

TEACHING AND LEARNING CASE STUDY	
Name of Institution/ Organisation	South East Technological University (SETU)
Who led the initiative?	Dr Haider Al-Juboori, SETU-Faculty of Engineering & Built Environment, Dept. of Electronics Engineering and Communications.
Date and timeframe of the initiative	The academic year 2022 – 2023 and ongoing.
What was the reach of the initiative?	Around 30 students in initial case-study
Initiative Title	Design of adaptive augmented reality system to enhance learning outcomes: a case study for electronic/mechanical engineering applications
Aims/ Objectives	<p>The primary goal of this initiative is to explore the potential of Virtual Reality (VR) technologies in enhancing the educational experience for engineering students, particularly in fields like electronics and aerospace engineering. The focus was on how immersive digital environments can support learning by making complex concepts more accessible and engaging. This includes the development of workshops and training sessions using VR tools, such as the Oculus Quest 2 system, to simulate real-world scenarios (like space missions) for educational purposes [1,2].</p> <p><u>References:</u></p> <p>[1] Al-Juboori, Haider, and Gina Noonan, V. O'Brien, and D. Picovici. "Instructional Considerations For Virtual Reality In Engineering Training And Education: Preliminary Research Results." (2023).</p> <p>[2] Al-Juboori, Haider, and Gina Noonan. "Leveraging the Power of Digital Immersive Technologies to Enhance Engineering Education and Learning." In <i>2024 IEEE Global Engineering Education Conference (EDUCON)</i>, pp. 1-5. IEEE, 2024.</p>
Rationale and Identified Needs	The initiative was motivated by the need to address challenges in teaching complex engineering concepts that are difficult to convey through traditional methods. It was recognized that immersive technologies could simplify complicated topics, make learning more interactive, and cater to students' varying levels of understanding. Furthermore, the COVID-19 pandemic highlighted the necessity for remote learning solutions, making VR an attractive option for virtual labs and simulations. This need is especially relevant in disciplines requiring practical engagement with sophisticated systems and scenarios
Frameworks, Policies, or Strategies Aligned	<p>The projects align with several internal and national frameworks:</p> <ul style="list-style-type: none"> • Strategic Alignment of Teaching and Learning Enhancement (SATLE): Supported by funding from the National Forum for the Enhancement

(internal, local or national)	<p>of Teaching and Learning, emphasizing the integration of digital tools in higher education.</p> <ul style="list-style-type: none"> • SETU's Vision: The focus on digital transformation within the university's Strategic Plan 2023-2028, Connecting for Impact, foregrounds innovative teaching, learning and assessment strategies. • Irish National Framework for Digital Skills: This aligns with the national agenda to boost digital competencies in education, particularly through immersive technologies.
Summary	<p>The initiative explores the integration of immersive VR tools in engineering education, using the Oculus Quest 2 system to simulate real-world scenarios. This approach is based on the premise that VR can provide students with hands-on experience in a virtual environment, making it easier to grasp complex engineering concepts. One case study used VR to simulate space missions, allowing students to explore the International Space Station and experience a partial zero-gravity environment. The findings from the studies suggest that students were highly motivated and engaged when using VR, reporting enhanced understanding and retention of information. Challenges included the initial learning curve for the equipment and the sensitivity of VR tools in an educational setting. The research underlined the potential of VR to improve the accessibility of high-cost, complex lab experiments, making them available to a broader range of students. Overall, the initiative has shown promise in aligning educational outcomes with digital transformation goals, providing a new platform for interactive learning in higher education.</p>
Did you collaborate with internal and/or external stakeholders to deliver?	<p>Dr. Gina Noonan (<i>Teaching and Learning Centre</i>), <i>South East Technological University (SETU)</i></p>
Organisation and Planning	<ul style="list-style-type: none"> - Action Planning: Designed workshops involving VR technologies, focusing on specific engineering applications, and obtained ethical approval from SETU's Research Ethics Committee. - Piloting: Conducted preliminary training sessions with a small group of students to test the VR equipment and gather feedback. - Committee Meetings: Collaborated with SETU's Teaching and Learning Centre to align the project with institutional goals. - Timeframes: The project was conducted over the 2022-2023 academic year, with multiple phases including planning, implementation, and evaluation
What resources did you need?	<ul style="list-style-type: none"> - Financial: Funding from the SATLE Fund 2021, covering VR equipment (Oculus Quest 2) and software licenses. - Staffing: Involvement of engineering faculty, educational technology specialists, and research assistants.

