

# Assessment and Communication through AI-Enhanced Extended Reality Simulations: Educating the Future Workforce

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## ABSTRACT

This paper explores the transformative role of Artificial Intelligence (AI) in enhancing Extended Reality (XR) simulations and how these findings may translate to education within the military. Integrating AI into XR learning environments allows military instructors to streamline non-instructional responsibilities—such as content generation and assessment—thereby freeing time for more personalized teaching and fostering meaningful educator-learner relationships. AI-driven XR platforms support the development of highly immersive, responsive, and interactive training scenarios that mirror the complexities of real-world military operations. Gathering a deeper understanding of how AI within XR influences the ability to assess learning and accurately communicate knowledge is vital to education across Universities and colleges.

This paper presents empirical findings from a rigorously conducted randomized control trial, underscoring AI's efficacy in enhancing visualizations, movements, and interactions within extended reality simulations. The significance of this research lies in its potential to improve education by demonstrating AI's capacity to craft realistic scenarios, thereby elevating engagement. In addition, the paper explores how AI-enhanced XR simulations can improve communication strategies and provide educators with deeper insights into student performance. This approach enhances the precision of assessments and fosters a more dynamic and responsive educational environment.

By embracing AI-driven XR tools, educators can better equip students for complex, real-world challenges, contributing to enhanced training effectiveness and mission readiness. Participants in the presentation will receive free evidence-based practice simulations available for use tomorrow with their students. These simulations and their educator guide provide training on communication skills, how to deal with change, and how to de-escalate situations in various settings. Social narratives within virtual reality have been shown to improve students' critical thinking and communication skills. This presentation provides practical strategies and tools to effectively implement AI-powered XR simulations to create engaging and effective learning experiences for students.

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## ABOUT THE AUTHORS

**Maggie Mosher, PhD** is an assistant research professor at the University of Kansas (KU) Achievement and Assessment Institute (AAI) where she specializes in artificial intelligence (AI), extended reality (XR), social skill development, and individualized instruction. Mosher is co-PI of two 2.5 million grants on the development of XR and AI for assessing, monitoring, and intervening in social-behavioral-academic competencies for students.

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**Amber Rowland, PhD** is an associate research professor with the Center for Research on Learning and AAI at KU. Dr. Rowland's research centers on supporting educator professional learning at a distance and pursuing methods for integrating innovative technology to support all students, especially those with disabilities. Current work includes extended reality and AI with social skill learning, and progress monitoring and AI in writing.

## INTRODUCTION

Today's students are entering a workforce that is rapidly evolving, with employers increasingly prioritizing digital literacy and experience with emerging technologies. The demand for proficiency in Artificial Intelligence (AI) is no longer a future-looking concept but a present-day requirement. According to the 2024 Cengage Group Employability Report, 62% of employers believe their hires should have knowledge of generative AI and 58% of these same employers are more likely to interview and hire a candidate who states they have experience with AI. This sentiment is mirrored by students themselves, with 69% of K-12 students stating they are confident in using generative AI and 63% of K-12 students reporting generative AI is making a positive impact on their education (Cengage Group, 2024).

This growing alignment between student use and employer demand is further detailed in research from Baytas and Ruediger (2024) who surveyed 1,000 U.S. employers and 1,000 recent graduates. They found that the percentage of K-12 students using generative AI at least weekly has nearly doubled over the past year to 49%, matching the usage rate of college undergraduates. Although around 65% of teachers allow or encourage AI use, 39% of students report using it for schoolwork without permission, highlighting a gap in formal integration that needs to be addressed. Given this landscape, the central question for educators is no longer *whether* we should use these technologies, but *how* we can integrate them effectively to prepare students for their futures? This paper explores that question through a study that examines not only the effectiveness of AI and Extended Reality (XR) in teaching communication skills but also student preferences for these tools, providing critical insight into how we can align educational practice with workforce readiness.

