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# Transferring and Transforming Technology Education: A Study of Norwegian Teachers' Perceptions of Ideas from Design & Technology

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ABSTRACT: What happens when educational ideas cross national and cultural borders? How do teachers respond to ideas originating in a different school system and a different national culture? This article reports on an empirical study investigating the transfer of ideas from Design & Technology as a subject in England and Wales into Norwegian schools. A sample of teachers participating in a specific project on technology teaching inspired by this subject has been studied by means of interviews and classroom observation. Results of the study show that while some elements of Design & Technology are adopted by the teachers, essential ideas of the subject are significantly transformed. Drawing on Barnes, (1992, *Teachers and Teaching: From Classrooms to Reflection* (pp. 9–32), The Falmer press, London) concept of teachers' professional frames for teaching, it is shown how specific aspects of the national and educational culture have had a considerable effect on the teachers' interpretation of the nature of technology as a subject of teaching and its place in the curriculum. The study illustrates the importance of the cultural context in how educational ideas are interpreted, reshaped and realized in schools.

**Keywords:** classroom studies, Design & Technology education, national and educational culture, teachers, transfer of educational ideas

## INTRODUCTION

Education has become internationalised. Educational trends, concerns and debates exceed national and cultural borders, and ideas and innovations are being exchanged and transferred. Many curriculum programmes and reforms in education are inspired by international trends and by curricular ideas developed in a different educational and cultural context than the one in which they are put into practice. These differences may influence how educational ideas are interpreted, developed and realized in schools.

As a newcomer in the school curriculum in many countries, technology education is in particular subject to an exchange of ideas across national and cultural borders. Though drawing on a range of traditions of education, technology lacks the clear expectations often associated with well-established school subjects. This means that its content and purpose may be interpreted in various ways and be subject to diverse

influences and interests from stakeholders. In countries where technology is established as a regular subject of teaching, this dynamic is well documented on the level of curriculum policy (see e.g. Elgström & Riis 1990 in the case of Sweden; Layton 1995 in the case of England and Wales). A growing body of studies has also investigated how curricula on technology are implemented in schools (e.g. Eijkenhof et al. 1998; Jones et al. 2004; Lindblad 1990) and what teachers see as important aspects of technology as a school subject (e.g. Davies & Rogers 2000; McRobbie et al. 2000; Mittell & Penny 1997; Rowell et al. 1999). Some of these report a mismatch between curriculum policy and teachers' perceptions and teaching of the subject and suggest strategies for producing change in teachers' beliefs and practices.

Little research is, however, undertaken to elicit how ideas in technology education transform when crossing national and cultural borders, and how teachers' interpretations of and teaching in the subject may be a result of broader cultural references. This article presents an empirical study of the transfer of ideas from Design & Technology as a subject in England and Wales to Norwegian schools by way of a specific curriculum project on technology education inspired by the content and working methods associated with Design & Technology. The intention of the project has been to provide the foundation for the development of a corresponding subject in Norwegian schools, hence providing an opportunity to investigate the transfer of educational ideas to new educational and cultural contexts. The research study presented in this paper has investigated how teachers participating in the project perceive ideas on technology education and how they realize these ideas in their schools. Their expressed views and actions are compared to essential features of Design & Technology in England and Wales. On this basis it is argued that ideas have been significantly transformed with regards to the fundamental aims of the subject and its role in the school curriculum. It is shown how this transformation of ideas can be understood in terms of how specific aspects of the national and educational culture constitute an important component of teachers' professional frames for teaching, which in turn shape their interpretation of ideas in technology education.

The following section firstly gives perspectives on teachers' role in curriculum realization and the concept of teachers' professional frames for teaching. Then important ideas that have contributed to the shaping of Design & Technology in England and Wales will then be briefly reviewed. The context into which these ideas are transferred is presented in terms of ideological and cultural characteristics of the Norwegian school system, the arenas that exist for technology education in Norwegian schools and the specific curriculum project in which the teachers studies participate. The design and methods of the research study are described and findings are presented as specific areas where a transformation of ideas is detected in the study.

