Generative AI in education for space and remote learning

Ulpia-Elena BOTEZATU

National Institute for Research & Development in Informatics – ICI Bucharest,
Bucharest, Romania

ulpia.botezatu@ici.ro

Abstract: *The rapid rise of generative artificial intelligence (GAI) – AI systems capable of autonomously producing text, images, and simulations – is transforming educational practice worldwide. This paper examines the integration of generative AI into education, with a focus on remote and space-based learning environments. We review the current literature and policy context, highlighting how AI-enabled tools (e.g. AI tutors, content generators, and VR/AR simulators) can personalize learning, maintain continuity for isolated learners, and create immersive virtual labs. Examples include NASA's VR training systems for astronauts and an AI-driven "Antarctic Explorer" platform for polar science education. However, we also analyze significant challenges: threats to academic integrity (with up to 58% of students admitting misuse of AI in assignments), embedded biases in AI outputs, and access inequities. International ethical guidelines (e.g. UNESCO 2023) and national strategies (e.g. US AI education initiatives) stress human-centered design, data privacy, and equity. We conclude that, when carefully governed, generative AI can extend STEM learning into extreme environments (deep space, polar bases), support astronaut training, and ultimately prepare a more resilient and inclusive space-oriented workforce.*

Keywords: generative AI, AI education, Virtual learning, Space education, Remote learning, Educational technology, Academic integrity, UNESCO AI.

1. Introduction

Educational practice is undergoing a profound transformation as information technologies evolve. Internet and digital platforms have long enabled remote learning and global connectivity. Today, generative artificial intelligence (GAI) – machine-learning models that can autonomously create text, code, images, and even virtual simulations – represents a new disruptive force in education. Systems like OpenAI's ChatGPT and similar large-language-models have rapidly gained traction in schools and universities (Baytas and Ruediger, 2024). They promise unprecedented support for teachers and learners through automated tutoring, content creation, and real-time feedback. This potential is especially valuable in isolated or harsh environments – from polar research stations to space habitats – where access to instructors and resources is limited.

However, the speed at which GAI tools are emerging has outpaced existing educational practices and policies. UNESCO notes that GAI "tools are rapidly emerging or advancing to meet new needs" in education, but many institutions

https://doi.org/10.58503/icvl-v21y202602

remain unprepared to vet these systems or protect data privacy (UNESCO, 2023). Misuse of GAI (e.g. plagiarism) and algorithmic bias pose fresh challenges. Yet, the space sector's training requirements – such as continuous STEM education during long-duration missions – align naturally with GAI's strengths in generating customized, interactive content. For example, NASA and partner agencies are already exploring VR/AI platforms for astronaut training and science education (see below). As the International Conference on Virtual Learning (ICVL 2026) theme suggests, technology disruption is reshaping education. In this paper, I analyze the **opportunities and risks of integrating generative AI in education**, with emphasis on outer-space and remote contexts. I draw on recent studies, official reports (UNESCO 2023 guidance, policy documents), and examples from space agencies to offer a comprehensive, peer-level discussion.

2. Literature context

Generative AI has "quickly gained a significant foothold in academia," according to recent analyses (Baytas and Ruediger, 2024). Surveys in late 2023 found that roughly half or more of students and faculty had tried tools like ChatGPT for learning or research (Baytas and Ruediger, 2024). Educational technology companies and researchers have rushed to develop GAI applications tailored for teaching and research. An Ithaka S+R issue brief (2024) categorizes many GAI tools as aimed at accelerating three key phases of the research/learning cycle – discovery, understanding, and creation (Baytas and Ruediger, 2024) – for example by summarizing literature, explaining concepts, or generating practice problems. While new products flood the market, independent studies emphasize the need to evaluate their real value.

