

Technology Education Today – International Perspectives

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Technology Education Today – International Perspectives is the first book in a series to be published by a new network, The Centre of Excellence for Technology Education (CETE) which is a collaborative international research association formed by six leading academic research institutions within the field of Technology and Engineering Education.

The book is made up of a series of ten chapters each devoted to providing the current state of International Technology Education (TE) in the selected countries of Australia; Canada; Germany; Luxembourg, the Netherlands, New Zealand, Switzerland, Ukraine, the United Kingdom and the United States of America. The book provides an excellent overview into the different approaches, structures and challenges found when implementing TE in each country at a time when the need for developing technological literacy is recognised by all as important and yet TE is struggling to meet various stakeholders' expectations.

Chapter 1: Technology Education in Germany

Ingelore Mammes, Stefan Fletcher, Martin Lang & Dieter Münk

This chapter discusses in depth the need for TE in Schools within Germany; the necessity for Technological literacy and its relationship with technological socialisation; the need for technology in Primary schools; the institutionalisation of TE on the basis of curricular; teachers professionalism as a barrier for implementing TE; the current position of TE across age phases and within different school types (Comprehensive schools; grammar schools; special schools) including present implementation models and future requirements. The chapter ends by discussing the crucial separation that exists in Germany between general education and vocational education and the challenges that this affords to those designing and providing TE.

Chapter 2: US K-12 Engineering Education History: A keyword, field, and Social Network Analysis of Trends

Johannes Strobel, Mallory D. Lancaster & Yi Luo

Chapter 2 concerns a piece of on-going bibliometric research regarding K-12 Engineering Education (EngE) where there are strong associations between science, technology and mathematics. A database of bibliometric records extracted from ISI Web of Science were used as a basis for the project. In the first section Strobel et al. provide a useful detailed description of their methodology in terms of using keywords, as well as field and social network analysis. In the results section the analysis indicated research into K-12 EngE curriculum was most frequently found in High Schools. The field analysis of the top ten subject categories aligned to EngE is discussed; whilst the social network analysis indicated which authors contributed to EngE Research (EngER) and which of them worked collaboratively, and with whom. The final section of the chapter discusses how the research functioned as a means of quantifying and tracking the progress of EngER research in terms of what had already been researched most and what still needed to be researched. Strobel et al. suggest that their research could be used to progress EngE and that the same methodology could be repeated using other databases to provide even more accurate and generalizable results.

Chapter 3: Technology Education in Switzerland

Stefan Kruse & Peter Labudde

In this chapter Kruse & Labudde begin by stating that there is a severe lack of comprehensive, general TE for children at all levels and in all types of schools in Switzerland. They explain that in Switzerland where without primary energy and natural resources the country depends on the technological creativity of its skilled trades-people technicians and engineers. Despite this identified need for TE they describe clearly that there has been a decline in the demand for TE within schools. They explain that neither schools or families empower students sufficiently in the area of TE. They specifically mention that girls are not encouraged to study STEM subjects. After a section describing the Swiss educational system in general and Technology in the New Curriculum 21 in particular, Kruse & Labudde discuss a series of initiatives that have supported TE. They go on to explain that TE in Switzerland has never been seen as a self-contained area of the curriculum, but part of an interactive framework of different disciplines. This discussion leads into a useful section that describes the training of TE teachers and future proposals in terms of setting up a core theme for TE in the hope of closing the recognised gaps in the subject area. The final summary section optimistically looks towards the future of TE in Switzerland.