## CURRICULUM REALIZATION AND TEACHERS' PROFESSIONAL FRAMES

The introduction of Technology as a subject in Norwegian schools represents a realization of curricular ideas, which is a complex process influenced by several agents and conditions. Aspects of this process can be understood in terms of Goodlad's notion of curricular levels (Goodlad 1979). The first levels represent the intentions of what pupils should acquire in schools. These comprise an *ideological* as well as a *formal* curriculum, where the formal curriculum is the curriculum documents that guide work in school. When a formal curriculum is to be put into practice in schools, its meaning and the underpinning intentions are interpreted by teachers and other agents engaged with work in schools, such as textbook writers. Their interpretation of the curriculum is denoted the *perceived* curriculum, while the *operational* curriculum refers to how teachers realize the curriculum in their teaching. The way the receivers of the curriculum, that is the pupils, interpret and experience the teaching represents the final curriculum level denoted the *experiential* curriculum.

Teachers play a crucial role in this process. They are active agents in the perceived and operational level of curriculum, that is, the transition between the intentions of education and its recipients. This transition does not imply merely a 'delivery' of content predefined in a formal curriculum. Intentions and content are developed, contextualised and put in concrete terms by the teacher, whose beliefs and actions ultimately shape the kind of learning that young people get (Hargreaves & Fullan 1992). The teachers work in curriculum realization does not only mean identifying appropriate means for presenting a given subject matter to pupils; it also involves interpreting what this subject matter actually represents and the purposes it is supposed to fulfil.

Important aspects of how teachers interpret educational ideas are attended to in how Barnes (1992) has formulated the concept of *teachers' professional frames*. 'Frames' refers to the underlying assumptions that shape teachers actions. They represent clustered sets of expectations or preconceptions through which the teachers' knowledge of the world is organised and that provide repertoires for their behaviour in it. These include preconceptions, often implicit, about the nature of the subject or topic they are teaching, preconceptions about learning and how it takes place (modified by what can be achieved within the actual school conditions), preconceptions about students, beliefs about priorities and constraints inherent in the professional and institutional context and finally the nature of the teacher's overall commitment to teaching.

For most well established school subjects the traditions of the subject, and often also of a corresponding university discipline, will form an important component of teachers' professional frames for teaching. Educational traditions shape how new ideas related to the content and teaching of a school subject are interpreted and shaped. Teachers are

encultured into these traditions through many years in "apprenticeship of observation" (Lortie 1975) as pupils and students. Observing their own teachers and experiencing teaching methods and teaching resources shape the professional frames of new generations of teachers with regards to what represents valid knowledge, methods and achievement in the subject they are to teach.

For technology as a new subject in the curriculum, teachers lack exposure to an apprenticeship of observation with regards to what constitutes the nature of this subject. This means that teachers do not bring with them a shared culture of experiences, beliefs and expectations of the meaning of technology as a component of general education. In that sense one could expect that teachers will be more open to new ideas and that they represent an opportunity for forming new frames specific for technology as a new subject of teaching. On the other hand, the way teachers perceive and realize new educational ideas in their schools are likely to be shaped by other aspects of teachers' frames than those constituted by traditions, experiences and expectations within the specific subject. These frames will to a high degree be shaped by and consistent with a more general educational culture teachers have been socialized into as pupils, in their teacher education and in their work as teachers. When ideas cross national borders, as is the case with the study reported in this article, the national culture also constitute a relevant aspect of teachers' professional frames for teaching. This provides for a transformation of ideas under the influence of cultural, educational and institutional circumstances.

## IDEAS FROM DESIGN & TECHNOLOGY

Ideas inherent in Design & Technology as a subject of teaching will be familiar to a majority of readers of this journal. For the purpose of this article, I will nonetheless present essential ideas of relevance to the research study presented and how results are interpreted. This presentation also represents a methodological move, as it clarifies the researcher's interpretation of the subject, which is crucial in the analysis of how these ideas have transformed into a Norwegian context. The presentation of what the 'original' ideas represent hence provides for credibility of the study in the sense that it gives the reader insight in what represent the interpretative framework for data analysis.

