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Exploring pre-service teachers' perspectives on integrating artificial intelligence in education

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ABSTRACT

Artificial intelligence (AI) is increasingly influencing education and is anticipated to be a key driver of future educational reforms. This study examines pre-service teachers' perceptions of AI's role in higher education. Using a quantitative descriptive approach, data were collected from a randomly selected sample of first-year students to ensure representativeness. The findings reveal a prevailing neutrality among participants, suggesting limited AI literacy, while many expressed optimisms about its transformative potential. Despite recognizing AI's pedagogical benefits, concerns about its challenges persist. The study underscores the necessity of comprehensive AI-focused training programs to equip future educators with the competencies required for effective AI integration in education.

Keywords: artificial intelligence, pre-service teachers, teachers perspectives, AI in education

INTRODUCTION

The accelerated integration of artificial intelligence (AI) across various sectors substantially alters how our societies operate, and education is no exception (Chen et al., 2020). Teachers have great potential as AI technologies keep improving, but they also have major difficulties. Leading front-edge pre-service teachers are responding to a fast-changing educational environment and becoming ready to guide the next generations in a world increasingly shaped by AI (Vakarou et al., 2024; Haseski, 2019).

Understanding the viewpoints of pre-service teachers is essential, as they will be the forthcoming cohort of educators influencing the implementation of AI in schools (Sanusi et al., 2024). Their experiences and insights might illuminate the prospective benefits of AI, including personalized learning, enhanced teaching tools, and data-driven decision-making (AlKanaan, 2022). They are well-positioned to illuminate ethical concerns, constraints, and the impact of AI on teacher autonomy and student participation.

Moreover, pre-service teachers' perspectives are pivotal in addressing the practical challenges educational institutions face when integrating AI. Pre-service teachers offer fresh, unbiased insights than in-service teachers, whose perceptions are often shaped by entrenched classroom routines and established pedagogical frameworks (Guan et al., 2020). They are uniquely positioned to identify gaps in AI implementation strategies, as their views are influenced by contemporary teacher education curricula that reflect the latest educational technologies. This perspective helps uncover potential barriers to AI adoption early on, enabling proactive adjustments in training programs to prepare future educators better (Zakaria & Hashim, 2024).

Furthermore, pre-service teachers can highlight AI integration's ethical and pedagogical challenges from a learner-centric viewpoint. Their reflections can reveal concerns about student data privacy, algorithmic biases, and the potential dehumanization of the learning process issues that policymakers may underemphasize, focused primarily on technological efficacy and systemic implementation (Polak et al., 2022).

The ongoing discourse regarding AI in education predominantly focuses on technological capabilities and policy implications (Kotsis, 2025a, 2025b, 2025c). Nevertheless, a notable deficiency exists in comprehending the perspectives of individuals joining the profession regarding this integration. Examining different viewpoints allows for a more thorough comprehension of the benefits and limitations presented by AI, particularly in its application to education (Zhang et al., 2023).

Several studies have been carried out to investigate the views, perceptions, and misconceptions of both students and teachers regarding various science subjects (Gavrilas & Kotsis,

2024; Kotsis & Panagou, 2023a, 2023b; Panagou et al., 2022, 2024a, 2024b, 2024c; Stylos et al., 2025; Tsoumanis et al., 2024). The aim is to enrich international literature and develop more effective teaching methods, curricula, and training for teachers and students.

This study intends to explore different viewpoints, offering a comprehensive analysis of pre-service teachers' perceptions about the role of AI in education. It aims to contribute to the continuing discourse regarding AI in education, providing insights that might improve teacher training programs and guide educational policy-making.

Literature Review

Diverse theoretical frameworks advocate for incorporating AI in education, highlighting the evolving dynamics among technology, pedagogical approaches, and educator cognition (Saputra et al., 2023). This study aims to understand how pre-service teachers' perspectives of AI are shaped by ideas about educational technology and teacher development. These perspectives can influence AI integration in classrooms and impact student learning outcomes.

The study analyzes these viewpoints within a theoretical framework to reveal how future educators can effectively harness AI to enhance teaching methodologies and foster engaging learning environments. AI integration has transformed teaching and learning, and the findings may guide curriculum developers in designing training programs for AI integration in education (Muhie & Woldie, 2020).