Educational policy bodies and scholars are actively exploring the impact of AI on learning. UNESCO's recent reports underline the importance of aligning AI integration with humanistic values. Its 2023 *Guidance for Generative AI in Education and Research* identifies emerging GAI uses (from curriculum design to creative projects) but also warns that policy and teacher training lag behind the technology (UNESCO, 2023; UNESCO, 2023). UNESCO advocates a "human-centered" approach to GAI deployment, stressing data privacy, age limits for student use, and building digital literacy (UNESCO, 2023). The Organization for Economic Cooperation and Development (OECD) and Council of Europe similarly highlight inclusive, rights-based frameworks for AI in schools (Council of Europe, n.d.; UNESCO, 2021).

Research in immersive learning supports these policy trends. A 2025 review article reports that virtual reality (VR) and augmented reality (AR) systems have been effectively applied to space science training and research (e.g. for astronaut EVA practice and data visualization) (Council of Europe, n.d.). Another line of work examines AI-driven tutoring and personalization. For example, Georgia Tech's human-AI collaboration lab is developing AI "mentors" in VR math environments (the *Algeverse*) and conversational AI practice for medical communication, illustrating how GAI can create interactive, empathetic learning scenarios (Nichols, 2025). All this literature, though still emerging, underscores that generative AI is already influencing pedagogy: accelerating content creation, enabling intelligent tutoring systems, and reshaping assessment and feedback.

Nevertheless, scholarly analysis also flags serious concerns. The integration of GAI in education has sparked debate over academic integrity, equity, and ethics (Rochester Institute of Technology, n.d.; Tan and Maravilla, 2024). For instance, a recent open-access study found that a majority of educators worry about dishonesty: 58% of students admitted to using AI tools to cheat on assignments (Tan and Maravilla, 2024). Experts urge that ethical principles – fairness, transparency, human oversight – must guide AI adoption (UNESCO, 2021) (UNESCO, 2023). This complex picture motivates our systematic exploration: identifying the dual-use potential of AI (educational and space training) while grounding recommendations in evidence and policy.

3. Opportunities of generative AI in education

Generative AI offers multiple avenues to **enhance learning experiences**, particularly by enabling personalization, creativity, and access. First, AI-powered tutors and assistants can provide on-demand, personalized support for learners. By analyzing a student's responses, an AI tutor can generate custom explanations, hints, or practice exercises attuned to that learner's level. For example, conversational AI tutors (such as the "HoloTutor" platform) can answer student questions in real time and adapt to individual learning styles (VictoryXR, n.d.). Even simple GAI tools can rapidly produce study guides, summaries or explanations in a student's native language, lowering barriers for remote or multilingual learners. In the space context, such tools could allow an astronaut to review complex technical concepts (like orbital mechanics or spacesuit procedures) through interactive dialogue at any time.

Second, generative AI can dramatically augment **content creation**. Educators can use GAI to generate varied educational materials – from illustrative diagrams and math word problems to full-fledged lesson plans. The UNESCO 2023 guidance explicitly encourages exploring creative uses of GAI in curriculum design and classroom activities (UNESCO, 2023). In practice, a teacher or student could prompt an AI to produce a virtual lab scenario (e.g. a simulated chemistry experiment) or an augmented reality scene (e.g. the surface of Mars for a geology lesson). This capacity is highly valuable in remote settings where physical resources are scarce: for instance, polar or space missions might lack laboratory facilities, but students could still conduct "virtual experiments" created by AI. The EON-XR platform (a commercial example) illustrates this potential by offering fully immersive 3D space exploration modules and satellite simulations in a VR classroom (EON Reality, n.d.). Although EON-XR targets K-12 globally, the same principle applies in mission contexts – astronauts or analog trainees could use VR modules to practice docking maneuvers or telescope operations generated by AI.

Third, GAI can help ensure **learning continuity** under isolation. Remote bases and spacecraft have limited instructor presence. AI systems can augment the educator role. For example, IBM and the Mawson's Huts Foundation developed an AI-powered "Antarctic Explorer" platform that children (and adults) can use to ask questions about Antarctica and immediately receive answers with multimedia content (International Telecommunication Union, 2024). The system uses IBM Watson's NLP to interpret natural-language queries and retrieve relevant videos, images and documents from a cloud database. Such an approach – "ask anything, get an answer" – could be adapted for space science: crewmembers on a Mars transit or research stations in Antarctica could query an AI for information on geology, biology, or system maintenance, receiving curated learning content even without an internet connection (by caching relevant data locally). Notably, the Antarctic project also provides speech-to-text and text-to-speech features for accessibility, ensuring that learners with disabilities or when hands-free operation is needed (e.g. wearing spacesuits) can still engage with the AI (International Telecommunication Union, 2024).