### **An Educator's Guide to AI and XR in the Classroom**

It is impossible to ignore that AI and XR are transforming K-12 classrooms and specialized fields like military education by fundamentally changing how educators teach and students learn. In military contexts, AI streamlines complex processes, creates better training simulations, and enables more intelligent decision-making based on data (Noever & Regian, 2023). Simultaneously, XR technologies—such as Virtual Reality (VR) and Augmented Reality (AR)—offer immersive training environments where personnel develop critical skills through realistic, hands-on scenarios (Patti et al., 2023). This transformation is also happening in our schools. For K-12 students, AI paves the way for truly personalized learning and assists teachers with heavy lesson-planning tasks. Meanwhile, XR tools create interactive experiences that capture students' attention and help them grasp complex topics in ways textbooks cannot.

Exciting progress occurs where these fields overlap. In military education, AI automates administrative tasks and builds smarter training simulations, allowing instructors to focus on developing strategic skills and preparing personnel for modern challenges (Zurat, 2023). XR provides safe, risk-free environments to practice, gain situational awareness, and improve operational readiness (McGroarty & Metevier, 2023). In K-12 schools, AI personalizes tutoring, differentiates instruction, and supports curriculum development (Mosher, Rowland, et al., 2024). Paired with XR, it fosters active learning where students can see and manipulate concepts rather than just read about them (Flanagan et al., 2023). These tools engage diverse learners and maintain motivation (Carreon et al., 2023; Mosher et al., 2025).

However, this is not a simple plug-and-play solution. Ethical and practical challenges arise as we adopt these tools, especially within educational environments (Dai et al., 2024). We must carefully address student data privacy, security, and potential AI bias, particularly in schools (Noever & Regian, 2023; Garza, 2023). Research also highlights the need to understand learner competencies and ensure fairness and transparency to prevent widening educational gaps (Chiu et al., 2023; Sanusi et al., 2022). Moreover, equitable access and thorough training remain critical (Garza, 2023; Mosher, Rowland, et al., 2024).

### **AI and XR in Military Education**

The US Department of Defense (DoD) has faced difficulties in the cost and labor needed to enable model reuse and development (McGroarty & Metevier, 2023). AI-driven synthetic data generation offers a solution, allowing for the rapid creation of labeled datasets to train machine learning models for military applications (Garza, 2023). AI is a game-changer for professional military education (PME), reshaping teaching and preparation for the field

(Noever & Regian, 2023; Patti et al., 2023). AI manages time-consuming tasks like drafting lesson plans, freeing instructors to focus on high-quality teaching and mentorship, and designing engaging curricula for real-world challenges (Mosher, Dieker, & Rowland, 2025). Streamlining these workflows significantly improves learning experiences.

AI revolutionizes training simulations by creating incredibly realistic, immersive scenarios that improve combat readiness. For example, live pilots train in the air while interacting with virtual simulator partners on the ground, a complex integration AI enables (McGroarty & Metevier, 2023; Zurat, 2023). AI supports advanced data analysis and decision-making, processing vast information and identifying patterns. This helps educators and students understand complex operational environments and develop effective strategies, preparing them for fast-evolving military operations (Noever & Regian, 2023; Patti et al., 2023).

XR—encompassing VR, AR, and Mixed Reality (MR)—is becoming a staple in military education due to its potential to enhance learning. Military students learn complex concepts faster and more deeply with XR. It helps them navigate ethical challenges, such as protecting civilians in conflict zones, and improves situational awareness and decision-making (Estrada et al., 2024). XR creates realistic scenarios for risk-free training, which the Army's Training and Doctrine Command (TRADOC) recognizes as essential for preparing soldiers (Flanagan et al., 2023). Additional studies support these findings, emphasizing how immersive XR technologies can enhance tactical training outcomes and crisis management skills in military contexts (Bakken et al., 2022; Reiners et al., 2021; Patti et al., 2023).

### **Types of XR in Action**

- **VR** immerses users in fully digital environments to simulate real-world scenarios safely (Flanagan et al., 2023). Research shows its effectiveness in high-stakes training, such as improving surgical residents' skills (Lohre et al., 2020).
- **AR** overlays digital information on the real world, providing critical data during training (Flanagan et al., 2023).
- **MR** blends AR and VR, simultaneously allowing interaction with real and virtual objects, bridging theory and practice without physical risk (Zurat, 2023; Flanagan et al., 2023).