AI offers tools that shift education from conventional techniques to customized, efficient, and engaging experiences (Pham & Sampson, 2022). Theoretical frameworks provide insights into AI's impact, including personalized learning, data-driven instruction, automated tasks, and interactive virtual environments (Maghsudi et al., 2021). These frameworks emphasize preparing educators to use these technologies effectively and assess their implications for equity, accessibility, and engagement in diverse learning environments.

Personalized learning experiences

The literature indicates that AI improves individualized learning and is based on constructivist learning theory, which emphasizes the active participation of learners in knowledge construction through their experiences and reflections (Pratama et al., 2023). AI technologies, such as adaptive learning platforms and intelligent tutoring systems, tailor instruction to each student's pace, preferences, and needs. These systems adhere to constructivist principles by establishing individualized learning trajectories that enable learners to interact profoundly with knowledge and enhance their comprehension over time (Ayeni et al., 2024). This personalized approach not only fosters greater student autonomy but also cultivates a deeper understanding of the material, allowing learners to build connections between new concepts and their prior knowledge.

From this viewpoint, AI serves as a facilitator of learning rather than a direct information source, helping pre-service teachers envision applications for student-centered learning. The constructivist perspective (Tapalova & Zhiyenbayeva, 2022) is key to understanding how AI can empower students to direct their own learning, personalize education, and address individual cognitive and social differences. This shift toward individualized learning demonstrates AI's potential to adapt instruction to unique student needs while enhancing classroom engagement and motivation.

Data-driven instruction

Moreover, AI systems can assess enormous volumes of instructional data, enabling data-driven instruction. This approach reduces cognitive load by helping teachers better with the material they offer to their pupils, improving retention and involvement. To provide teachers with real-time feedback and insights, AI technologies examine student performance and behavior patterns, enabling tailored training (Luan et al., 2020).

In addition, AI can alleviate unnecessary workloads by automating data collection and analysis, allowing teachers to concentrate on creating learning experiences that enhance understanding (Koedinger et al., 2013). This study draws on these theories to investigate how pre-service teachers perceive the use of data-driven insights to customize their instruction and improve student outcomes.

Automated administrative tasks

Another AI capacity that has been studied is the automation of administrative duties like scheduling, attendance tracking, and grading (Owoc et al. 2019). This competence emphasizes the necessity of reducing time waste and optimizing resources. By automating mundane chores, educators can devote more time to instructional preparation and student engagement, eventually improving teaching quality (Ahmad et al., 2022). This shift not only enhances the efficiency of educational institutions but also allows teachers to focus on fostering meaningful interactions with their students, thereby creating a more dynamic and effective learning environment.

Pre-service teachers, often burdened by the administrative demands of traditional education, may view AI-driven automation as a means of enhancing their professional efficacy (Ayanwale et al., 2024). By drawing on efficiency, this research examines how pre-service teachers anticipate AI will streamline administrative work, freeing up cognitive and emotional resources to engage more meaningfully in the instructional process (Choi et al., 2023). Furthermore, AI suggests that time management can positively impact teachers' work-life balance by reducing workload pressures, which may influence their attitudes toward AI adoption (Attwood et al., 2020). This shift in perspective could lead to a greater willingness among pre-service teachers to embrace technology as an ally, rather than viewing it solely as a challenge or threat to traditional teaching practices.

Interactive virtual environments

According to Rodriguez et al. (2023), the advancement of AI-powered interactive virtual environments, including augmented reality and virtual reality, provides immersive and collaborative learning experiences that are consistent with social constructivism theory. According to Amineh and Asl (2015), social constructivism, as proposed by Vygotsky, asserts that learning is inherently social, and students acquire

knowledge through interactions with their peers and environment. Interactive virtual environments supported by AI offer opportunities for collaboration, allowing learners to engage in shared problem-solving and exploration in a controlled, dynamic setting. These environments not only enhance engagement but also facilitate personalized learning experiences, catering to diverse learning styles and promoting deeper understanding through active participation.