Central aspects of Design & Technology in England and Wales relate to the political foundation for establishing the subject. An important economic concern underpinned the development of the subject and the prominence it was given in the curriculum, and the then Minister of Education Kenneth Baker proclaimed that the subject was "of great importance for the economic well-being of this country" (see Layton 1995, p. 90). The concern, and the belief in the potential of Technology

as a subject in the curriculum to alter the situation, was related to a decreasing competitiveness and enterprise in the nation's industry. It was believed that the economic situation of the country would benefit from vocationalizing the secondary curriculum that so far had been dominated by academic subjects (Medway 1992). This motivation might have included an attempt to change attitudes represented in what Wiener (1981) has characterised as a "prevailing gentlemanly culture" where work related to industry and practical activity has low status, causing a decline of the industrial spirit and hence economic development and competitiveness.

Medway (ibid.) has identified further motivations for the emergence of the subject. It might have been an expression of an instrumental academic specialism, by replacing classical subjects with subjects with higher relevance to modern work life. The subject might meet a need for a subject that would be both intellectually taxing and legitimate in the eyes of a generation of career-minded students and their parents. This relates to a motivation for the subject that can be captured by the concept of "the rehabilitation of the practical" (Layton 1984). Practical subjects were associated with low status and low-ability students, and of Design & Technology as a compulsory practical subject for all pupils was anticipated to contribute to an increased prestige of practical work and human abilities in practical rather than in intellectual directions.

These motivations identified by Medway can all be seen as economic in nature and related to modern work life and partly to industrial production. The economic motivations are reflected in curriculum documents in that pupils are to design and make products for which they are to consider a market and learn how to communicate their ideas for product development and production. In essence, pupils are to develop products that have – at least in principle – a commercial potential. Textbooks in the subject maintain this focus (e.g. Clarcson et al. 2002). The link to industrial production is maintained in that pupils work with modern materials (such as plastic), study or employ modern production techniques and are to consider principles for mass production of their products. Commercial aspects are also attended to in the fact that pupils' products hold a relatively high technical and aesthetic quality.

The development of the subject has been marked by a pursuit for identifying the subject and its basis of knowledge. As the contexts for product development pupils work within span over areas as diverse as food technology, electronic control systems, textile work and mechanical constructions, the focus in curriculum development and assessment criteria became abilities to perform a design process with less emphasis on context-specific knowledge and skills. Knowledge from diverse subject areas was meant to be applied in the subject, while the design process was seen as constituting the subject's identity and distinguishing it from other subjects in the curriculum (see Kimbell 1997). The adequacy of structuring a curriculum around the conception of a design process has

been questioned from various perspectives (e.g. Chidgey 1994; Johnsey 1995; Murphy & McCormick 1997; Mawson 2003). Perhaps influenced by some of this critique, the process approach in Design & Technology has been modified in later revisions of the National Curriculum for England and Wales (DfE/WO (Department for Education/Welsh Office) 1995; DFEE/QCA (Department for Education and Employment/Qualifications and Curriculum Authority) 1999; DFES/QCA (Department for Education and Skills/Qualifications and Curriculum Authority) 2000). The four attainment targets have been reduced to two, denoted Designing and Making, and domains of more specific knowledge and skills are included in the curriculum.

Essential aspects of the teaching of Design & Technology seem to be influenced by a combination of the economic motivations described above and the need for some sense of documentation of the design process pupils are undertaking for assessment purposes. Pupils use considerable time on making visual presentation of their ideas by extensive use of drawing techniques, and folios containing pupils' drawings and design briefs are seen as an important component of the subject by a majority of teachers (Mittell & Penny 1997).

## TRANSFERRING TECHNOLOGY EDUCATION: THE NORWEGIAN CONTEXT

The research study is situated in a Norwegian context where teachers participating in a specific curriculum project on technology are studied. This is important for how teachers have interpreted and realized ideas on technology education gained from Design & Technology in England and Wales. The following section presents essential features of this context, in terms of ideological and cultural characteristics of Norwegian educational traditions and current thinking, the arenas for technology teaching that exist within the national curriculum despite the fact that technology is not a specified subject and finally a description of the curriculum project on technology that the present study is undertaken within.