Chapter 4: Elementary Science and Education within the Luxembourg Educational System

Charles Max

This chapter starts by emphasising the importance of elementary science and technology education in a Luxembourg context. It goes on to discuss how in 1989 along with the introduction of technical and scientific topics in fundamental education the curriculum was supported by materials for teachers, recommendations for equipping schools and learner centred courses in initial and continuous education. Max then explains how the initial enthusiasm for TE stalled, although he

believes that there has recently been a change in attitude induced by the following factors: the rising prominence of higher education and research; the diversification of the country's economy and its impact on the labour market; digitisation and connectivity in all walks of life; and the introduction of sustainable development. Each of these factors are described in detail. This is followed by a discussion concerning educating a very diverse school population and the problems this causes for teaching TE. Further sections follow concerning the relationship between Science and TE in Fundamental and Early Education. TE is then discussed in terms of its place in the four Learning Cycles especially in terms of Competency Standards. TE and Science in Secondary School and Practical activities in Science Education are also described. The effects of gender and the mixed distribution of foreign and Luxembourg students within TE and Science are explained. Finally, Max advocates ways forward in terms of further changes to Science and TE to include a new label for this combined school subject - SciTEC, along with suggestions for its syllabus content and the use of personalised learning approaches.

Chapter 5: Rise, Fall and New Perspective for Technology Education in the Netherlands

Marc J de Vries

In the first section of this chapter de Vries discusses the history of Dutch TE which, as in many other countries, started out as a craft-based subject. He also examines the effect that having a separation between general and vocational education at the age of twelve or thirteen has had upon the development of TE in the Netherlands, with two art and craft subjects taught in both types of school while a third subject, 'General Techniques' is taught only in Vocational Schools. This is followed by a description of the government lead development of 'General Techniques' and the fact that in neither type of education were pupils stimulated to acquire what would later be called 'technological literacy'. The next section details the rise of TE during the 1970s and 1980s and the reasons why the status of the subject was negatively affected towards the end of that period. The continued demise of TE during the 1990s and 2000s is then discussed, followed by a description of recent initiatives that signify 'new hope' for TE. Although as de Vries explains in the final section of the chapter this has not led to a return of the glorious past. He believes that TE can no longer survive as a separate school subject in the Netherlands explaining that the way forward is to seek alliances with science and mathematics. The chapter continues by describing these ways forward, finishing by suggesting that useful educational research investigating the political and policy processes pertinent to TE could result in strategies that could be used to safeguard TE's future survival. De Vries concludes the chapter by suggesting that the societal relevance of technology literacy as one of the prime aims of TE would justify the resources required.

Chapter 6: 'Academic Tasks' in Design and Technology Education: Past, Present and Future

Bill Nicholl & David Spendlove

In this chapter, Nicholl & Spendlove challenge the notion that D&T is characterised as a practical subject bereft of intellectual challenge and associated mainly with 'low ability' students. They draw on their extensive teaching experience and research and offer a view that D&T provides unique opportunities for learning through engagement with challenging activities and associated 'academic tasks'.

The chapter examines 'academic tasks' from a historical perspective, followed by the present location of such tasks within contemporary D&T in the UK. Finally, Nicholl & Spendlove propose that future D&T opportunities will require creative, critical and emotional dimensions to be addressed as essential features of these rich academic tasks. In the section 'Academic Tasks 1990-1990' they provide an insightful historical overview describing the procedural nature of the subject. They use examples from their own 'handicraft' experiences in the 1970's to illustrate this period. This section is followed by a discussion concerning developments during the 1980s leading to the National Curriculum in 1990 and a government initiative in 2004 emphasising designing, creativity and problem solving. Nicholl & Spendlove go on to illustrate the disconnect between policy and practice illustrating this with various examples. They then go on to speculate on possible ways forward for academic tasks in the future which they posit should be orientated around the following dimensions: Creativity; criticality; emotional. The chapter concludes with sections which detail exactly what they envisage in terms of each of these dimensions and why this direction is important for the future of D&T in the UK.