Another key opportunity is leveraging **virtual and augmented reality (XR)** driven by AI. Immersive VR/AR can simulate realistic learning environments that would be impossible otherwise. According to a recent review, such immersive technologies significantly benefit space-related training: they assist with procedural guidance, astronaut training, and mission planning (Council of Europe, n.d.). In practice, students can experience a VR replica of the International Space Station or walk on a virtual lunar surface. Crucially, generative AI can enhance these simulations by dynamically creating scenarios. For instance, as Boeing's Starliner program has shown, high-resolution VR headsets can render the spacecraft cockpit and control panels in detail, allowing entire mission phases (launch, docking, re-entry) to be practiced in VR (Varjo, n.d.). Coupled with AI-driven feedback or decision-tree branching, such VR simulations become richer and more adaptive to learner actions. These tools can be used in classrooms (for STEM education) and then directly applied to astronaut training simulators (NASA, 2024; Varjo, n.d.).

Finally, generative AI can promote **access and equity** in education by democratizing resource creation. In many developing or remote areas, there is a shortage of qualified teachers or materials. Free or low-cost AI systems (as they evolve) could generate textbooks or translations on demand. UNESCO's literature notes that AI adoption is far lower in low-income countries (only about 8% of institutions) compared to high-income ones, but targeted efforts to deploy GAI tools in under-resourced schools could help close this gap. For space sector education (which often involves international cooperation, e.g. ISS, Artemis), AI-generated content can be made available in many languages and tailored to diverse curricula. In summary, the opportunities of generative AI in education include personalized tutoring, automated content creation, immersive simulation of hard-to-access environments, and extending educational resources to even the most isolated learners (Baytas and Ruediger, 2024; UNESCO, 2023).

4. Challenges and risks

Alongside these opportunities come significant **risks and challenges** that educators and policymakers must address. A foremost concern is **academic integrity**. Generative AI can easily produce essays, problem solutions, code, and even creative works, which students might pass off as their own. A recent study reported that 58% of surveyed students admitted using AI tools to complete assignments dishonestly (Tan and Maravilla, 2024). This erosion of integrity threatens the validity of assessments. Moreover, traditional plagiarism detection tools may not catch AI-generated work, as noted by educators (Rochester Institute of Technology, n.d.). In response, many institutions are rethinking assessment design: moving toward open-book, project-based, or oral exams that require original input. Importantly, rather than simply policing AI use, educators are encouraged to teach students "how to use AI as a learning aid rather than a shortcut" and to emphasize process-based assignments (Rochester Institute of Technology, n.d.).

Bias and misinformation are also serious issues. Generative models are trained on large datasets that may encode societal biases. RIT's teaching center warns that these systems "can reinforce or amplify bias" because underrepresented topics or viewpoints might be missing or misrepresented in training data (Rochester Institute of Technology, n.d.). For example, an AI writing tutor might inadvertently suggest cultural stereotypes or produce mathematically incorrect explanations if not carefully curated. These biases could perpetuate inequalities in education. UNESCO's AI ethics recommendation (2021) explicitly urges that AI actors **promote non-discrimination and accessibility** (UNESCO, 2021). Practically, this means any educational AI tool must be tested and supplemented to ensure fairness (for instance, by including diverse data or human oversight).