### *Ideological and cultural characteristics*

A school system is inevitably shaped by the ideological and cultural characteristics of the society it is situated within. Simultaneously, there are many commonalities between the educational systems in Western (and in fact other) societies. For the purpose of analyzing how educational ideas in technology education have transformed under ideological and cultural influences, it is helpful to consider how Gundem (1993) has given an account of what is *specific* to the Norwegian educational situation in an international perspective, and how this reflects historical, political and geographical aspects of culture more generally. These characteristics can be summarized as follows:

- Close connection between the Lutheran state church system and the educational system
- Low degree of urbanisation combined with major differences between rural and urban areas
- A struggle for national and cultural independence, in which education has been seen a means for the building of a cultural identity and a national awareness
- Deliberate emphasis on utilitarian knowledge rather than classicism in schools
- Emphasis on equity, justice and democratic values

In accordance with several of these characteristics, the Norwegian educational system has a long tradition of homogeneity. Though there has been some division between urban and rural areas, the nation has had a national curriculum in some form since late 19th century. The emphasis on equity is evident in the principle referred to as *one school for all*, regardless of social background or abilities. Compulsory school constitutes 10 years without streaming of pupils into different lines of education. Instead, differences in pupils' interests and abilities are attended to by the legal right to individually adapted education for all pupils in compulsory schooling. The emphasis on equity corresponds with how utilitarian knowledge has been given priority over classicism in Norwegian schools.

### *Arenas for technology teaching in Norwegian schools*

Although the Norwegian national curriculum for compulsory education (KUF (Royal Ministry of Church, Education and Research) 1996), implemented in 1997 and commonly referred to as 'L97', does not give specifications for technology as a self-contained subject, it provides opportunities for technology teaching within and across subjects. Technological topics can be found as subject elements specified in the subjects Art and Crafts, Science and Social Studies. In addition, L97 highlights interdisciplinary approaches and thematic structuring of content while teaching the various subjects in the curriculum. It states that local work at individual schools or co-operating schools must involve co-ordination of related main subject elements from different subjects and also thematic structuring of contents. This means that main subject elements from one or several subjects are brought together in meaningful units (themes), taking into account the pupils' experience, interests, and cognitive development as well as connections with the local environment and topicality. Clearly, the many-sided nature of technology easily lends itself to a thematic approach across the existing subjects.

L97 emphasises that pupils should be active, enterprising and independent in their schoolwork, and project work is accordingly put forward as an important teaching method. L97 describes project work as:

> "...a form of work in which pupils, in order to tackle a problem or set of problems or a specific assignment, define and carry out a purposeful piece of work from the original idea to the finished product, result or solution. (KUF (Royal Ministry of Church, Education and Research) 1996, p. 85)"

This formulation shows some commonalities with the process approach originally introduced in Design & Technology (DES/WO (Department for Education and Skills/Welsh Office) 1990), where pupils were intended to follow a *design process* from Identifying needs and opportunities, through Generating a design, Planning and Making and finally Evaluating.

Project work as prescribed by L97 is meant as a method of working with the curricular content of various subjects, not as a curricular topic in itself. However, project work is also placed as a specific elective subject called *Practical project work*. This subject is defined as one among several choices within *Compulsory additional subjects* at the lower secondary level (grades 8–10). Other electives are mainly second foreign languages, such as German, French and Finnish. A diversity of activities can go into the subject 'Practical project work', and pupils themselves should participate in defining the content according to their interests. Thus, the elective subject 'Practical project work' provides opportunities for practical work with technology for those pupils choosing this subject.

Finally, opportunities for technology teaching can be found within the curriculum's specification of a subject area called *'School's and Pupils' Options'*. The intention of this subject area is to give each school the possibility to focus on local main areas and to give pupils opportunities to choose topics and activities they are particularly interested in. Hence, both schools and pupils have the opportunity to define technology – interpreted in any sense – as an appropriate content of this subject area.

### *A curriculum project on technology teaching*

The fact that technology is not a defined subject in Norwegian schools, in contrast to several of our neighbouring countries, is an issue of growing concern and debate. One important initiative made to change this situation is a project called 'Teknologi i Skolen' ('Technology in Schools', abbreviated TiS), initiated by the Norwegian Society of Engineers (NITO) in 1996. The overall aim of the project has been to promote technology as a field of teaching in Norwegian schools, and to establish a foundation for technology as an independent subject in the school curriculum.

