.

3.1 Connection

Students believe that AI can address privacy concerns and support student-teacher connections by providing social interaction cues without personal camera Information. They stated that they do not want to turn on their camera in online learning, even though turning off the camera adversely affects their presence and participation in class. In this sense, they liked the Virtual Avatar system, where AI communicates student facial expressions and body language to the instructor via a virtual avatar. Students expect that this will make them feel more comfortable attending the class and less intrusive about at home learning. Overall, students appreciated the potential of AI systems as it solves the problem of not needing to show actual face but can still participate in class. Conversely, teachers believe that the addition of AI would help them become more aware of students' needs. They stated that students tend to turn off their cameras in online learning spaces. They also generally expressed that AI systems like Virtual Avatar and AI Facial Analytics could be helpful for they would allow students to share their body language and facial expressions without directly sharing their video feed. Furthermore, emphasizing that turning on the camera can be helpful not just for the teacher but also for students' own accountability. Overall, instructors appreciated AI's ability to provide critical information to understand how students are doing and how they feel in online learning.

3.2 Feedback

Although AI can strengthen the connection between students and teachers, students are uncomfortable with the measurement of their unconscious behavior, such as eye tracking or facial expression analysis, because it feels like surveillance. They are concerned that facial expression is something that happens might be outside of their control, so AI might overlook the nuance of authentic human emotion. Similarly, they expressed that nuances in social interaction are something that should be left up to humans and not guided because it is innately something to humans. Overall, students complained that they did not want to use AI's measures of unconscious behavior, such as eye tracking or facial expression analysis, even if there are positive aspects. Correspondingly, teachers were negative about relying on AI interpretation to understand students' social interaction cues. All teachers felt uncomfortable with collecting private data, such as eye movements and facial expressions of students through AI. Additionally, they are concerned that AI Facial Analytics might force students to smile to get a good engagement score, which could adversely affect online learning itself. In this sense, they declined to use AI systems that use eye tracking and facial expression analysis in their online classes. In general, instructors were uncomfortable with AI giving detailed information about how students engage with their online classes, and they wanted to understand these social interaction cues for themselves.

II. CONCLUSIONS

The role of artificial intelligence in student-teacher interaction in online learning has been unprecedented, especially during the pandemic. From the discussion, AI has fostered the improvement of instructional communication, engagement, and support towards optimal learning. With the utilization of AI in online learning, student-teacher interaction becomes engaging and intuitive, innovative, and creative towards an improved the overall standard of education.

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