AI-enabled virtual environments allow students to practice skills in lifelike simulations, supporting situated learning experiences that connect theory to practice (Sinha et al., 2021). This theoretical approach helps to explore how pre-service teachers perceive AI's potential to create collaborative, immersive, and contextually rich educational experiences that go beyond the constraints of the traditional classroom. By leveraging AI's capabilities, educators can design innovative curricula that foster critical thinking and creativity, equipping future teachers with the tools they need to thrive in an ever-evolving educational landscape.

Challenges of artificial intelligence for pre-service teachers in education

The literature identifies inadequate AI preparation as a major barrier for pre-service teachers due to insufficient training in integration (Fundi et al., 2024). Many teacher preparation programs fail to keep pace with technological advancements, leaving future educators ill-equipped to implement AI effectively. Without proper training, teachers may struggle with implementation, feeling overwhelmed by AI's complexities, which can undermine student engagement and limit AI's potential benefits. Ethical concerns, particularly regarding student data privacy and algorithmic bias, further complicate adoption (Remian, 2019).

AI's role in education risks diminishing teacher autonomy and professional identity (Mirbabaie et al., 2022). Tools like data-driven instruction and personalized learning may shift decision-making from teachers to AI systems, potentially reducing educators to facilitators (Karataş & Yüce, 2024). Pre-service teachers fear AI could dehumanize education by assuming responsibilities like course design, assessment, and feedback, eroding their professional role.

Disparities in AI access exacerbate inequities in education (Holstein & Doroudi, 2021). Schools lacking infrastructure, high-speed internet, updated devices, or technical support hinder effective AI integration (Roshanaei et al., 2023). These gaps disproportionately affect under-resourced or rural schools, limiting AI's potential to enhance learning outcomes equitably.

Aims and Scope of Research

This study explores pre-service teachers' perspectives on AI integration in education, examining their views on AI's potential, challenges, and classroom applicability. As AI transforms education, understanding how future educators perceive its role both as a pedagogical tool and a critical subject for students is essential.

Recognizing pre-service teachers' perceptions is vital, as they are the ones who will shape future educational practices in technologically evolving classrooms. Their attitudes influence how effectively AI tools are adopted and how critically students are taught to engage with them. Literature emphasizes that positive attitudes among educators toward AI correlate with greater willingness to integrate it meaningfully into instruction, fostering innovation and personalized learning (Holmes & Tuomi, 2022; Zawacki-Richter et al., 2019). However, this also demands pedagogical preparedness, ethical awareness, and sufficient training, as a lack of confidence or knowledge may lead to misuse or underutilization of AI in classrooms (Luckin & Holmes, 2016; Roll & Wylie, 2016). Thus, examining pre-service teachers' understanding and readiness provides valuable insights into how teacher education programs should evolve to address technological advances responsibly and inclusively.

The focus on pre-service teachers is deliberate: they are at a formative stage of pedagogical identity development, where foundational AI attitudes emerge before classroom experience biases their perceptions. This approach captures their initial, uninfluenced views, offering insights into AI's reception during early training.

Research Questions

The research was skillfully crafted to address the following overarching inquiries:

1. How do pre-service teachers perceive the role of AI in education?
2. What are the main concerns of pre-service teachers regarding the ethical dimension and the impact of AI in the educational process?
3. In what ways do pre-service teachers feel prepared or unprepared to integrate AI-driven tools and technologies into their future classrooms?

METHODOLOGY

Instrument

This study used a structured questionnaire to gather data (20 questions), utilizing a 5-point Likert scale survey (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree) to measure pre-service teachers' perspectives about AI in education. Before the candidates completed the survey, a language expert reviewed its translation for accuracy. Data was collected during the early semester of the 2023–2024 academic year.

The questionnaire was meticulously crafted (**Table 1**), incorporating questions from two rigorously conducted surveys that comprehensively examined the subject matter (Antonenko & Abramowitz, 2023; Haseski, 2019). They were subsequently organized and examined to guarantee a thorough data collection methodology.

Participants

The study participants were (N = 121) first-year students (19% men & and 81% women) from the department of primary education at the University of Ioannina. The study employed a convenience sampling method (Etikan et al., 2016).