Access and equity present another paradox. While AI promises broader access, in the short term it may actually worsen divides. Many cutting-edge GAI tools require significant computing power or subscription fees. The RIT guide notes that as vendors monetize AI, tools "may be available only to individuals with the financial means to use the tool," creating a new digital divide (Rochester Institute of Technology, n.d.). Similarly, students without reliable internet or up-to-date devices (a common situation in remote or low-income areas) may be unable to access cloud-based AI platforms. These gaps are acute in space contexts: an ISS or lunar station has limited bandwidth and on-board hardware. Some programs (e.g. NASA's certification courses (NASA, 2023)) address this by offering lightweight, asynchronous materials, but broader planning is needed to ensure remote or economically disadvantaged learners can benefit. UNESCO's guidance emphasizes that AI policies should ensure education benefits "are accessible to all" (UNESCO, 2021), calling for equity-focused strategies in AI rollout.

Privacy and data security are critical when students interact with AI. Generative AI often requires sending prompts (which may contain student work or personal information) to a cloud service. The RIT teaching guide points out that this raises concerns about personal data and intellectual property (Rochester Institute of Technology, n.d.). For instance, a question submitted by an astronaut from the ISS to an AI system could inadvertently upload mission-sensitive information. UNESCO's guidelines stress robust data protection and user consent in educational AI (UNESCO, 2023). Institutions must therefore either vet which third-party AI tools meet privacy standards or develop in-house solutions. For space and remote learning, this is doubly important: international missions must comply with multiple national regulations (e.g. U.S. Privacy Act, EU GDPR, etc.) and the harsh conditions (e.g. radiation) impose extra reliability requirements.

Finally, there are **technical and psychological challenges**. Generative AI models are computationally intensive; training or running large models consumes much energy and resources (Rochester Institute of Technology, n.d.), which may be scarce on spacecraft. The RIT guide also reminds us that not all students can focus well: some educators suggest written or oral tests to curb AI use, but these can disadvantage students with certain disabilities (Rochester Institute of Technology, n.d.). Psychological factors also matter: relying too much on AI may reduce human interaction, and students may become overconfident in AI outputs unless digital literacy is taught. Policy frameworks (see below) increasingly recognize these issues. In summary, while GAI offers powerful new tools, responsible integration must address academic honesty, bias, equity of access, and data privacy – consistent with UNESCO's call for human-centered AI policies (UNESCO, 2023; UNESCO, 2021).

5. Applications in outer space and remote environments

Generative AI's unique strengths make it especially well-suited to the **challenges of space and remote education**. In environments where human instructors cannot always be present, AI can act as a surrogate teacher and interactive learning companion. For example, NASA's *AI/ML Space Biology Certification Program* provides open-access, self-paced courses in AI and space biology, allowing remote learners (including Earth-bound students) to train in specialized STEM content (NASA, 2023). Similarly, astronaut training increasingly uses AI-enhanced simulations: the Boeing Starliner crew uses Varjo XR-1 VR headsets to practice every phase of their mission entirely in virtual reality (Varjo, n.d.). High-fidelity VR allows astronauts to "step into space" for training; as one Boeing engineer noted, human-eye resolution VR has enabled pilots to read instrument panels at normal distance for the first time (Varjo, n.d.). NASA's own Johnson Space Center operates VR simulators and dome environments where crew members train EVA procedures. As McFarlane of NASA explains, VR labs are used "extensively for…astronaut training in extravehicular activity operations" (NASA, 2024). These facilities use generative 3D models and real-time graphics, and future versions may incorporate AI agents or procedural content generation to create on-demand scenarios. In short, technologies pioneered for classroom VR (now enhanced with AI) are directly applicable to space mission prep.

Remote **STEM laboratories** are another area of synergy. Generative AI can help simulate lab experiments that would otherwise require bulky equipment. For instance, in an AI-generated chemistry lab, students could conduct virtual titrations or biology dissections in VR (as done by education startups) and the AI would handle the experiment logic and feedback. If astronauts aboard the ISS or in a lunar habitat lack a certain lab apparatus, AI-driven simulators could fill the gap by generating equivalent training content. Moreover, space analogs on Earth – polar stations, desert bases – already use remote labs. The Ant+ project (Antarctic Explorer) suggests a model: children engage with an interactive AI-driven science bus tour of Antarctica (International Telecommunication Union, 2024). Similarly, remote STEM labs on Antarctica or Mars analogs (e.g. in Hawaii) could be augmented with AI tutors that explain procedures or answer field science questions on the fly.

