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Editorial: Reimagining Human–Technological Futures: Insights from ATERC 2024

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This editorial introduces the Special Issue of the Australasian Journal of Technology Education featuring peer-reviewed papers first presented at the 2024 Australian Technology Education Research Conference (ATERC), held in Sydney, Australia, 27–29 November.

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Reimagining Human–Technological Futures: Insights from ATERC 2024

Introduction

This special issue of the *Australasian Journal of Technology Education* presents research from the 2024 Australian Technology Education Research Conference (ATERC). The conference, held in Sydney under the theme *"Reimagining Human–Technological Futures,"* provided a platform for Australian and international researchers to share new work on the changing purposes and practices of technology education.

The papers selected for this issue represent the depth and variety of current research across the field. They include studies on artificial intelligence and cultural representation, gender and equity in technology teacher education, teacher preparation and professional identity, design-led pedagogies, curriculum development, mechatronics education, and the role of play in fostering creativity and computational thinking among young learners.

Collectively, these contributions show a field responding to technological change while centring values such as cultural awareness, ethical responsibility, and learner agency. Several recurrent themes are

evident: (a) ethics and responsibility, (b) agency and empowerment, (c) inclusion and equity, and (d) curricular coherence for a technology-rich future. Importantly, taken together, the papers in this issue strengthen the intellectual foundations of Technology Education by clarifying its core ways of thinking, making, and evaluating. This positions the field as one that is conceptually robust, pedagogically principled, and oriented toward the deliberate design of preferred technological futures. Below we briefly introduce each paper, before identifying the central cross-cutting themes that resonate across the collection.

Ethical Frontiers: Digital Technologies, Representation and Responsibility

McMaster, Morrison, Jordan and O'Chin discuss the issue of *Generative AI and Australian First Nations Representation: Ethical Concerns and Cultural Implications*. Their study exemplifies one of technology education's most urgent tasks—ensuring that emergent technologies such as Generative AI are evaluated not only for their utility, but also for their social and cultural consequences. Using collaborative autoethnography, the authors show that AI systems, when prompted to produce "First Nations perspectives," often rely on reductive, Westernised datasets that distort or erase Indigenous voices. Their findings highlight digital colonialism and the risks of decontextualised algorithmic knowledge creation. This paper challenges technology educators and developers alike to implement culturally responsive and transparent design, and to foreground Indigenous data sovereignty in both research and classroom practice.

Gender and Belonging in Technology Education

Puddicombe's *Unmasking Gender Norms: Female Pre-service Teachers' Perspectives on Persistent Stereotypes in Western Australia's Technology Education* brings a critical gender lens to the field. Continuing disparities in Technology Education—where women are still under-represented both in classrooms and in leadership—shape how future educators experience belonging and legitimacy. Drawing on interpretive phenomenological analysis, Puddicombe reveals that female pre-service teachers confront persistent assumptions about technical competence and authority. Yet they exercise resilience and self-determination through peer networks, visible skill demonstration, and selective boundary-setting. Her findings call for educational cultures that celebrate diverse forms of expertise and identity and underscore the importance of mentoring and institutional support in sustaining women's participation.

Strengthening Teacher Preparation and Maker Agency

Zagami's *Improving Teacher Preparation for Technologies Education in Australia* critically analyses 41 initial teacher education (ITE) programs, uncovering inconsistencies in how Technologies subjects are embedded across universities. The research exposes structural barriers such as inflexible accreditation guidelines that impede responsiveness to rapidly evolving domains like artificial intelligence, computational thinking, and advanced manufacturing. Zagami proposes greater national consistency in accreditation and the establishment of minimum curriculum expectations to ensure all pre-service teachers acquire both pedagogical and technical confidence.

Rouse, Ellis and Puddicombe extend this focus in *Agency in the Making: Empowering Pre-Service Technology Teachers*. Through case studies at three universities, they show how structured engagement with makerspaces, open-ended design challenges, and values-based projects fosters pre-service teachers' "agency toward making." Developing such agency equips teachers to take creative risks, blend digital and material technologies, and lead innovative design projects in schools. Both papers stress that technologically confident teachers are essential foundations for reforming the system as a whole.

Bridging Theory, Practice and Values

The paper by **Mason, von Mengersen, Gill, Mason, Smith and Cameron**, *Bridging Theory and Practice in Technology Education: Supporting Student Agency Through Pedagogical and Values-led Frameworks*, synthesises constructionist, social constructivist, and ethical frameworks to propose principled teaching approaches for supporting student agency. The authors argue that education must integrate doing, making and reflecting as a holistic process—empowering students to connect technical skill with ethical and cultural understanding. They also recognise the contribution of Indigenous knowledge systems, where community, environment, and ethics are inseparable. Their call for values-led pedagogy resonates with several other papers in this issue, especially those grappling with ethical uses of AI and sustainable curriculum design.

Human-Centred Innovation and Mechatronics

Waters and McMasters, in *From Users to Designers: A Sequenced Pedagogical Model for Human-centred Mechatronics Education in Schools*, provide a compelling vision of students as thoughtful designers who integrate technical knowledge with social awareness. By aligning Inquiry-Based Learning, Human-centred Design and Project-Based Learning in a sequenced model, the authors demonstrate how mechatronics education can move beyond "using robots" toward designing technologies that serve human needs. This pedagogical model not only cultivates engineering and computational thinking skills, but also reinforces empathy, ethics, and creativity—qualities equally crucial in AI, robotics and digital design.