As XR improves, it will expand to new military roles, enhancing skills, situational awareness, and decision-making under pressure (McGroarty & Metevier, 2023; Zurat, 2023). XR technology makes learning more interactive and exciting for all students (Mosher et al. 2024). Virtual and augmented reality brings challenging subjects to life through activities such as walking through ancient civilizations and conducting AI-enhanced virtual science experiments with historical figures like Isaac Newton (Flanagan et al., 2023; Mosher, Rowland, et al., 2024). XR boosts knowledge retention by promoting active learning, which helps information stick long-term (Flanagan et al., 2023). XR and AI adapt to diverse learning styles, increasing accessibility and motivation (Mosher, Rowland, et al., 2024).

### **AI and XR Providing Personalized, Interactive, Affordable Learning**

AI in education (AIEd) encompasses technologies like chatbots, intelligent tutoring systems, and automated grading (Mosher, Dieker, & Hines, 2024). Tools such as ChatGPT can generate instructional content, summarize data, and customize learning plans, freeing instructors from routine tasks. The U.S. Army's Generative Programming (GenProg) research project utilizes a flow-based programming interface, allowing military modeling experts to author complex models without deep computer science knowledge, which can then be code-generated into various simulation environments (McGroarty & Metevier, 2023). This model-driven approach aligns with the DoD's digital engineering strategy to formalize the use of models to inform decision-making. However, caution is warranted, as over-reliance on AI can cause biased and inaccurate information to be propagated (Noever & Regian, 2023).

XR, including Virtual Reality (VR) and Augmented Reality (AR), allows for high-fidelity training experiences that replicate complex operational scenarios (Zurat, 2023). The integration of XR with Model-Based Systems

Engineering (MBSE) allows users to visualize and validate system interfaces in a true-to-scale 3D environment before physical development, as demonstrated by the BIFROST prototype for PEO Aviation (Flanagan et al., 2023). When combined with AI, these environments become more adaptive and data-informed, allowing for real-time learner analytics and behavior-based scenario branching.

When combined with AI, XR tutoring systems offer tailored real-time feedback, allowing students to learn at their own pace and engage meaningfully regardless of starting level (Mosher, Dieker, & Rowland, 2025). XR fosters a classroom where students can see and manipulate complex ideas. AR lets students explore 3D models, like molecules or the human heart, enhancing engagement and understanding (Flanagan et al., 2023; Zurat, 2023). This is particularly effective for students with special needs, where VR improves social skills and communication (Mosher et al., 2022; Carreon et al., 2022). Although XR may seem costly, schools are finding budget-friendly ways to implement it, democratizing access to immersive learning experiences (Flanagan et al., 2023; Mosher & Carreon, 2021).

AI tutoring systems can adapt to each student's pace, reinforcing concepts and filling learning gaps, especially during independent work (Lopes et al., 2019; Mosher, Rowland et al., 2024). Chatbots enhance student interest and competence by providing personalized support (Fryer et al., 2019). AI-driven STEM interventions have notably improved student learning (Hasan & Khan, 2023). Research also points to AI's potential to reduce teacher workload and prevent burnout by automating routine tasks (Hashem et al., 2024).

### Curriculum Development and Guidelines

Organizations like the Association for the Advancement of Artificial Intelligence have developed "Five Big Ideas" to guide teaching AI in K-12 (Mosher, Rowland, et al., 2024). The MIT Media Lab's DAILY curriculum offers hands-on AI experiences for middle school students, scaling educator comfort with AI concepts (Mosher, Rowland, et al., 2024). Mello and colleagues (2023) also provide recent developments on generative AI in education and frameworks that surround these advancements.

### METHODS

This study was designed to determine if AI and XR-assisted tools would improve student communication skills better than a teacher and XR assisted tools alone and to understand student preferences for these technologies, which in turn informs how we can better prepare them for their futures. Within this study, middle school students were asked to create and share what career path they desire as a communication assignment. A little over 15% of students mentioned within their chosen career paths (i.e., pilot, medic, lawyer) their desire to pursue military employment and service.

### Participant and Setting Demographics

The study included 100 students (n=50 per group) and 10 educators from public, private, and charter schools in rural, suburban, and urban locations. Both groups had a similar distribution of male and female students and included students from 10 to 13 years old. While there were slight differences in racial distribution, diagnoses, and specific education plans, the groups were equal overall. Educators' teaching experience ranged from three to over 25 years. All participants had adequate access to technology and more than three years of experience teaching students on the devices (Chromebooks or iPads) used in the study.