	- Technical: VR headsets, software for simulations (e.g., Mission), and technical support for setup and maintenance
Has it been evaluated? How successful has it been?	The evaluation involved student surveys and semi-structured interviews, focusing on engagement, motivation, and perceived learning effectiveness. The feedback was largely positive, with students expressing increased interest and improved understanding of engineering concepts. However, minor challenges were noted, such as the need for better training on equipment handling and the high cost of VR tools. The overall outcome was successful, indicating that VR could be a valuable addition to engineering education
Any future plans, including the sustainability of the initiative?	Future plans include expanding the use of VR across other engineering courses and potentially broader academic disciplines. There is interest in developing a framework for integrating VR sustainably in educational curricula, including cost-effective solutions for equipment and content creation. Additionally, the team plans to investigate multi-purpose VR tools to enhance their scalability and to explore partnerships with other institutions to share resources and expertise
Key Learning Points	<ul style="list-style-type: none"> - Immersive VR tools can make complex subjects more accessible and engaging for students. - Training sessions need careful planning to address the learning curve associated with new technologies. - While effective, VR remains a costly solution; strategies to reduce expenses and increase accessibility are crucial. - Student feedback suggests VR can significantly enhance motivation and interest in technical subjects. - The integration of VR should be gradual, with clear pedagogical goals and alignment with traditional educational principles to ensure its effectiveness.

Teaching and Learning Focus Areas (please tick all that apply)

Categories	Elements	Topics	Target Groups
Commit <input type="checkbox"/>	Leadership, Strategy & Governance <input type="checkbox"/>	Digital Transformation <input checked="" type="checkbox"/>	Students <input checked="" type="checkbox"/>
Coordinate <input type="checkbox"/>	Curriculum and Assessment <input type="checkbox"/>	Education for Sustainable Development <input checked="" type="checkbox"/>	Staff <input checked="" type="checkbox"/>
Consult <input type="checkbox"/>	Innovation in Teaching <input checked="" type="checkbox"/>	Academic Integrity <input checked="" type="checkbox"/>	Wider community <input type="checkbox"/>

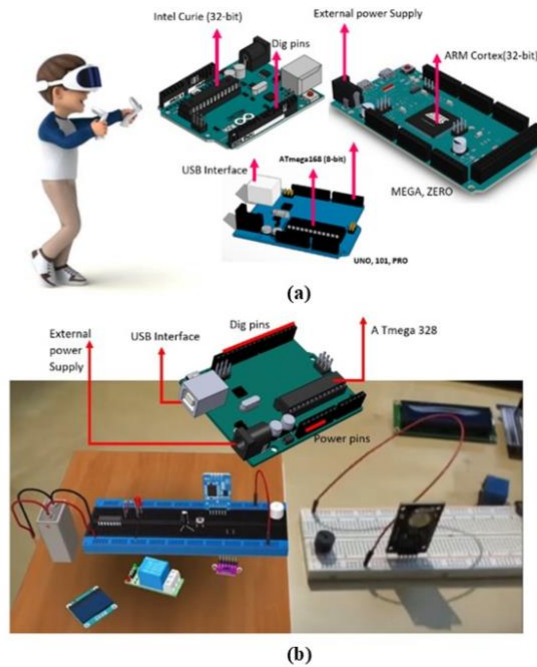
Create <input type="checkbox"/>	Professional Development <input checked="" type="checkbox"/>	Inclusive and Equitable Teaching Practices <input checked="" type="checkbox"/>	Other <input type="checkbox"/>
Celebrate & Continue <input type="checkbox"/>	Research and Evaluation <input checked="" type="checkbox"/>	Innovations in Assessment and Feedback <input type="checkbox"/>	
		Student Engagement and Partnership <input checked="" type="checkbox"/>	
		Collaborative and Interdisciplinary Approaches <input checked="" type="checkbox"/>	
		Artificial Intelligence <input type="checkbox"/>	
		Other <input type="checkbox"/>	

