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Reimagining the Teaching of STEM Subjects Through Arts-Based and Participatory Methodologies

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This special issue of *Educational Research for Social Change* focuses on rethinking the teaching of science, technology, engineering, arts, and mathematics (STEM) subjects through integrating creative arts-based (thus, STEAM) and participatory methodologies in classrooms. Methods of teaching of STEM subjects, mostly using traditional teaching methods (e.g. lectures, question-and-answer, practical work) have worked to some extent. They have however, been found to present knowledge that students only meet in formal institutions, and through strategies that have little relevance to the students' lives. These strategies and knowledge ultimately leave some students alienated from the intended learning of STEM subjects. And this, in turn, undermines the purpose of education—to enable each learner to develop their talents to the full and to realise their full creative potential including responsibility for their own lives and achievement of their personal aims, goals, and objectives.

The aim of the United Nations' Sustainable Development Goal #4 (Global Goals, n.d.) is to facilitate quality education at individual, societal, and global levels in order to foster sustainable development. Good quality STEAM education therefore helps learners to attain well-being by creating conditions for flourishing—that is, the continuing development of their optimal potential and living as human beings. It means learners should be engaged in relationships and activities that are meaningful to them (de Ruyter, et. al., 2022). These engagements should thus be aligned with an individual's own values and humanistic values, which enables them to achieve well-being in the learning of STEAM subjects. This calls for the reimagining of educational processes that promote human flourishing through education.

Approaches to the teaching of STEAM must involve transformative approaches to the teaching and learning. Transformative teaching and learning approaches can humanise subjects by showing their connections to other aspects of learners' lives. Humanising knowledge commonises it, rather than making it a privilege for the few who can understand it (Bollier, 2020). Transformative teaching and learning approaches facilitate epistemological access, which reduces the alienation perpetuated by traditional teaching methods. Furthermore, transformative methodologies that enable epistemological access assist with the decolonisation of the discourse of STEAM subjects.

In this issue, Caleb Mandikonza explores transformative approaches to teaching using arts-based teaching approaches in natural sciences education in his article, "Using Arts-Based Methodologies: Facilitating First-Year Pre-Service Teachers' Collaborative Teaching of Cell Biology." His students worked in small groups to present on teaching cell biology concepts of their choice, using strategies such as dance, drama, music, poetry, and drawing as stimulus for learning the concepts.

Tholani Tshuma and Eunice Nyamupangedengu's article, "Drama in the Science Classroom: Reimagining the Teaching of Natural and Life Sciences" demonstrates how the integration of arts-based, participatory, and humanistic methodologies in the teaching of science subjects has potential to stimulate student interest, facilitate epistemological access, and improve their performance. Through self-study research, these two teacher educators share and reflect on their observations and experiences of using drama in teaching science concepts (diffusion, DNA structure, meiosis) and a socio-scientific issue (albinism) to pre-service teachers training to be high school teachers. Data were in the form of drama scripts, journaling of observations, reflections, and discussions with a critical friend.

The next article is "A Formative Study Towards the Inclusion of Indigenous Technologies and Knowledge Practices in Science, Technology, Engineering, Arts, and Mathematics (STEAM) Curriculum Settings" by Rob O'Donoghue, Wilma van Staden, John Bhurekeni, Janet Snow-Macleod, and Lindiwe Ndlamlenze. These authors use a cultural-historical approach to examine three collaborative case studies through formative research on the pedagogic tools for including Indigenous technologies and knowledge practices in teacher education (these practices are generally excluded in the contemporary classroom). They found that although teachers are highly interested in their Indigenous knowledge heritage, they do not have the knowledge to include this in their teaching—and their learners tend to prioritise modernity over indigenous heritage and technologies, often undervaluing the latter as forgotten past.