**Table 1**

#### *Student Demographic Information*

Race and Ethnicity	Group 1 (%)	Group 2 (%)
African American	2	2
American Indian/Alaska Native	10	10
Asian	6	2

Race and Ethnicity	Group 1 (%)	Group 2 (%)
Hispanic/Latino	6	8
White	76	82

Student Age	Group 1 (%)	Group 2 (%)
10 years old	44	12
11 years old	34	34
12 years old	12	16
13 years old	10	14

Gender	Group 1 (%)	Group 2 (%)
Female	72	52
Male	28	48

*Note: N = 100 students (n = 50 per group)*

**Table 2:**

*Student Diagnosis*

Diagnosed Disability	Group 1 (n)	Group 2 (n)
Attention Deficit Hyperactivity Disorder (ADHD)	18	16
Autism Spectrum Disorder (ASD)	29	18
Obsessive Compulsive Disorder (OCD)	2	1
Depression	2	2
Learning Disabilities (LD)	9	3
Anxiety	1	0
Intellectual Disability (ID)	1	0

*Note: N = 100 students (n = 50 per group)*

**Table 3**

*Career Interests of Middle School Students (N=100)*

Career	Number of Students Interested
Trade (Welder-2, Mechanic-2)*	4
Engineer*	9
YouTube Influencer	14
Medical (Nurse-2, Doctor-3, EMT/Medic-2, Veterinarian-1, Dentist-1)*	9
Teacher	8
Social Worker	2
Actor	9
Legal (Lawyer-3, Judge-2, Justice-1)	6
Business (Own-5, Work Professional-1)	6
Marketing	2

Career	Number of Students Interested
Artist (Musician-2, Painter-1, Designer-1, Writer-1)	5
Programmer*	10
Pilot*	5
Researcher (Biologist 1, Zoologist 3)	4
Finance (Accountant 2, Banker 1)	3
Politics (President-1, Senator-2, Lobbyist-1)	4

*Note: This table summarizes the career interests of one hundred middle school students, highlighting the diversity of aspirations. \* Means that students in this category mentioned the military when stating this career.*

**Table 4**

*School Demographic Information*

Location	n	%	State	n	%	Type of School	n	%
Rural	3	30	KS	2	20	Public	5	50
Suburban	4	40	NM	1	10	Charter	1	10
Urban	3	30	VA	4	40	Private	4	40
			NC	3	30			

Approval was received from the Office of Research Institutional Review Board (IRB) prior to the study. Participants were randomly assigned into two groups and all participants participated in 30 XR simulations which both taught and assessed communication and pragmatic language. After these XR simulations were complete:

- **Group 1 (Control):** communicated with a human educator to ask questions and create narratives to help generalize skills learned in the XR environment.
- **Group 2 (Experimental):** communicated with an AI chatbot within MagicSchoolAI to ask questions and create narratives to help generalize skills learned in the XR environment.

The study ran from September 2022 to April 2023. Interventions were delivered via iPads or Chromebooks.

**Measures**

Using two well-validated assessments, the Clinical Evaluation of Language Fundamentals, Fifth Edition (CELF-5) Pragmatic Profile and the Computer Simulation Evaluation Scale for Students (CSES-S), we saw significant gains in how students express themselves and understand others after both groups completed the XR simulations. The Computer Simulation Evaluation Scale for Students (CSES-S), a reliable and valid tool, was used to assess student attitudes. The scale's items were applicable for comparing perceptions of learning, quality, and engagement between the AI and human educator groups. The survey consists of twelve statements rated on a five-point Likert scale, from 1 (Strongly Disagree) to 5 (Strongly Agree). The CELF-5 Pragmatic Profile was chosen as the pre and post intervention standardized measure because of its ability to identify strengths and weaknesses as a basis for intervention recommendations in expressive, receptive, and pragmatic communication. A comprehensive review confirmed that the CELF-5 PP is the only measure that is not only individually administered and norm-referenced but is also: (1) supported by valid and reliable research, (2) applicable to students of varying backgrounds, (3) previously implemented with middle schoolers, (4) evaluated extensively in peer-reviewed journals, and (5) based on well-established norms (Wiig et al., 2013).