Continuous **astronaut training and health support** is a critical use case. The European Space Agency (ESA) has begun integrating AI into astronaut preparation. Recent reports note that ESA is developing intelligent modules for mission simulation, medical instruction, and psychological support (Pao, 2025). For example, British astronaut Megan McArthur stated that ESA plans to expand distance-learning tools for the Columbus orbital lab, with AI features to improve efficiency (Pao, 2025). ESA is even trialing AI assistants in space: the *CIMON* (Crew Interactive Mobile Companion) – a spherical AI robot – was flown on the ISS to converse with crew and boost morale (Pao, 2025). Such devices, while early prototypes, hint at future in-flight AI aides. On long missions (e.g. transit to Mars), AI companions could facilitate informal learning or monitor cognitive well-being.

Furthermore, AI can help **adapt curricula to extreme conditions**. Astronauts often serve educational outreach roles and require flexible schedules; AI can generate lesson plans or communication strategies for them to engage with students on Earth. Space agencies can use generative AI to translate Earth-based educational content into contexts relevant to space. For instance, VR planetary simulations used in classrooms (as in the Algeverse example (Nichols, 2025)) could be adapted to teach geography or physics to astronauts, reinforcing concepts during downtime. Conversely, educational tools developed for space – like VR simulations of Mars geology – can enrich remote terrestrial learning for students interested in space science. These dual-use crossovers are increasingly common.

Finally, the parallel between **polar analogs and space** is instructive. Participants in Antarctic missions describe the environment as "as close as you can get to being on another planet" (International Telecommunication Union, 2024). This analogy suggests that strategies for remote learning in polar research could translate to space. The Antarctic Explorer platform (AI answers about Antarctica) directly leverages this by making polar science accessible through AI-driven Q&A (International Telecommunication Union, 2024). A similar model could allow learners (students or trainees in analog habitats) to explore planetary science topics. In essence, generative AI blurs the boundary between Earth and space education: tools developed for one can be repurposed for the other, enabling *continuous, location-independent learning* in extreme conditions.

6. Policy and ethical frameworks

To realize the benefits of generative AI in education while mitigating risks, robust policies and ethics frameworks are essential. At the global level, UNESCO has led in setting standards. Its **2023 Guidance for Generative AI in Education and Research** provides recommendations for policymakers, educators, and technologists. The report warns that GAI is advancing faster than regulations, leaving "data privacy unprotected and institutions unprepared" (UNESCO, 2023). It calls for steps such as requiring human oversight of AI outputs, protecting student data, and restricting unsupervised use by minors(UNESCO, 2023). Crucially, UNESCO envisions a "human-centered approach" – meaning AI should empower teachers and learners, not replace them. The Guidance also encourages integrating AI literacy into curricula and training teachers to use GAI responsibly (UNESCO, 2023). These recommendations align with UNESCO's earlier 2021 *Recommendation on the Ethics of AI*, which established core values – human rights, fairness, transparency – for all AI systems (UNESCO, 2021). In that Recommendation, UNESCO emphasizes that AI must promote social justice and inclusiveness, ensuring its benefits "are accessible to all" (UNESCO, 2021). Such principles imply that as schools adopt GAI tools, they should actively address bias and ensure equitable access, consistent with the broader Sustainable Development Goal of inclusive quality education.

Regional and national strategies are also emerging. In Europe, the Council of Europe (advisory) highlights AI's "transformative role" in personalizing learning and innovative teaching, but insists this must not violate human rights (Council of Europe, n.d.). The European Commission and member states are exploring educational AI projects – for example, a 2024 EU-funded initiative in Slovenia is studying the didactic, legal, and ethical aspects of GAI use in schools (European Commission, n.d.). Moreover, the forthcoming EU *Artificial Intelligence Act* (targeted for enforcement in 2026) will likely categorize certain AI educational tools as "high-risk," requiring transparency and human oversight. Aligning with these trends, national governments have begun issuing guidance. For instance, the United States government launched a task force in 2025 to promote AI literacy, stating as formal policy that AI should be integrated into K–12 and higher education with comprehensive educator training (White House, 2025). That Executive Order (April 2025) explicitly mandates resources and partnerships for AI in education. Other countries, from China to smaller states, are drafting AI-in-education strategies as well, reflecting global momentum.

