

# Humanising STEM Education

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No matter what scale, institution to national to international, STEM education has increasingly focused on humanising the learning experience, making STEM disciplines more relatable, engaging, and accessible. While not limited to STEM education, Monash University's "Impact 2030" Strategic Plan is aligned with this focus, grounding efforts in addressing global challenges of climate change, geopolitical security, and thriving communities ([Monash University, n.d.](#)). Similarly, the University of Sydney's "Sydney in 2032" Strategic Plan is aimed at tackling challenges to contribute to the common good through multidisciplinary problem-solving while ensuring a collegial and welcoming environment ([University of Sydney, n.d.](#)). The Australia National Science Statement ([Australian Government, 2024](#)) asserts that, to build a diverse and skilled workforce, the government will:

Offer programs that support diverse and under-represented groups and remove barriers holding them back from entering and staying in STEM careers.

Elevate, respect, and invest in Aboriginal and Torres Strait Islander knowledge systems and Aboriginal and Torres Strait Islander scientists.

Incentivise new approaches to science, including greater multidisciplinary collaboration across humanities and science disciplines.

The seventeen United Nations Sustainable Development Goals (United Nations, 2015) also offer a foundation for targeting humanisation of STEM education. Specifically, Goal 4 is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". The targets for this goal include cost, access, development of employability skills, equity, and inclusivity. Humanising STEM is achieved by emphasising the integration of human elements into the teaching and learning process by connecting with students' interests, experiences, and values. Humanising STEM education is not just a trend. This special issue provides a platform for global discourse and rigorous exploration of evidence-based practices to humanise undergraduate STEM education.

Humanised STEM education recognises that students have diverse needs; a one-size-fits-all approach simply does not work. To help all students thrive, we should embrace **flexible** and **adaptive** teaching methods. This requires tailoring instruction to individual learner strengths, needs, and interests, providing personalised instruction using student-centred pedagogy. The tenets of student-centred learning can be achieved through game-based learning (Coleman & Money, 2020). In this issue, the Original Research article "Using a Game-Based Learning Approach to Help Students Understand the Importance of Ethics in Science" presents evidence that learners' ethical perspectives relative to science were positively impacted through this student-centred game-based learning approach.

By incorporating outdoor-focused activities into the classroom, STEM education can be humanised through **experiential learning**, an approach that can improve a variety of learner

outcomes. The Original Research article “Integrating Outdoor STEM Activities into an Elective Course to Promote Students’ STEM Literacy” presents evidence that integrating outdoor education with STEM can increase STEM literacy of secondary students. By connecting classroom learning to real-world contexts and fostering hands-on exploration, outdoor STEM can spark curiosity and deepen understanding of complex STEM concepts.

At the heart of humanising STEM is the recognition that students are individuals with unique experiences, interests, and values. A strategy aimed at this understanding is **contextualisation**. Instead of presenting STEM concepts in isolation, we can place them within real-world contexts relevant to our students' lives. There are abundant examples of this, such as a physics lesson on energy tied to discussions about renewable energy. We should seek more challenging and pressing contexts beyond generic human experiences, tackling modern wicked problems and grey areas, like inequality, health care, terrorism, and environmental degradation. This goes beyond helping learners see the practical applications of STEM and pushes them towards the forefront of leadership in seeking solutions to these issues that are relevant to their everyday lives. In this issue, the Curriculum Development and Innovation article “From Blind Drawing to How to Make a Cheese and Vegemite Sandwich” explores motivating students through activities that help them draw strong connections between content and the world around them.

Beyond active learning strategies like games and outdoor activities, humanising STEM involves tapping into the **emotional and historical dimensions** of scientific discovery. In this issue, a two-part study explores how historical stories can foster emotional engagement in undergraduate physics laboratory units. In “Humanising Undergraduate Laboratories: Part 1 – Creating Colourful Historical Stories”, the design case is presented for bridging the gap between abstract concepts and human experience on topics including thermal physics, electricity, mechanics, and waves. In “Humanising Undergraduate Laboratories: Part 2 – How Does Students’ Emotional Engagement Differ in Two Physics Courses”, the authors present their findings. While quantitative results were similar pre- and post-intervention for emotional factors including anxiety and boredom, qualitative data indicated the stories stimulated interest and engagement when sharing the human stories behind the data.

**Inclusivity** and **equity** are also squarely aimed at the recognition in STEM education that students are individuals with unique experiences, interests, and values. Historically, systemic barriers within STEM disciplines have hindered the success of specific communities (e.g., women, ethnic minorities, socioeconomically disadvantaged) (McGee, E.O, 2020; Bloodhart et al., 2020). All students deserve equal access to STEM education and a welcoming STEM professional community. This requires creating inclusive environments that address diversity and ensure that all students feel valued and supported. Strategies for achieving this include implementing culturally responsive teaching pedagogy and universal design for learning. As stated by Wong et al. (2022), “[W]e need to be wary that those who exit the STEM pipeline are not *forced off the road* by social inequalities and exclusions (emphasis in original).” In this issue, the Original Research article “Integrating Indigenous Science and STEM” presents a fascinating discussion of the challenges and opportunities in an integrated STEM course that draws on both Indigenous Knowledges and Western scientific protocols, embodying the concept of *etuaptmunk*, a Mi’kmaq (First Nations people of the Northeastern Woodlands in North America) term that translates to “two-eyed seeing”. This philosophy uses both Indigenous and Western lenses and values diverse perspectives and knowledge systems in each. This integrated approach creates a more inclusive and culturally relevant learning experience.

While inclusivity involves curriculum design, it also extends to the professional development that supports teachers in diverse settings. In this issue, the Original Research article “Cultural and Linguistic Factors in the Effective Use of Lesson Study with Mathematics and Science Teachers in the Philippines” reveals how local cultural values such as *pakikisama* (group harmony) and *hiya* (modesty) can influence the open critique required for effective Lesson Study cycles. By documenting the dynamics in professional development collaborations and code-switching in teacher reflections, this work brings to light the need to adapt globally recognised professional development models for local cultural and linguistic nuances in order to be both inclusive and effective.

Through humanising STEM education, we can offer welcoming, engaging, and transformational experiences that strengthen the STEM pipeline. But this effort goes beyond individual students, contributing to addressing societal challenges and achieving broader societal goals. As seen in both national and international contexts, there is a need for STEM professionals that possess diverse perspectives and experiences. By connecting with students' interests, experiences, and values, creating inclusive environments, and emphasising the human element of STEM, we can support and inspire a new generation of STEM learners and innovators who are equipped to make a positive impact on their world.

## References

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