Procedural fidelity of the training was collected by the Research Assistant (RA) in 35% of the professional development sessions across all participants using direct observational recording (Barton et al., 2018). Prior to the fidelity collection, the RA was provided a script, a checklist, and a notation-per-occurrence form. Procedural fidelity

was measured by calculating the percentage of correct implementor behaviors ( $[\text{correct behaviors}] / [\text{total number of behaviors}] \times 100$ ; Billingsley et al., 1980). The RA specifically determined whether the presenter (human or AI) (a) presented the correct materials, (b) accurately followed the procedural script, and (c) modeled the implementation of the design in a manner like the listed example.

## RESULTS

A one-way Analysis of Variance (ANOVA) was conducted to compare the end-of-intervention scores between the educator group and the AI chatbot group. The analysis of the total score from the CSES-S was that all students made significant gains,  $F(1,98) = 24.89$ ,  $p < .001$ , with a large effect size ( $\eta^2 = .20$ ). There was no statistical significance between groups. Although all students made gains in expressive, receptive, and pragmatic communication, students in the AI-assisted group reported significantly more positive attitudes ( $M = 4.11$ ) compared to those in the teacher-supported group ( $M = 3.19$ ).

Individual item analysis revealed statistically significant improvements for the AI-assisted group than the human assisted group across the following domains:

- **Learning:** Students reported higher understanding and skill acquisition (e.g., "Working with the...AI helped me learn effectively,"  $p < .001$ ).
- **Quality:** AI-created narratives and feedback were perceived as higher quality and more relevant (e.g., "The feedback from the...AI helped me learn well,"  $p < .001$ ).
- **Engagement:** Students were more motivated by and engaged with the AI-enhanced simulations than with traditional instruction (e.g., "I found the...AI's social narratives motivating,"  $p < .001$ ).

## CONCLUSION

Using a well-validated assessment, the CELF-5 Pragmatic Profile, we saw significant gains in how students express themselves and understand others. We can be confident in these results because our study was built on a solid foundation, using a randomized control design with matched pairs and independent observers to ensure the intervention was delivered as intended.

### Findings and Implications

Our research shows that combining AI and XR is not just a futuristic idea—it is a powerful opportunity to reshape learning right now, from K-12 classrooms to high-stakes military training. Students who used the AI chatbot were more engaged, felt the quality of their learning was higher, and were more motivated compared to their peers who collaborated only with a human educator. They responded positively to the XR simulations and the interactive AI tools within, which helped them better understand and apply new communication skills. These findings are important to consider in military training, which prioritizes effective adaptability, communication, and decision-making.

The AI and XR tools within this study can be integrated into existing instructional settings without significant disruption to current policies and practices. The entire intervention was delivered over Zoom using the Chromebooks and iPads that students already use daily, embedded right into their normal social skills instruction time. The CELF-5 Pragmatic Profile with the Expressive and Receptive Communication subdomains displayed significant gains in how students express themselves and understand others in both groups that used XR but the group that used XR and the AI assistance showed slightly increased gains than the group who used XR and the teacher alone, without AI enhancements.

### *Implications for Military Education*

Numerous forms of employment, such as military, operate in high-stakes environments where instructional quality, adaptability, and efficiency directly influence operational readiness. Emerging technologies like AI and XR have begun reshaping how instruction is delivered and assessed (Mosher, Dieker, & Hines, 2024). AI's capacity to automate non-instructional tasks like lesson planning and grading provides military educators more time to build meaningful relationships and deliver personalized instruction. AI-enhanced XR combines immersive training environments with intelligent systems capable of adapting instruction, monitoring performance, and generating

personalized feedback (Patti et al., 2023). The findings from this study have direct applications in numerous learning environments. The strong preference for AI-supported narrative creation after learning occurs within XR suggests that occupational training (e.g., military personnel) may benefit from XR training with feedback from AI for developing communication skills and situational understanding.