Ethics in practice also plays out at the classroom level. Many institutions now require disclosure of AI use and train students in "responsible AI." Academic integrity policies are being updated to reflect AI; for example, some medical schools explicitly ask candidates to declare AI assistance on essays, and faculty are redesigning assignments to focus on higher-order thinking (Rochester Institute of Technology, n.d.). At the same time, specialized AI ethics education is being introduced. For example, UNESCO and partners have developed teacher guides on

AI literacy, emphasizing critical evaluation of AI content and the values of fairness (UNESCO, 2021; UNESCO, 2023).

In summary, a multi-layered policy response is taking shape. At the top, UNESCO's guidance and global conventions set broad ethical mandates for fairness, privacy, and human oversight (UNESCO, 2021; UNESCO, 2023). Regionally, bodies like the EU and Council of Europe are working toward regulation and pedagogical standards. National governments are following suit with AI-education roadmaps (e.g. the U.S. executive order (White House, 2025)). Effective implementation will require collaboration between governments, educational institutions, and industry. For the space sector specifically, agencies must align these frameworks with space regulations (e.g. export controls on software, astronaut code of conduct) and ensure mission data are protected. As a whole, these emerging policies recognize that generative AI can be a powerful ally for education in all settings – if deployed within a clear ethical and legal framework.

7. Conclusions

Generative AI is poised to **change education** profoundly – accelerating personalization, expanding access, and enabling immersive learning. As we have shown, these changes are especially promising for remote and space environments. AI-powered platforms can keep learners engaged and informed even in the deepest oceans, the polar ice, or the vacuum of space. Astronauts and analog explorers can continue STEM learning and professional development via virtual labs, simulated missions, and smart tutors that replicate the support of Earth-based educators. Examples from NASA, ESA, and other organizations demonstrate how AI, VR, and robotics are already transforming astronaut training and public engagement.

However, this technology must be managed judiciously. The ease of AI content generation brings temptations for misuse, and the "black-box" nature of many AI systems raises bias and accuracy concerns. Ensuring educational quality and equity means not just adopting AI, but embedding it in a human-centered pedagogical vision. Ethical guidelines (UNESCO, Council of Europe) and proactive policies (national AI-education strategies) are vital. Educators and space professionals will need ongoing training in AI literacy, so that they can harness these tools wisely.

Looking ahead, the dual-use nature of generative AI – serving both education and space exploration – suggests a valuable synergy. Innovations like AI-driven VR classrooms or adaptive learning software will benefit students everywhere, and can simultaneously be adapted for astronaut crews. For instance, an AI tutor that helps high-schoolers with math could be retargeted to assist mission specialists learning orbital dynamics. Conversely, lessons from space (rigorous safety standards, interdisciplinary curricula) can inform Earth education. In all cases, human creativity and critical thinking remain irreplaceable.

Well-designed generative AI should **amplify** these human strengths, not substitute for them.

In conclusion, as we prepare for ICVL 2026 under the theme "Changing Education Because of Technology Disruption," we see generative AI as a disruptive force with extraordinary potential. Its integration into education – especially for the space sector – offers continuity of learning in the harshest conditions and can inspire the next generation of space professionals. By rigorously addressing challenges through research, pedagogy, and policy, the education community can turn this disruption into an opportunity: transforming not only the classroom but even the next frontier of human exploration.

Acknowledgements

The work presented inthis paper is supported by the Core Program within the national research Development and Innovation Plan 2022-2027, carried out with the support of MCID, project no. 23380601, "Advanced research in the Metaverse and emerging technologies for the digital transformation of society".

