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Shared Insights: Removing barriers to understanding in design and technology education

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The world over there seems to be increasing pressure on educators – pressure from budgets, pressure from policies, pressure from schemes of accountability, whether for teaching, researching or pastoral aspects of the role of an educator. Dealing with such pressures brings with it a reduction in time to get on with the practice of teaching –whether we are working with early learners, teenagers or undergraduates. And the knock-on effect from this can be even more reduction in time for reflecting on our practices as educators. Pressure of time can stifle innovation, collaboration - from doing anything beyond addressing the immediate with safe solutions from past practices, staying in our comfortable silos, whether they are boundaried by the age groups we teach, the disciplinary aspects that we teach, the national and regional contexts we teach in.

The DATE journal took a brave decision some ten years ago to disrupt some boundaries in design and technology education. The journal's antecedents date back to the 1967 with the publication of the first issue of *Studies in Education and Craft*, a journal centred almost exclusively on UK mainstream primary and secondary schooling. There is an evolutionary path to the current *Design and Technology Education: An International Journal* but the international, age, stage and disciplinary diversity of articles now published in the journal shows a step change in the audiences the Journal now communicates with. As editors, there is a constant question – does the academic working with postgraduate design students stop, read and learn from an article focused on research with the very youngest children in our education systems? And is this stepping beyond reciprocated. Can we learn from each other?

This final issue of Volume 22 is as varied as the journal has become – authors representing: Canada, England, France, New Zealand, Norway, Sweden, Turkey, and Wales; compulsory, undergraduate, pre-service and in-service education. But the overarching theme of all articles is learning. Taken together, in many ways the articles provide insights that can enrich understanding of design and technology education across the diversity, shared insights across barriers. From an article about oral assessment feedback with undergraduates whose messages are equally relevant to oral feedback with young learners, to three articles from different contexts, looking at dimensions of 21st Century skills, that between them provide a rich collection of insights, to two articles that open up questions, insights and possibilities around Interdisciplinarity that have broader messages that inform pedagogical approaches, not least in the context of STEM, this issue provides reflective nourishment.

So, we encourage readers to pause, step over boundaries, explore the potential of sharing insights from beyond.

With no departure from the tried and tested, Richard Kimbell provides another of his reflections, this time giving some thought to the ebb and flow of tides. In *Bow creek and some mental arithmetic,* he ponders on

some technological possibilities of tidal waters, the impetus they have provided and continue to provide for innovation. This sets him to reflect on some of the exciting project work he has witnessed over the years, reinforcing his conviction of the value of embedding design and technology projects in rich, thought provoking contexts – an important issue for many and particularly timely in the current schools' context.

Moving to the research section of the journal, this issue provides insights into formative assessment, maker based education, 21st Century skills, pre-service education, teachers' perceptions and perspectives, and pedagogic approaches and challenges to interdisciplinary settings.

Kristine Hoeg Karlsen, Østfold University College, Norway contributes, *The value of oral feedback in the context of capstone projects in design education*. This first article focuses on formative assessment with undergraduate design students, in particular the use of oral feedback - what students find useful and the conditions that need to be met to support the feedback being useful. Research was undertaken with final year students working on their capstone projects. Open ended in-depth interviews were conducted linked to a four-dimensional framework: the form of the feedback, the focus of the feedback, the purpose of the feedback in terms of the learning potential and temporality in terms of feed-back and feed-forward. Feedback was initially coded using the binary of useful or useless and then analysed through the lenses of the four dimensions. Feedback was more often seen as useful than useless, but what emerged through more detailed analysis was the sequence of dialogue – an example given illustrates how a student found feedback helpful that started with a question from the tutor, followed by a judgment and then a correction and concluding with a suggestion. An important condition was a student's perception of the tutor's comments as trustworthy, based for example on their knowledge and experience or the level of engagement with the student's work. The article provides fascinating, detailed insight into the range of aspects that influence the effectiveness of oral feedback, providing much to reflect on for anyone working with students on design projects.

The next three articles focus on the development of 21st Century skills, two in the education of pre-service teachers and the third exploring teachers' perceptions.

In *Creativity assessment in the context of maker-based projects*, Benjamin Lille, Université Laval, Canada, and Margarida Romero, Université Nice Sophia Antipolis, present research into the links between learning through making and the development of creativity. The article draws from #SmartCityMaker, a research project that approaches learning-by-making through a co-designing and co-constructing pedagogical model and that includes digital resources that combine with physical resources to create smart city models. The participants in the research were pre-service pre-school and elementary school student teachers. The students worked in teams and were assessed first on an individual basis, focusing on their process of creating an urban building model. The second assessment was team based and focused on pedagogical creativity in developing a resource that addressed an educational issue. Assessment was qualitative and formative, drawing evidence from team-based diaries and learning journals, and made use of a rubric-based tool. This enabled assessment of creativity and design thinking in both building models and in designing pedagogic activities, alongside assessing knowledge such as coding and robotics. They argue that maker-based pedagogical design projects support creativity without sacrificing knowledge acquisition. This is valuable learning for pre-service teachers.