Chapter 7: Technology Education in Ukraine

Zinaida Bakum & Viktoria Tkachuk

This chapter starts by discussing the higher education system in Ukraine and teacher training preparation. With specific reference to Vocational Education, Bakum & Tkachuk discuss the detailed statistics concerning the numbers of students across the sector. They review the complexity of training used to achieve both professional and specialist subject competencies. These are described in detail; as is the detail of what students should learn in their TE provision in order to ensure the development of work culture, technical culture, practical knowledge and skills which they see as central to TE in Ukraine. Bakum & Tkachuk go on to describe the methods, means, and processes used. Whilst also discussing the results of the consequences of the knowledge, application and transformation of natural, artificial, and social environments that they believe are reflected in the study TE in Ukraine and which they deem are not provided by other areas of general education in the Ukraine.

Chapter 8: Technology Education in Australia: A case study of some good news but some serious challenges ahead.

Denise MacGregor & Howard Middleton

MacGregor & Middleton start the chapter by providing a brief historical account of the development of education in general and TE in particular in Australia. It includes a thorough description of the two distinct but related subjects of Design and Technologies and Digital Technologies that together form the Australian National Curriculum for Technologies. This is followed by a comprehensive analysis of the current position in terms of the development and implementation of TE at both primary and secondary level and how the subject is presented through two related strands of 'Knowledge and Understanding' and 'Processes and Production Skills', also how Design and Technologies is taught through five specified contexts. This is then followed by a section that provides an analysis of where each state is both in terms of its existing curriculum and in the implementation of the National Technologies curriculum. The diversity and discrepancy in level of uptake of the new curriculum in each of the states is clearly defined. A fourth section of the chapter discusses the new directions for TE in terms of the vocational education agenda and the political pressure for teachers of Technology, Science and Mathematics to keep up-to-date with the STEM agenda. A warning is provided for D&T educators to make them aware that by adopting an integrated approach that the focus of D&T should not be lost but rather emphasised and enriched. This is followed by an overview of teacher education programmes to be found in Australian Universities, and a discussion of the current and future supporting role of the professional associations. The final section is devoted to examining the developing research culture that exists with concluding comments that draw together the themes that MacGregor & Middleton provide as pointers for future developments.

Chapter 9: Technology Education in Canada: An update

Ann Marie Hill

This chapter starts by providing an overview of Education in Canada. Because of the diverse nature of subject content in each province and territory these are separately described in great detail; providing the reader with an understanding of the differences reflected in geography, names given to TE, educators visions, their curriculum and implementation strategies. The detail indicates that some areas of Canada provide a mainly vocational pathway and others a more academic pathway but that all set out to address local needs. Hill explains that even though school technology meets these local needs there is a common pedagogical approach across Canada in terms of learning by doing, 'the joining of head and hand', that engages and motivates students and is as Hill suggests, an approach that because of its success is being adopted in other areas of the curriculum across many parts of Canada.

Chapter 10: Technology Education in New Zealand: Embedding a New Curriculum

Alister Jones & Cathy Buntting

This chapter shares some of the story of how what Jones & Buntting describe as 'a small nation' has moved from technical education to a broader view of technological literacy and the provision of TE for all. The chapter discusses in detail the development of the New Zealand National Curriculum; the Introduction of TE as a Core Learning Area with the key driver being the role that technology is believed to play in New Zealand's economic growth and social development. The revision of the curriculum in 2003 which led to a change of emphasis within TE is discussed in detail, as is the current position of the subject. This leads to a summary and some closing thoughts about future developments and the need for further investment if all students are to reach their potential in this important aspect of a pupil's education.

Reviewer's Conclusion:

As explained at the start of this review this book provides an excellent overview into the different approaches, structures and challenges found when implementing TE in Australia; Canada; Germany; Luxembourg, the Netherlands, New Zealand, Switzerland, Ukraine, the United Kingdom and the United States of America, at a time when the need for developing technological literacy is recognised by all as important and yet TE appears to be struggling to meet stakeholders' expectations in each of these countries. These challenges and struggles are not confined to the ten countries portrayed in each chapter and I therefore believe that this book will provide food for thought for researchers, educationalists and government officials far beyond the nations represented in *Technology Education Today – International Perspectives* by providing pointers for the future development of a subject area that the world cannot afford to allow to decline.