Contact Details

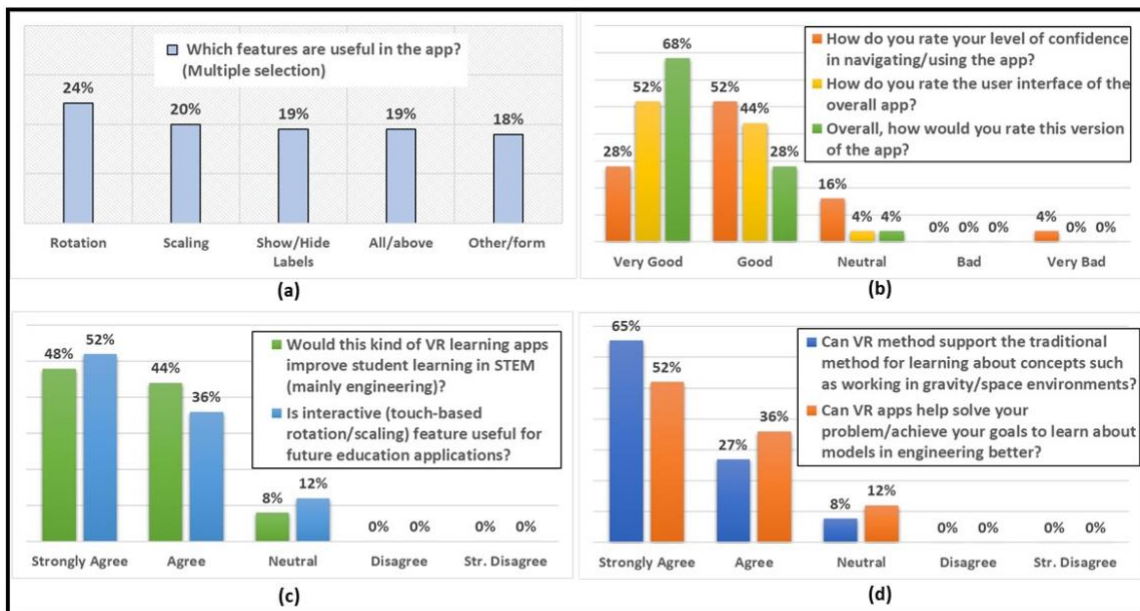
Contact Name/s	Haider Al-Juboori
Date	15 November 2024
Email Address	haider.aljuboori@setu.ie
Links	DOI: 10.1109/educon60312.2024.10578667 DOI: 10.21427/ESFH-1214

Photos/Graphs/Illustrations to support [see next page]

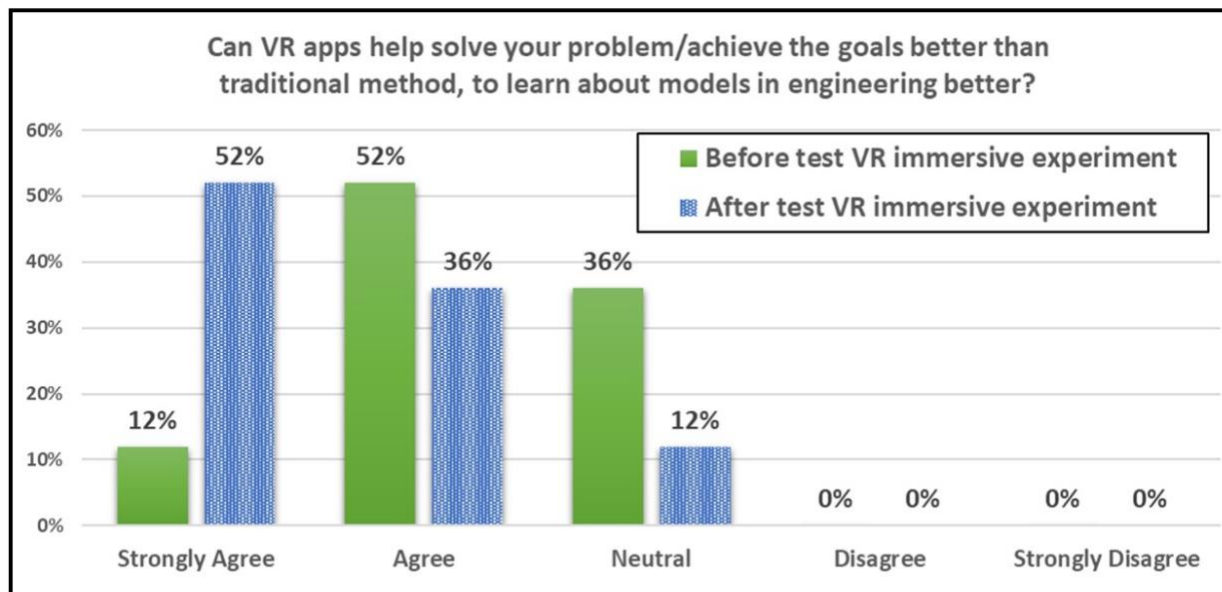
Virtual tools:
the Arduino micro-
controller
architecture and
all electronic
board properties



PRINCIPLES OF SUGGESTED TWO LEVELS
EDUCATIONAL IMMERSIVE SYSTEM.



Summary of the users' responses after testing the Mission:ISS software via VR Headset.



User feedback before and after using VR headsets in engineering education



(a) Part of a training sessions at the 3D virtual reality laboratory at NASA's Johnson Space Centre in Houston, (b) Use of cases for Oculus Quest 2 as part of Livestream of the users' view in SETU-Carlow Campus.