# Review

The Cultural Transmission of Artefacts, Skills and Knowledge: Eleven studies in technology education in France

Title:	The Cultural Transmission of Artefacts, Skills and Knowledge: Eleven studies in technology education in France
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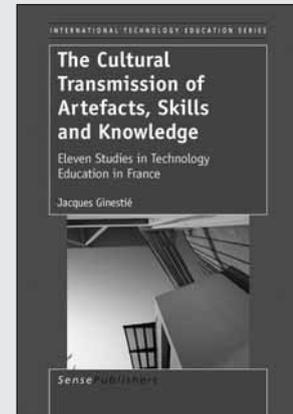
Introduction

The introduction to this book is written in the form of 3 short 'explanation pieces'. The first, written by Jacques Ginestié provides the reader with an understanding of the research that has been carried out over the past twenty years to support the development of technology education in France by the 'GESTEPRO' research team in Marseille, where investigations have dealt with the technological knowledge taught in classrooms, the way that such knowledge is taught and the way that pupils learn, leading to a greater understanding of the school situation and in particular the processes of teaching and learning in French technology education.

The second 'explanation piece', written by Marc de Vries is actually the most important chapter to read first for in it he explains the main aim of the book – that being to make available to non-French speaking technology educators the research carried out by the GESTRPRO group. He provides a useful insight into the split in the world between those who publish in French and those who do not explaining that the two groups, the Anglo-Saxon and the Francophone do not get to know each other's work and that he believes that many *"opportunities for the fruitful exchange of ideas are missed"* (p7). To help the Anglo-Saxon reader de Vries describes some of the differences between French and Anglo-Saxon traditions in technology educational research and, as he believes that misunderstandings can easily arise if the terminology presented in the various chapters of the book is not understood by the reader, he goes on to explain clearly the misleading translation of the word 'didactique' to the English word 'didactics'.

In terms of French technology education research he discusses some of what he considers are the important characteristics and focuses not found elsewhere explaining that in French research there is often explicit attention paid to *'a proper conceptualisation of the subject content'* with a lot of research reported in the book aimed at gaining an insight into how mental images are formed that match with what technology is really like. Another characteristic that he helpfully discusses is the issue of 'transformation', which is referred to in several chapters in the book. He explains why French researchers believe that technology from the real world needs to go through a transformation in order to become teachable and learnable. In his 'explanation piece' he also clarifies the important relationship between task and activity, the bringing together of philosophy and (cognitive) psychology and the tendency for French technology education to focus on high tech topics.

The third and useful 'explanation piece' in the introduction is once again written by Jacques Ginestié, in it the place of technology education within the French schooling system is explained and by doing so the titles of the two sections of the book *Structuring Artefacts, Skills and Knowledge for Teaching and Teaching and Learning Artefacts, Skills and Knowledge* are explained and justified.

Section 1 Structuring Artefacts, Skills and Knowledge for Teaching

In chapter 1 *The Structuring Role of Artefacts in Thought Development* Colette Andeucci reviews pertinent psychological literature and discusses the methodology, data collection and findings from a piece of research concerning 8-years old children which sets out to examine the concept for these children of *'occupied space'* and how an understanding of the concept depends on the compaction rather than disassembly of objects. The chapter concludes with the statement that the research findings merit the attention of all researchers in technology education, as they show how the important knowledge

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gained through studying the properties of technical artefacts is not covered by other scholarly disciplines and must therefore be addressed in technology education.

In chapter 2 *Technology and the Nature of Teachers' Relationships with Science and Society* Adel Bouras and Virginie Albe turn to Higher Education and a research project concerning Tunisian electrical engineering teachers all of whom initially specialised in the sciences during their university study. Through analysis of a questionnaire and interviews they attempt to document the epistemological points of view of these trainees. The results indicate that the trainees perceive technology from an 'applicationist' perspective of science. They appear to establish a dichotomy between theory and practice with Science bringing laws and models whilst technology targets the practical application of those scientific theories. In terms of teaching the results suggest that the trainees continue to place emphasis on the practical side of technology and in class are more inclined to look at the social, political, economic and moral aspects of technology.

