

Editorial 26.1

Thinking design? Design Thinking?

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Welcome to the first issue of the journal for 2021. As we enter what will hopefully be the final chapter of the current pandemic, this issue provides opportunities for sharing recent research alongside some speculation about how things might change and what future research may focus on. The issue includes six research articles, a reflection piece and two book reviews. The research articles fall into two categories and the first three report directly on research in design and technology activities in mainstream schooling.

However, the further three represent a slight shift away from articles normally published in the journal as each looks within and beyond design and technology education, exploring broader links with design thinking and design pedagogy. Having articles focusing on Design Thinking submitted to the journal is something new and has given us editors, not to mention a small number of our reviewers, a certain amount of soul searching. Do such articles fall within the scope of the journal? Is it beneficial to authors and readers to have them included? And ultimately, where does the journal sit in terms of the broader adoption of Design Thinking beyond what we might see as the family of design and design & technology education? Do we want to protect our territory or be open and inclusive? This is a tricky issue. A dimension that many of us take pride in is the interdisciplinary nature of design. Any knowledge is design knowledge if you need to know and understand it to make progress on a 'wicked' task. Processes of design, the wicked nature of design knowledge and design problems make the 'discipline' special whilst also providing a centre of gravity for working within and across disciplines. For some, design is even seen as post disciplinary.

So, where does the journal sit in relation to research that centres on Design Thinking, rather than exclusively on design and technology education?

As editors, we made a choice to accept articles for this issue that might appear to be coming in from left field, and we hope that readers find them as valuable, interesting and stimulating as we do. But, as always, we welcome comments and views, including on future directions.

But now to the contents of this current issue.

The first research article focuses on the use of ePortfolios. In *Long-Term Use of ePortfolios in Craft Education among Elementary School Students: Reflecting the Level and Type of Craft Learning Activities*, Auli Saarinen, Pirita Seitamaa-Hakkarainen and Kai Hakkarainen from the University of Helsinki, Finland present research from a longitudinal study on use of ePortfolios from 3rd – 9th grade in the context of Finnish National Curriculum Craft education. The authors describe the affordances of this type of portfolio as a method of documentation, including the development of digital competences. What is reported in this article builds on two previous reports, one focusing on user experience of ePortfolios over three years and a second analysing

textual and visual contents of ePortfolios across four years. This current article sheds light on the types of learning activity and cognitive processes that are made visible through the portfolios. A background to developments and types of ePortfolios is presented in advance of focusing on the reported study in which pupils worked in groups, collecting images and descriptions of pivotal events in their working and learning. Data was gathered from 2013-2018 and a detailed analysis was undertaken including interviews with eight students each with six years experience of using ePortfolios. The study revealed a shift from concrete to abstract cognitive processes, an increasing focus on procedural knowledge over technical matters and student-led over teacher-led activities. At interview students showed a critical attitude, focusing on aspects such as reflection and communication. The authors suggest more research is needed, but present a detailed and fascinating account of the impact of longitudinal use.

A second longitudinal study from Finland is presented by Marja-Leena Rönkkö and Virpi Yliverronen (University of Turku) and Kaiju Kangas (University of Helsinki). In *Investigative activity in pre-primary technology education—The Power Creatures project* they present research with pre-primary children (5-6 years old) exploring a playful investigative approach as children designed and made ‘power creatures’ – felted creatures containing soft circuits. The project was set within an integrative STEAM approach that was inquiry based, multidisciplinary, involved creative problem solving and hands-on activity. The aim of the study was to understand the nature of the children’s activity focusing on everyday technologies and to identify pedagogical practices that support such investigative activities. Data was collected through video recording the activities of 19 young children and then analysing these using a deductive content analysis method. The article reports on the phases of the activities over a four month period highlighting teacher scaffolding and involvement alongside the children’s investigative activities. Children’s motivation, confidence and empathy were supported through stories, play and exploration and included constructing a circuit with alligator clips, battery, battery holder and buzzer both through ‘circuit play’ (in which the children were the components) and also with real components. They also engaged in hands-on craft activities, learning how to felt wool and use this to make their creatures. The article highlights the educational focusing taking place, such as dialogue and collaboration, reflection and reasoning. This joyful article provides illustrated insight into both young children’s learning and the pedagogic practices that supported this.

A further article focusing on pedagogical tools in a project involving circuitry comes from Sarah Pule and Jean-Paul Attard from the University of Malta. In *Spatial cognitive processes involved in electronic circuit interpretation and translation: their use as powerful pedagogical tools within an education scenario*, they present research on spatial cognitive processes with older learners – 15 and 16 year olds studying vocational engineering technology in a Maltese secondary school. Some background and history on iconic and schematic circuit diagrams is provided along with factors that impact on our understandings of different ways of representing items and to the learning involved. Data was collected from research with a mixed gender and ethnicity class of 18 students at a point in their course where the focus was on electronic circuit assembly. The students’ task was to translate a schematic circuit diagram into a stripboard layout using computer software to create an iconic circuit representation. Grounded theory was used to derive data from mainly qualitative analysis. An aspect was identifying sub sections of units that link to a particular function – what are referred to as ‘chunks’. Analysis focused on the shift from symbolic to iconic representation and to two key

'chunks' of the system and indicated that while the shift from symbolic to iconic components was managed well by the novices, with more cognitively taxing aspects such as flow within 'chunked' functions, they were less successful. The authors suggest the normative practice in electronic education of starting with symbolic and moving to iconic could be unhelpful, referencing Bruner's theory that intellectual development moves from enactive to iconic to symbolic representation. They suggest that this could influence pedagogic approaches.