Curriculum Futures and Systemic Coherence

At a policy and systems level, **King, Cameron and Hughes** in *Working Toward a Future-Resilient Technologies Curriculum* analyse how the Australian Curriculum: Technologies and the newly developed Digital Literacy capability respond to national and global priorities. Their discussion identifies the need for curriculum frameworks that balance adaptability, coherence, and ethical depth. They show how Design, Systems and Computational Thinking connect teachers and students to sustainability, wellbeing, and innovation agendas. The authors highlight the challenges of declining ICT literacy and call for professional learning structures that enable teachers to integrate emerging technologies within cross-disciplinary, future-focused learning experiences.

Foundations in Early Childhood: Creativity and Computational Play

Completing the issue, **Murcia, Cross and Menne's** *Let's Play Together: Fostering Children's Creativity and Computational Thinking Through Play with Coding Robots* turns attention to early learning. Through collaborative action research, the authors reveal how digital play using coding robots (such as Cubetto or Blue-Bot) can engage four- and five-year-old children in computational thinking while nurturing creativity and collaboration. Their vignettes highlight how children and parents co-create playful problem-solving experiences that mirror the social and cognitive processes of design. By situating computational thinking in relational and playful contexts, this research bridges early childhood learning with later technology education, reinforcing the importance of early exposure to inclusive, hands-on technological experiences.

Cross-Cutting Themes

Though the topics vary widely, the papers collectively address four significant and interdependent themes: *ethics and responsibility, agency and empowerment, inclusion and equity*, and *curricular coherence for a technology-rich future.* Together, these themes define key directions for research, teacher education, and policy in Technology Education.

1. Ethics and Responsibility

The ethical dimensions of technology—its capacity to include or marginalise, empower or exploit—are increasingly central to research and practice. McMaster et al.'s interrogation of AI-driven cultural misrepresentation demonstrates how ethics cannot be an "added layer" but must be embedded throughout the lifecycle of technological learning and design. Mason et al. extend this to pedagogy, showing that values-led frameworks support students' moral reasoning alongside technical mastery. Waters and McMasters further highlight that mechatronics and robotics education must foreground human needs and social contexts, ensuring that future innovators design for collective benefit, not technological novelty alone.

Across these papers, ethics becomes both a conceptual stance and a practical skillset—comprising cultural responsiveness, environmental stewardship, digital wellbeing, design empathy, and awareness of unintended consequences. Ethical engagement is also linked to sustainability: whether through curriculum design or daily classroom practice, educators are challenged to teach technologies that sustain rather than deplete human and ecological systems.

2. Agency and Empowerment

A second major thread concerns the cultivation of *agency*—for teachers, learners, and communities. Rouse, Ellis and Puddicombe articulate this as "agency toward making," describing how hands-on design fosters ownership, problem-solving, and confidence. Similarly, Murcia et al. show that even very young children can develop agency through playful, collaborative coding, learning that technology is something to be shaped rather than merely consumed.

At a professional level, Puddicombe's analysis of female pre-service teachers and Zagami's critique of ITE program structures show that agency is both personal and systemic. It arises when individuals experience professional credibility and when institutions provide resources and flexible pathways that support creative risk-taking. Agency, therefore, is framed not only as a pedagogical goal but as a condition for sustained innovation in the field.

3. Inclusion and Equity

Equity is woven throughout the collection as both a challenge and a responsibility. Puddicombe highlights gender inequity within ITE cohorts and classroom hierarchies; McMaster et al. illuminate how Indigenous representation is often distorted by technological tools themselves. Mason et al. and King et al. argue that inclusive design and curriculum approaches must recognise multiple ways of knowing, embracing cultural diversity and accessibility.

Equity also extends to early learning and student engagement. Murcia et al.'s coding-robot play sessions exemplify inclusive pedagogies that enable participation across varied ability levels and social contexts. These papers collectively assert that Technology Education must dismantle elitist or exclusionary assumptions about who "belongs" in technical domains, ensuring that all learners see themselves as potential creators and innovators.

4. Curriculum Coherence and Systemic Support

Finally, across these studies, a shared recognition emerges that enduring change requires a coherent curriculum and systemic support. Zagami and King et al. demonstrate the tension between policy ambition and institutional implementation—where accreditation, funding, and professional learning either enable or inhibit innovation. The authors advocate for national alignment of Technology Education, more adaptive governance of ITE accreditation, and professional development opportunities that respond to new digital literacies.

Curriculum coherence is not simply a matter of consistency, but of *connection*: connecting early childhood creativity (Murcia et al.) with school and tertiary pathways (Rouse et al., Puddicombe), connecting ethical and cultural understanding (McMaster et al., Mason et al.) with technical capability, and connecting teacher agency with national policy frameworks (King et al., Zagami). Such systemic coherence ensures that learners encounter Technology Education as an integrated and sustainable continuum rather than fragmented experiences.

Conclusion

Taken together, the papers in this Special Issue illustrate a field in transformation. Technology Education in Australia and beyond is moving beyond questions of *what* technology education to teach, toward deeper questions of *how* we teach them, *who* they represent, and *why* they matter. Across school, university, and community contexts, these authors envision education as a space where innovation is ethically grounded, creativity is inclusive, and agency is collective. This future-focused orientation positions Technology Education as a discipline concerned not only with responding to change, but with enabling students to actively shape futures that are socially just, environmentally sustainable, and technologically responsible. Through emphases on design, systems and computational thinking, ethical reasoning, and purposeful innovation, the field supports students to identify real-world challenges, such as climate change and sustainability, and to design considered, context-aware responses that reflect human values and long-term consequences. Reaffirmed throughout this collection is the view that Technology Education does not simply prepare students for future work, but it prepares them to participate in the creation of preferred futures. The eight papers assembled here offer powerful insights and practical pathways for educators who seek to build technological futures that are equitable, culturally grounded, and ethically informed.