In chapter 3 *Teaching the Prevention of Risks in Professional Contexts: Procedure & Knowledge* Hélène Cheneval-Armand and Jacques Ginestié concentrate on underlying knowledge and methods put into practice for the teaching of adults. The theme of the chapter concerns the analysis of a report on risk-prevention for workers installing air conditioning systems and sheds light on the knowledge underlying professional procedures. The link back into school technology is explained in terms of what pupils learn in schools about risk prevention and how that relates to the practices 'used' in the world of work.

Chapter 4 *The Conceptualisation of a Staircase: An example of Knowledge Transportation in Architecture* is split into three distinct sections. Perrine Laon and Jean-Charles Lebahar provide an in-depth comparative study that shows how one can observe the levels of knowledge, which correspond to the stages of a knowledge transportation process. This is accomplished by comparing the knowledge and practical know-how of first year and final year students from two different architecture schools in France and the observed design activity involved in designing a staircase carried out by a group of fourteen designers (three non-architects, three architects, four final year students, four first year students). In section one the authors compare the conceptual process found in the professional domain compared to that found in architectural training. The second section is dedicated to factors observed in the professional and academic conception scenario concerning the design of the staircase, whilst the final section looks at the different

aspects of teaching architecture and indirectly at the process of knowledge transportation taking place therein.

In chapter 5 *The Transmission of Higher-Order technological Skills in Technology Education from a Social-Constructivist Point of View* Pierre Vérillon discusses from the social-constructivist point of view the case for teaching engineering drawing. Pierre Vérillon believes that the cognitive processes and the epistemology underlying student and teacher activity in the technology classroom has attracted less attention from research in France than the design, development and assessment of curriculum, and that as a consequence there is a lack of knowledge concerning the singular nature and forms of cognition involved in the transmission and construction of technical skills and knowledge. Through the focus of this chapter Pierre Vérillon addresses this criticism by linking a socio-constructivist approach to teaching with an epistemological model of technical representation in mechanical engineering and a psychological model of cognitive development in 3-dimensional space.

Section 2 Teaching and Learning Artefacts, Skills and Knowledge

In chapter 6 *Contemplation and Use of Technical Aids in Primary Schools* Marjolaine Chatoney reports a study into the thought processes of 6-7 year olds regarding technical objects. The chapter starts by describing technological education in French primary schools and the need to make the teaching of science and technology more effective and above all give it an experimental dimension. Supported by earlier research Chatoney describes the strong links between the stages of conception, production and usage of technical objects and the emergence of a successful structural concept for teachers themselves. The chapter reports research carried out using observational methodology whilst pupils were involved in a unit of work entitled 'discovering the world of objects'. The conclusions drawn are clearly articulated with results indicating that *'… materials occupy a vital place in the design and production of a technical object…'* (p144) and that *'… involvement in the task, decision making and discussion were vital in making 6 to 7 year old pupils aware that materials are restricted by questions of assembly, form, links, technique and unit of production directly linked to the functionality of the object'* (p145).

In chapter 7 *Describing an Automated System, With the Help of a GRAFCET to Understand How it Works* Liliane Aravecchia & Jacques Ginestié discuss the role and status of technical language (in particular GRAFCET) in the learning process during an experiment in a technology class in a French "college" (pupils aged 12-13 years old).

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The meaning of the acronym GRAFCET (a formal symbolic language which responds to precise rules) is carefully explained although not till the fifth page of the chapter. The educational aim of the lessons in this research project was to develop pupils' understanding into how automated systems function. The experiment is well described and supports the conclusion that pupils need to understand technical jargon to succeed in understanding automated systems. In broader education terms the pedagogical importance in designing teaching scenarios that allow students to develop their learning in order for them to reach a higher level of understanding of their technological environment is carefully articulated.