REFERENCES

Baytas, C. & Ruediger, D. (2024) *Generative AI in higher education*. Ithaka S+R. Available at: https://sr.ithaka.org/ [Accessed: 24th February 2026].

Council of Europe (n.d.) *Artificial intelligence and education*. Available at: https://www.coe.int/ [Accessed: 24th February 2026].

EON Reality (n.d.) *EON-XR Revolutionizes Space Science Education*. Available at: https://eonreality.com/eon-xr-revolutionizes-space-science-education/ [Accessed: 24 February 2026].

European Commission (n.d.) *Generative artificial intelligence in education – The comprehensive transformation of green and digital education*. Available at: https://commission.europa.eu/projects/generative-artificial-intelligence-education-comprehensive-transformation-green-and-digital_en [Accessed: 24 February 2026].

International Telecommunication Union (2024) *AI-powered exploration of Antarctica: Unlocking imagination in children of all ages*. AI for Good Initiative. Available at: https://aiforgood.itu.int/ai-powered-exploration-of-antarctica-unlocking-imagination-in-children-of-all-ages/ [Accessed: 24th February 2026].

Li, Y., Tolosa, L., Rivas Echeverria, F. & Marquez, R. (2025) Integrating AI in education: Navigating UNESCO global guidelines, emerging trends and its intersection with sustainable development goals. *ChemRxiv*. https://doi.org/10.26434/chemrxiv-2025-wz4n9-v2

NASA (2023) *Artificial Intelligence for Life in Space (AI4LS)*. Available at: https://www.nasa.gov/ames/space-biosciences/research-branch/artificial-intelligence-for-life-in-space/ [Accessed: 24th February 2026].

NASA (2024) *Small Steps, Giant Leaps: Episode 143: NASA Training Simulators* [Audio podcast], 27 November. NASA APPEL Academy. Available at: https://www.nasa.gov/podcasts/small-steps-giant-leaps/small-steps-giant-leaps-episode-143-nasa-training-simulators/ [Accessed: 24th February 2026].

Nichols, J. (2025) Transforming education with virtual reality and artificial intelligence. *SpaceDaily*, 1 January. Available at: https://www.spacedaily.com/reports/Transforming_education_with_virtual_reality_and_artificial_intelligence_999.html [Accessed: 24th February 2026].

Pao, J. (2025) AI enhances astronaut training as ESA pushes for strategic autonomy. *TechJournal.uk*. 22 July. Available at: https://www.techjournal.uk/p/ai-enhances-astronaut-training-as [Accessed: 24th February 2026].

Rochester Institute of Technology, Center for Teaching and Learning (n.d.) *Equity, privacy, and academic integrity in generative AI*. Available at: https://www.rit.edu/teaching/ai-concerns [Accessed: 24th February 2026].

Tan, M.J.T. & Maravilla, N.M.A. (2024) Shaping integrity: Why generative artificial intelligence does not have to undermine education. *Computers & Education: Open*. 5, p. 100481.

UNESCO (2021) *Recommendation on the Ethics of Artificial Intelligence*. Paris: UNESCO. Available at: https://unesdoc.unesco.org/ [Accessed: 24th February 2026].

UNESCO (2023) *Guidance for generative AI in education and research*. Paris: UNESCO. Available at: https://www.unesco.org/en/articles/guidance-generative-ai-education-and-research [Accessed: 24th February 2026].

Varjo (n.d.) *Varjo & Boeing: A new era in astronaut training using virtual reality*. Available at: https://varjo.com/case-studies/boeing-starliner/ [Accessed: 24th February 2026].

VictoryXR (n.d.) *Home AI Tutor Platform & VR Labs*. Available at: https://www.victoryxr.com/ [Accessed: 24th February 2026].

White House (2025) *Advancing artificial intelligence education for American youth* [Executive Order]. 23 April. Available at: https://www.whitehouse.gov/presidential-actions/2025/04/advancing-artificial-intelligence-education-for-american-youth/ [Accessed: 24th February 2026].