The questionnaire was administered during a scheduled 30-minute teaching session. Participation was entirely voluntary, and students had the freedom to choose whether to

Table 4. Research questions & answers provided by respondents in response to questions

No		1	2	3	4	5
1	AI is an advanced technology that can imitate human intelligence.	2.5	18.2	50.5	29.8	9.1
2	I am familiar with the possibilities of AI.	9.1	26.4	46.3	16.5	1.7
3	AI has the potential to enrich the educational experience.	2.5	6.6	32.2	38.0	20.7
4	AI is vital for the progress of humanity.	8.3	19.0	48.8	19.8	4.1
5	AI may pose a threat to human existence.	3.3	14.0	27.3	35.5	19.8
6	To what extent do you agree with the claim that the application of AI carries the potential risk of reducing human interpersonal interaction?	1.7	9.9	21.5	33.9	33.1
7	AI can potentially reduce the costs associated with education.	5.0	16.5	52.1	21.5	5.0
8	AI offers innovative methods for excellence in education.	4.1	11.6	51.2	24.0	9.1
9	AI has the potential to improve our living standards by providing us with innovative solutions.	0.8	9.1	36.4	40.5	13.2
10	AI has the potential to challenge human autonomy.	5.0	17.4	38.0	28.1	11.6
11	AI will replace teachers with robots.	12.4	24.0	30.6	23.1	9.9
12	AI is used as a support tool for teachers.	2.5	11.6	35.5	37.2	13.2
13	The teacher's job is made much easier with the use of AI.	5.8	12.4	49.6	24.0	8.3
14	AI will help students develop problem-solving skills.	11.6	12.4	43.8	27.3	5.0
15	Research has shown that AI can remarkably improve students' attention.	10.7	25.6	33.1	29.8	0.8
16	AI can help students make informed decisions about their education.	8.3	20.7	51.2	17.4	2.5
17	Accessing information about lessons has become easier for students thanks to AI.	1.7	1.7	32.2	35.5	28.9
18	The use of AI leads to the acquisition of limited skills by students.	6.6	17.4	39.7	25.6	10.7
19	The increased use of AI has resulted in students spending more time in front of screens.	0.8	4.1	17.4	41.3	36.4
20	Do you think that AI should be an imperative in your work?	17.4	26.4	41.3	12.4	2.5

complete the questionnaire without any form of coercion or obligation.

Data Analysis

Quantitative descriptive data analysis was implemented to synthesize the responses, thereby enabling the identification of central tendencies, dispersion, and patterns within the dataset (Mishra et al., 2019), and the IBM SPSS statistics 29.0 statistical program (Field, 2013) were employed to analyze the research data. The participants' answers to the questionnaire are shown in **Table 1**. The questionnaire's internal consistency and reliability were evaluated using Cronbach's alpha coefficient, which resulted in a value of 0.75 (Tavakol & Dennick, 2011).

The application of descriptive statistical methods provided a foundational understanding of the dataset by summarizing responses through measures such as mean, median, standard deviation, and frequency distribution. These measures allowed the researcher to explore the general trends and variability in the pre-service teachers' responses, which is essential when assessing perceptions across a diverse participant group (Creswell & Creswell, 2017). The use of IBM SPSS statistics 29.0 enabled the efficient organization and computation of data, ensuring accuracy and facilitating the extraction of meaningful patterns. These patterns can reveal not only the dominant attitudes but also areas of divergence or inconsistency, which are critical for interpreting the educational implications of AI integration from a teacher training perspective.

Furthermore, the internal consistency of the questionnaire, evaluated using Cronbach's alpha, demonstrated an acceptable level of reliability, with a coefficient of 0.75. According to established psychometric criteria, a Cronbach's alpha value above 0.70 is considered acceptable for research instruments used in social sciences, indicating that the questionnaire items were sufficiently correlated to measure the underlying constructs consistently (Tavakol & Dennick, 2011). This degree of internal consistency ensures that the data derived from the questionnaire can be interpreted with confidence and supports the validity of the conclusions drawn. Moreover, the reliability of the instrument reinforces the importance of methodological rigor in educational research, especially when investigating attitudes and perceptions that may influence future pedagogical practices.