In chapter 8 *Searching for Information on the Internet About the Link Between Task and Activity* Pascale Brandt-Pomares describes the benefits to teaching and learning from using the Internet. The study sets out to highlight the distance between 'task' and 'activity', through a study of pupils' information search carried out during a technology task. On the one hand there is the nature of information-finding activities, which contribute to individualisation by awarding a specific status to knowledge, and on the other hand, the fact that it is relatively easy to put the activity into practice. In the first section of the chapter the search for information is placed in the context of the theory of the activity, the next section describes the link between task-activity and the teaching scenario. This is followed by thoughts on the scholarly task involved. The technological task used in this research study concerning the creation of an electronic quiz game which is then described in detail to indicate the use of the Internet within the project. The research methodology concerning data collecting methods is discussed at length, as are the results. The conclusion drawn by the authors suggest that the information made available by the Internet is only rendered useful by effective information consultation processes put in place by teachers.

In chapter 9 *The Use of Collective Workspaces in Technology Teaching* Jean-Francis Ranucci describes an experiment in which laptop computers are made available to students. The chapter starts with the theoretical context in which laptops were given to every pupil and all the teachers who taught them in one of France's local authorities in 2003. The digital workspace, access to the platform and information, the concept of events and resources, and the co-operative work's functions are all described before a description of the research project itself is provided. The task under scrutiny was carried out both 'in-lesson' and 'outside-the-classroom' time. The collected data is described in detail. A number of pertinent conclusions are suggested. For instance: the use of computers as educative technology is dependent upon how the teacher uses them. In practical terms the results suggest that of prime importance is keeping the laptops in good working condition. In terms of operational methods, linking learning to the task is found to be easier when pupils work in groups rather than as individuals. It is also concluded that as the learning scenario develops it allows the pupils to become both users and producers of information at the same time.

In chapter 10 *The Notion of Autonomy for Students in the Services Sector Using Information Technology Tools* Christine Montuori provides a longitudinal study with students when they were 11 and 13 years old in an attempt to answer the question of student autonomy as an essential element of education. After defining three views of autonomy, she sets herself the question as to whether there is a link between the use of IT equipment in a classroom and autonomy, in particular could a non-autonomous situation move to an autonomous situation merely as a result of IT equipment being present in the classroom. Her results indicate that IT equipment tends to produce positive results but also negative effects with regard to the appearance of an autonomisation process. The results of her study suggest that autonomisation can appear and evolve with the help of IT tools but more importantly it is the organisation by teachers linking together the task and the IT activity that will enable the student to become a 'doer' in the use of IT rather than a 'consumer'.

Chapter 11, the final chapter of the book entitled *From Task to Activity: A redistribution of roles between teacher and pupils* is written once again by Jacques Ginestié. In the introduction he starts by discussing the widely held belief that scenarios used in technology education are significantly different from scenarios used in the teaching of other subjects. He explains that Technology is a "doing to learn" rather than a "learning by doing" educational situation both in terms of curricula design and the tasks that teachers provide for pupils. He describes two contrasting scenarios for a teacher's role as *'a guider of action',* the first describing organisational attributes in which the task is exclusively designed to lead student activity towards producing the result, which is the teacher's intended solution. The second, designed around open tasks based upon the knowledge that the teacher needs the student to acquire. Ginestié also interestingly discusses how teacher's activity can create illusions of student autonomy and student success. The research project used to support and develop his thinking is designed to measure the effects of interactions between teacher and student(s) on students' activity when they are taught

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about how a controlled (test) system operates. In terms of these interactions Ginestié describes three distinct interaction modes: injunctive, descriptive and interrogative. The analysis of the results provides interesting detailed insight into the teachers' role in the two contrasting modes of learning and the different modes of interaction.

There is no overall conclusion to the book although Ginestié's final chapter brings together a number of the themes and ideas being presented in other chapters. In conclusion to my review I return to the final remarks made by Marc de Vries in the second of the two 'explanation pieces' where he explains that *'we cannot afford to let language differences block the road to international exchange of insights and experiences',* I would wholeheartedly support this statement and I am grateful for de Vries' chapter in setting the scene for these differences and for the work of Ginestié and the GESTEPRO research team for providing their research in a form that is accessible for the Anglo-Saxon technology educational research community. Unfortunately I do feel I need to warn the reader that the translation into English of the various chapters did need more careful proof reading as I found that I often had to re-read paragraphs in order to make sense of what had been written – but found that it was well worth persevering.