- **Reduced Instructor Burden:** AI systems can automate grading, lesson planning, and content generation, reallocating instructor time for live debriefing, mentorship, and personalized coaching.
- **Adaptive Instruction:** AI can tailor scenarios and content based on user behavior and performance, providing skill-specific remediation or advanced challenges.
- **Embedded Communication Training:** Simulations integrated into XR can reinforce communication protocols, team cohesion, and behavioral expectations during joint operations.

## FUTURE RESEARCH

The future is bright for AI and XR in military and K-12 education as technology and teaching methods evolve. XR will become more accessible and extend to new military roles, such as Joint Terminal Attack Controllers and drone pilots, offering richer training experiences (McGroarty & Metevier, 2023). AI will drive personalized learning paths in K-12, adapting lessons to individual student needs and promoting critical skills like problem-solving and collaboration, which are essential for the future of work (Rožman et al., 2023; Mosher et al., 2024). It may be that incorporating AI-facilitated narratives after XR can help participants build empathy, communication, and team-based decision-making competencies without the fear of disappointing the educator. Studies gathering a greater understanding of when AI should be used to allow for practice, dialogue, and answering questions versus when the teacher and peers should be involved would help to know how best to foster resilience, adaptability, and clear communication.

## Synergy of AI and XR

The real magic happens when AI and XR combine. AI provides real-time analysis and personalized feedback within XR simulations, making military training more efficient and classroom learning more immersive (Mosher, Dieker, & Rowland, 2025). Early results show that adaptive XR training powered by AI significantly boosts performance in defense environments (Stanney et al., 2022).

## Moving Forward: Standards for Appropriate, Accessible, and Equitable Learning

Clear standards and best practices are needed to integrate these tools thoughtfully and mitigate risks in military and K-12 education (McGroarty & Metevier, 2023; Mosher, et al, 2025). XR can make education more equitable by granting all students access to high-quality resources, such as virtual field trips for underfunded schools (Flanagan et al., 2023). AI's real-time analytical capabilities can offer instructors deep insights into trainee performance, including communication style effectiveness, decision-making trends under pressure, and group cohesion (Noever & Regian, 2023). Military XR environments enhanced with AI can effectively mimic stress-inducing conditions and capture precise performance data for robust after-action reviews. This aligns with the goals of MBSE and digital twin technologies, which seek to validate system interfaces and human-machine interaction early in the development lifecycle (Flanagan et al., 2023). AI should be employed as a powerful supplement to, not a substitute for, live feedback and expert human mentorship. This is crucial as complex systems require human intuition to identify errors or missed concepts that an AI might overlook (Flint et al., 2023).

## *Challenges to Keep in Mind*

Of course, bringing these powerful tools into our schools is not as simple as just handing out devices. For this to work, we must be practical. Schools need clear and thoughtful plans for adopting any innovative technology, and that means bringing our IT staff into the conversation from the very beginning to ensure we are always protecting student data. That open line of communication between us as educators and our IT colleagues is crucial if we are to harness generative AI's potential safely and effectively in our classrooms (Flint et al., 2023).

**Connecting Student Engagement to Future Employability.** The fact that students in our study were more motivated and engaged by AI-assisted tools is not merely a matter of preference; it is a direct reflection of their

preparation for a future workplace. When students willingly and effectively engage with the very tools employers value, we are not just improving a lesson—we are building a bridge to their future careers. This study demonstrates that aligning instructional methods with student preference can simultaneously fulfill educational goals and critical workforce readiness demands. In addition, these tools can be integrated into existing instructional settings without significant disruption.

For military education, the implications are clear. These findings point to a potential to reduce instructor burden by automating time-consuming prep work, freeing experts to focus on coaching and mentorship. AI-powered XR can provide safe, realistic training scenarios for critical communication and situational skills, complete with detailed performance data for targeted feedback. The key, however, will always be ethical oversight—ensuring AI is a tool that enhances, but never replaces, expert human judgment.

In conclusion, this study reminds readers that AI-enhanced XR interventions offer a promising path toward improving student engagement and positive communication outcomes necessary for future employment. This paper is being presented at this conference because additional research with field validation in military environments is needed to refine these tools and maximize their impact. The authors hope to collaborate to determine how these findings influence military personnel and students with diverse learning needs within the military.

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