Lastly, the implementation of quantitative descriptive analysis offers an accessible yet comprehensive approach to exploring the perspectives of pre-service teachers on a complex and emerging topic such as AI in education. While inferential statistics could potentially reveal deeper associations or causal relationships, the focus on descriptive statistics in this study is particularly valuable for initial explorations in under-researched areas (Babbie, 2020). By identifying patterns and distributions within the data, this approach lays the groundwork for future, more advanced analyses. It also contributes to building a clearer picture of the current state of awareness, preparedness, and concerns among future educators, guiding both curriculum development in teacher education and policy formulation in educational innovation.

RESULTS-DISCUSSION

The survey results indicate a general trend toward agreement on several essential items, suggesting a positive outlook among respondents, as presented in **Table 1**.

Questions 5, 6, 9, 12, 17, and 19 demonstrate strong consensus, with over 50% of participants agreeing or strongly agreeing. For instance, 77,7% of respondents agreed with the statement in question 19, reflecting a shared perspective on that issue (Charters, 2024).

According to our research, 55.3% of the candidates strongly agree that "AI may pose a threat to human existence" in question 5. This agrees with an analysis by BMJ global health (Federspiel et al., 2023). This study emphasizes the positive

aspects of AI, often overlooking its potential harm, which are typically associated with its misuse in clinical settings. This analysis identifies various ways AI could negatively affect human health, including its influence on social and upstream health determinants, manipulating individuals, deploying lethal autonomous weapons, and ramifications for employment. Furthermore, the rise of self-improving artificial general intelligence poses an existential threat to humanity. To mitigate these risks, there is an urgent need for effective regulation governing the development and application of AI, and until such measures are established, a moratorium on the advancement of self-improving artificial general intelligence should be implemented.

Similarly, question 6 shows 67% agreement, highlighting broad support, with 33.1% of respondents strongly agreeing. This agrees with a study conducted across six countries by Viberg et al. (2023). Many teachers expressed concerns that AI's role in automating educational tasks, such as grading and feedback, could reduce teacher-student interaction. The fear is that AI may take over tasks traditionally associated with human connection, thus reducing opportunities for interpersonal communication in the learning process.

Intriguingly, numerous inquiries demonstrated an increased degree of objectivity. The choice of "neither agree nor disagree" by nearly half of the participants for questions 1, 2, 4, 7, 8, 13, and 16 suggests an element of ambiguity or doubt. Contrary to the findings of numerous studies that suggest pre-service teachers are aware of the definition of AI as technology designed to replicate specific human intelligence capabilities, including learning, reasoning, and problem-solving, the results of question 1 are contradictory. Despite this, their comprehension levels are inconsistent. Zhang et al.'s (2023) research at a German university indicated that most pre-service instructors can generally characterize AI as "*mimicking human intelligence*." This pattern suggests that respondents may exhibit uncertainty or indifference toward certain concerns, maybe attributable to unfamiliarity, topic complexity, or insufficient understanding. In addition, the concordance rate of 49.6% was disclosed in question 13, suggesting that nearly half of the pre-service instructors had integrated AI into their daily tasks. This serves as an illustration of the extensive application of this innovative technology.

The survey results indicate that most people agree or strongly agree with the statements. However, there are mixed responses and many neutral opinions on certain items. The prevalence of "neither agree nor disagree" responses indicates a significant level of uncertainty among participants regarding AI's role in education. This ambiguity may stem from limited exposure to AI technologies in their academic and personal experiences. Bae et al. (2024) found that despite increased awareness, pre-service teachers often exhibit lingering uncertainties about adopting AI tools in their teaching practices.

To explore this further, it's essential to consider cognitive dissonance theory, which posits that individuals experience discomfort when confronted with new information that challenges their existing beliefs. In the context of this study, pre-service teachers might struggle to reconcile traditional pedagogical paradigms with the transformative potential of AI, leading to neutral responses as a coping mechanism.

This uncertainty has critical implications for teacher training programs. Incorporating experiential learning opportunities such as hands-on AI tool demonstrations, case studies, and reflective discussions can bridge the gap between theoretical knowledge and practical application. By engaging with AI technologies in controlled, supportive environments, pre-service teachers can develop a more nuanced understanding of both the opportunities and challenges associated with AI integration in education. Holmes and Porayska-Pomsta (2021), advocate for such approaches to navigate the ethical challenges of AI in education.