The second article comes from Paul Snape, University of Canterbury, New Zealand. In *Enduring Learning: Integrating C21st soft skills through Technology Education*, Paul provides a scholarly review of 21st Century skills linked to learning by doing in authentic contexts. A particular emphasis is on the importance of developing enduring learning and the New Zealand Technology Education curriculum. The article highlights the iterative active and reflective nature of the learnings. It also highlights a strength provided through Maori culture and the affordance of focusing on spirituality, reciprocity, sharing knowledge, respect, tolerance and understanding. As with the previous article, there is a clear message about the potential for balanced development of knowledge acquisition and high order 21st Century skills and the importance of this understanding for pre-service teachers

The third article providing insights into 21st Century skills focuses on practicing teachers' perceptions. In *Design, system, value: The role of problem-solving and critical thinking capabilities in technology education, as perceived by teachers*, Patrick Schooner, Charlotta Nordlöf, Claes Klasander and Jonas Hallström, Linköping University, Sweden, focus on the under-researched area of teachers' views on teaching 21st Century skills. The research explores the views of twenty one teachers in the Swedish compulsory sector, through in-depth qualitative interviews. Analysis identified three different approaches to developing these skills, a design approach focusing on design and construction, a systems approach focusing on the complex and network aspects of technology and a values approach, concerned with social and other implications of technology. While allowing for these different approaches to be identified, what was also apparent was how teachers used different approaches at the same time, using an integrative pedagogy. These findings indicate a contrast with other research, suggesting that much teaching is de-contextualised design and make activities. The research also indicates more complex aspects, for example the decrease in focus on problem solving from designing and making, though the systems approach to the values approach, and the reverse being evident for critical thinking, and the implications this has for teacher development. The research has a wider message, of going beyond pedagogical rhetoric, showing a value for research that focuses directly on the practices and beliefs of classroom teachers.

The final two articles look at the challenges and benefits of working across disciplines.

In, *Action Reflected and Project Based Combined Methodology for the Appropriate Comprehension of Mechanisms in Industrial Design Education*, H. Güçlü Yavuzcan and Damla Şahin of Gazi University (Turkey) focus on the challenge of introducing engineering knowledge into industrial design courses in Higher Education when the pedagogy is based on traditional verbal lectures. The research presented is drawn from a study where an alternative model, drawing on Kolb's work on learning cycle and learning styles, focused on experiential, project based learning formed the basis of the pedagogic approach. The engineering knowledge at the core of the project was that of mechanisms. Drawing together theoretical and practical knowledge, including 3D computer modelling, the students were presented with an action learning team challenge of designing mechanical games. The outcomes illustrated the value of using visual approaches with industrial design students alongside concrete learning and hands-on modelling, including 3D modelling, embedding the learning of conceptual knowledge in activities where students were 'doing' and applying. A valuable dimension of the article is the contrasting of two distinctly opposed pedagogic approaches, one more typical in engineering and one more typical in industrial design, at a time when technological developments are drawing extensively on both disciplinary areas, particularly with the increased focus on integrated STEM education.

Last, but certainly not least, is an article showing the positives of interdisciplinary experiences. In *How to frame the un-known? The odd alliance of design and "fundamental physics" in a design school*. Annie Gentes, Anne-Lyse Renon (Telecom ParisTech) Bobroff Julien (LPS - Univ. Paris Sud CNRS) France, provide insight into the increasing importance of Interdisciplinarity and the impact of using science in a productive way in the education of design students. The article focuses on how design students can engage with interdisciplinarity through co-design and dialogue with other disciplines. The authors aimed to take 'designerly ways of knowing' into the realms of 'expansive learning'. The project brings together design educators with a fundamental physicist. The research focuses on a framework with five properties or dispositives: affective, cognitive, reflexive learning, economics and political and is based on a series of workshops themed on fundamental physics (superconductivity, quantum physics, light and optics) each of which formed the inspiration for students to create a design project. Drawing on data gathered through post-hoc interviews, each of aspect of the framework is illustrated, indicating its value for interdisciplinary projects. An important message from this research is, while they might increase their understanding of science, the real significance is how students can become better designers, dealing with complexity and uncertainty, by designing in a context of 'odd alliance' across disciplines. This message has been present in the literature for more than forty years – this article provides a strong example of learning this through practice.

Issue 22.3 concludes with two book reviews, both focusing on new edited collections from the *Contemporary Issues in Technology Education* series, published by Springer. In the first review, *A new paradigm for design and technology education?* Matt Mclain reviews *Critique in Design and Technology Education*, edited by P. John Williams and Kay Stables. Jason Davies then provides the second review, this time for *Contemporary Research in Technology Education*, Edited by John Williams and David Barlex.

We hope that you enjoy this issue of the Journal. As always, we welcome comments and questions on the Journal, and invite all interested to submit articles for consideration to be included in future issues.