Drawing from the project, Mentoring as a Method to Promote Women's Health in the Context of HIV-Prevention and Unequal Gender Relations, Mathabo Khau's article reports on "Using Drama Pedagogy to Enhance Understanding of HIV Transmission, Infection, and Prevention Among Third-Year Student Teachers." The data were generated through the arts-based activity, drama, to teach about HIV transmission to student teachers in a bid to equip them with alternative ways of teaching learners about HIV and AIDS. Her findings disclose the student teachers' lived experiences, and how they shaped their perceptions of HIV infection and living with AIDS, and that the arts-based pedagogy allowed for their enhanced understanding of complex phenomena.

In her position paper, "Enabling STE(A)M in Sustainability Education Through Dialogic/Dialectic Reconciliation," Ingrid Schudel uses illustrative examples of a broad range of arts to explore possibilities for STEAM education with an education for sustainable development focus that counters disciplinary alienations between the arts and the STEM disciplines. This author posits that unnecessary alienations between cultural-emblematic and mathematical-logical epistemes, especially those linked to narrow interpretations and restricted developments in dialogism and dialectics respectively, are

influenced by restricted understandings of epistemological, ontological, and praxiological philosophical drivers in meaning making and responsive action. Her paper further develops a series of philosophical principles that could underpin STEAM education practices.

Next, is the article “Exploring Design Principles for STEAM Learning Activities Development by Science and Technology Teachers” by Maria Tsakeni. Following the design-based research stages of needs analysis, development, testing, and reflection, her study produced design principles underpinned by the learning theory of constructionism. These principles include design thinking, finding solutions for learning problems, creativity, and innovation applied to instructional design. Her study recommends the use of design thinking pedagogies in developing teacher knowledge on STEAM classroom practice

Eunice Nyamupangedengu and Constance Khupe’s article, “Turning the Art of Karanga Beer Brewing Into a Science: An Example of Humanising Biology Teaching and Learning” demonstrates how Indigenous knowledges can be incorporated into STEM subject content. They argue that humanising the teaching of STEM subjects by building on Indigenous knowledges can make these subjects attractive, accessible to, and relevant for students—especially given that many children are engaged in subsistence-based knowledge economic practices and activities that are rooted in Indigenous practices.

The book reviewed in this issue is *Against Racial Capitalism: Selected Writings, Neville Alexander* (Vally & Motala, 2023). According to Nadeema Musthan, this carefully curated collection of Neville Alexander’s writing is the latest contribution to ongoing collective efforts to honour who Alexander was, acknowledge and interrogate the vital intellectual contributions he made (particularly in reference to contemporary struggles), and recognise the indelible mark he left—not just in South Africa but globally. This edited selection of Neville Alexander’s writing was compiled by two of his long-standing friends, Salim Vally and Enver Motala, who have individually and collectively, struggled and continue to work tirelessly in workers’ education, community struggles, political, worker and student organisations, and globally in anti-colonial struggles of various kinds. This contribution not only introduces Neville Alexander to another generation of activists and engaged intellectuals but also serves as an expression of radical love, which encourages us to build critical communities, insist on and engage in dialogical spaces, and develop critical reflective practices oriented towards human dignity and a more just world.

This special issue ends with Logamurthie Athiemoolam’s report on the 10th South African Education Research Association conference hosted by Rhodes University from 30 October to 3 November 2023, with the theme *Education(al) Foundations, Education(al) Futures*. The conference was well attended with over 300 delegates from across the spectrum of higher education institutions in South Africa and from some international universities too, including Sweden. A noteworthy feature of the conference was that it offered a rich, diverse programme that included plenary presentations by renowned educational researchers, workshops, parallel sessions, book launches, poster presentations, and ample opportunities for networking during the conference. Participants believed the conference shed light on important issues affecting education at large, and contributed positively to their ongoing personal, professional, and academic development within the contexts of the higher education institutions. The sense of sharing common issues, challenges, and concerns in a collaborative, collegial, and supportive space—especially for novice and emerging academics—signified hope for the next generation of academics.

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