Additionally, the findings suggest a need for curriculum reform to include modules that address ethical considerations, critical thinking about AI's societal impact, and strategies for maintaining human-centered teaching practices in technologically enriched classrooms. Bae et al. (2024), also highlight the importance of professional development in AI literacy to address pre-service teachers' uncertainties and enhance their familiarity with generative AI tools. This suggests that respondents may require more information or clarity to form a definite opinion. These findings can guide further research or interventions, especially in addressing uncertainty or possible lack of knowledge. These findings suggest a substantial alignment in certain aspects of the survey, reflecting a positive attitude or perceived importance of these topics.

This study emphasized the need for comprehensive training and ongoing support for teachers in adapting to the rapidly evolving landscape of AI in education. Also, it underscored the importance of extensive professional development to equip educators with the necessary skills to navigate AI tools effectively. Moreover, participants recognized the challenges posed by AI, particularly in terms of accessibility, equity, and the digital divide. Concerns were raised about ensuring that AI-driven tools benefit all students, regardless of socio-economic background. Without deliberate efforts to address these disparities, there is a risk that existing inequalities may worsen.

The insights shared by pre-service teachers offer a valuable foundation for shaping AI integration strategies that are aligned with core educational values. These strategies should ensure that AI enhances the learning experience rather than a disruption, fostering a more inclusive and equitable educational environment. The complex interplay of perspectives among participants reveals both enthusiasm and caution regarding integrating AI into education. Many expressed excitement about AI's potential to enhance student learning outcomes, particularly through personalized and adaptive educational experiences that can respond more effectively to individual student needs.

However, alongside this enthusiasm, participants voiced concerns about the ethical implications of AI and the risk of depersonalizing education. They emphasized the need for a balanced approach, where AI complements rather than replaces the human element of teaching. Maintaining the teacher's role as a guide and mentor remains essential, as the relational aspects of education are seen as critical to student

development. The consensus underscores the importance of leveraging AI to enhance the learning experience without undermining the human connections fundamental to meaningful education.

CONCLUSIONS

In conclusion, exploring pre-service teachers' perspectives on integrating AI in education presents a nuanced understanding of both the promising opportunities and the inherent challenges. Participants recognize the transformative potential of AI to revolutionize education, offering personalized learning experiences and enhancing student engagement. However, there is a strong caution against overreliance on technology, emphasizing preserving the human touch, which remains central to effective teaching. A balanced approach is advocated, where the capabilities of AI are leveraged without compromising the relational dynamics that foster meaningful connections between teachers and students.

Additionally, there is a clear call for robust training and equitable access to AI-driven tools, ensuring that the benefits of AI are widely shared across all demographics. To avoid exacerbating existing educational inequalities, comprehensive training programs are essential to equip educators with the skills to integrate AI to enrich the learning environment for all students. Guiding the future development of AI in education requires a collaborative effort informed by pre-service teachers' perspectives. These insights offer a critical foundation for policymakers, educators, and technologists, who must work together to shape AI's educational role.

The focus should be on fostering an environment where innovation is balanced with inclusivity, ensuring that AI is a powerful tool that enhances the educational process without replacing the unique contributions of teachers. This collaborative approach will be essential in developing AI-driven solutions that complement human instruction and prioritize the holistic development of students.

Equally important is the critical examination of the cultural and contextual relevance of AI applications in education. Pre-service teachers highlight the necessity of designing AI systems that align with local educational values, languages, and pedagogical traditions, rather than importing one-size-fits-all solutions. Educational AI must be culturally responsive to address diverse learners' needs and to promote a sense of belonging and identity within the learning process (Selwyn, 2022; Williamson & Eynon, 2020). Therefore, national education systems must work alongside AI developers to ensure these technologies serve inclusive and context-sensitive educational goals.

Furthermore, the psychological implications of AI use in the classroom warrant deeper exploration. While AI has the potential to support motivation and learning through adaptive feedback and gamified experiences, there are concerns about reduced student autonomy, privacy issues, and the possible erosion of intrinsic motivation (Holmes et al., 2022; Luckin et al., 2022). Pre-service teachers advocate for responsible AI practices that empower learners and promote agencies, emphasizing that digital tools must be thoughtfully integrated to support emotional and cognitive development rather than replace critical thinking and human interaction.

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Declaration of interest: The authors declare that they have no competing interests.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

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