The research with 5 and 6 year olds presented by Rönkkö, Yliveronen and Kangas and that of Pule and Attard is quite different in many ways. But a fascinating connection is apparent when considering the enactive pedagogic approach taken with the young children and the findings with the older children. Despite age and education phase differences, there are important insights here for design and technology educators at all levels of education.

The fourth research article is the first of our articles on Design Thinking. In *Meeting the Challenges of STEM education in K-12 Education through Design Thinking* Ahsen Öztürk from Ondokuz Mayıs University, Turkey draws on international and Turkish perspectives to consider ways in which STEM education is interpreted and incorporated into curricula. The position in Turkey is interesting, wherein the technology and design and science curricula in primary and secondary schools have a focus on STEM, with technology and design emphasising creativity, innovation and user-centred design. It is also proposed that its teachers becoming mentors for other subjects. Insight into a Design Thinking approach is drawn from literature, along with its increasing application in mainstream schooling, including in curriculum and instructional design – an issue also highlighted in the final research article in this issue by Mehmet Ersoy. Multiple approaches of Design Thinking are compared. This analysis of STEM and Design Thinking then become the backcloth for exploratory research into the challenges of STEM education in Turkey, initially through semi-structured interviews with teachers and school principles and then through participating in a STEM workshop as participant-observer. The interviews revealed challenges with integrating STEM, partly because of the diversity of subjects and partly because an engineering design process and results oriented mindset was being promoted and partly because of scheduling difficulties. The STEM workshop highlighted the importance of collaborative approaches and a value of engineering in STEM including inquiry-based problem solving and engineering design process. Once again teachers highlighted challenges such as a results-oriented mindset linked to a national education focus on exams over creativity. Set against the literature review of Design Thinking, the similarities and differences in approach between mindsets of engineering and mindsets of Design thinking were compared, the latter seen as providing potential solutions to challenges identified in the exploratory research.

A second article on the affordances of Design Thinking is contributed by Ivano Bongiovanni of the University of Queensland, Australia and Dayana Balgabekova of the University of Glasgow, UK. In *Ask me if I am Engaged: A Design-led Approach to Collect Student Feedback on their University Experience* they present an innovative approach to using Design Thinking to gather feedback from Masters-level students in a Business school through a design led workshop. The workshop was held across two days and centred on students co-designing the 'University of the future.' This novel approach was explored as an alternative to the normative satisfaction questionnaires and surveys that students complete as a feedback mechanism on their experience. The authors outline the importance of feedback and critique approaches currently taken and set out the aim of the workshop as collecting rich data about student experience

whilst providing students with an engaging experience and introducing them to Design Thinking approaches. Research was undertaken through two 2-day workshops with a total of 59 students of mixed nationalities and degree courses, none of whom had a background in Design Thinking. Working at times on their own and at times in groups, the students engaged in a series of design-led activities identifying both problems and opportunities from their experiences and proposing solutions based on these. A mix of qualitative and quantitative data was collected through a pre-workshop survey, analysis of the activities throughout the workshop and a post-workshop survey. The feedback from the students on the workshop itself was overwhelmingly positive but equally of value is the article's reporting of the use and impact of Design Thinking strategies in producing rich data about a university experience.

The final research article in this issue shifts our focus to higher education and curriculum Instructional Design and, echoing the previous article, taking a design pedagogy/design thinking approach. In *An IDEA for design pedagogy: Devising instructional design in higher education 4.0* Mehmet Ersoy of Eskisehir Osmangazi University, Turkey, makes a case for developing a design approach to Instructional Design in the current context where so much teaching and learning has moved online, speeding up the potential and challenges of Education 4.0 and with a specific focus on pedagogy. Via a brief introduction on pedagogies for e-learning he makes a case for a connectivist approach and, linking this to 21st Century skills with an example from the World Economic Forum makes a further link to a key focus on Industry 4.0. This background forms the context for the development of a conceptual model for Instructional Design that places design pedagogy at the centre. Through his study he analyses literature on design pedagogy including design thinking, instructional design and education 4.0 and draws together links to create a conceptual model for curriculum development and instructional design that includes pedagogical motives, concepts and technologies and stakeholders. The model - Instructional Design for Educational Actuality (IDEA) - is highly detailed, inclusive and ambitious and in the final sections of the article this is recognised by an analysis of implications for current practice alongside a critique that recognises technology's inability to be a solution for everything.

In addition to research articles, this issue also includes a reflection by Derek Jones of The Open University, UK and reviews of two recently updated books.

In *Making little things visible*, Derek Jones reflects on the challenges faced by design and technology educators in 2020 and the ways in which little things taken for granted or that have become tacit have been made visible by the major shift in the ways that teaching and learning have taken place, for example in the absence for many of the pedagogical culture of the physical studio. In addition to reflecting on the past year he highlights the value of capturing and sharing insights and development that have occurred as a result of transitions that have been made, referencing the recent call for articles for a special issue of the journal "*Alternative Studios: Design Education Changes in 2020*" that Derek will guest edit along with his colleague Nicole Lotz.

Finally, we have a review from Andy Mitchell of the recently published 2nd (revised) edition of *Teaching STEM in the Secondary School: Helping teachers meet the challenge* by Frank Banks and David Barlex and from Bhavna Prajapat a review of the recently published 4th (revised) edition of *Learning to Teach Design and Technology in The Secondary School: A Companion to School Experience*, edited by Alison Hardy.