The project has been non-governmental in the sense that it was initiated and run by NITO and a steering group consisting of experienced and dedicated teachers, representatives from professional organisations and science educators from a college and a university. It has, however, been partly financially supported by The Ministry for Church, Education

and Research. 19 schools were involved in the project during its first three years. As the project has gained much attention and enthusiasm, the project period, initially set as five years from 1997 to 2002, has been extended, and the current project (2004) involves about 100 schools as well as colleges for teacher training.

The project has gathered ideas and inspiration from Design & Technology in England and Wales, and the essential component of being part of the TiS project has been the teachers' participation in a two weeks course at an English college. Two teachers from each of the schools involved in the project attended this course during their summer holiday. The teachers volunteered to participate based on their own individual interest in the project and their motivation for learning more about technology education and introducing it in their schools. The course consisted of mainly practical work, but also lectures and school visits which together gave teachers a brief insight into and experiences with contents, structure and activities associated with Design & Technology. The course has been followed up by seminars and schools have aquired some material resources to assist them in building up their own technology teaching.

Responsibility for realizing the aims and content of the project after the course has resided with the individual schools and teachers. This has led to a variety of approaches to the content of technology teaching and ways of organising it within the school's general schedule. The opportunities the curriculum provides, described above, have been utilised in various ways, and technology teaching associated with the project has hence taken place as occasional activities within subjects, as cross-curricular technology projects lasting for some time or as specified units within the curriculum's allocation of time resources to school's and pupil's options.

## RESEARCH DESIGN

The research study was carried out as an explorative cross-case study involving classroom observations and interviews with 14 teachers from 9 of the schools participating in the TiS project's early phase. The empirical part of the study was conducted in the period 1999 to 2001 as part of a doctoral study (Bungum 2003).

Teachers were selected for the study as a heterogeneous sample (Robson 2002), with the intention of providing a wide span as possible with regards to teacher characteristics such as age and subject background as well as school characteristics such as level (primary or lower secondary school), size and location. The sample of schools and teachers included some with a high profile on technology teaching as well as some to which technology was not a highly prioritised topic. This variation was sought not to achieve a representative sample for the

purpose of making statistical inference, as the study rather concerns *analytical generalization* (see e.g. Kvale 1996; Yin 1994), where phenomena observed and interpretations made may apply to a larger sphere than the one being studied, yet without any anticipation of their relative prevalence.

Data collection was conducted by means of interviews with teachers and classroom observations. Interviews lasted from 45 to 90 minutes and where semi-structured. They focused on what the teacher saw as important aspects of technology teaching, what they considered as its aims and what they wanted to achieve through their teaching of technology with pupils. Specific aspects of the teacher's technology teaching evolving through observation were also addressed in the interviews. Observations of teachers in their realization of technology teaching in their classroom varied from one single visit to a period lasting several weeks. Observations focused on what activities teachers chose to include in their sessions, how these activities were introduced and structured and what aspects of technology was in focus in the teaching. The combination of observations and interviews has served as a means for for focusing the interviews on interesting aspects of the individual teacher's realization of technology as a subject, as well as ensuring validity of interpretations by triangulation.

Empirical data from the study are analysed on two levels. Within-case analysis has attended to the individual teacher and how he or she perceives technology as a subject of teaching and realizes technology teaching in the classroom. Cross-case analysis has involved identifying similarities and differences between cases, development of categories that transcend individual cases as well as examination of common features of the phenomena these categories describe. The teachers involved have been consulted for 'member-check' on interpretations of data related to themselves, and acknowledged the interpretations made.

## TRANSFORMING TECHNOLOGY EDUCATION: NORWEGIAN TEACHERS' PERCEPTION AND REALIZATION OF IDEAS FROM DESIGN & TECHNOLOGY

Results from the study show that some essential aspects of Design & Technology have been transferred into Norwegian classrooms through the teachers' involvement in the TiS project including their training at an English college. Observations of the teachers realization of Design & Technology in Norwegian schools show that the key feature of the subject, that is, the designing and making of physical objects as teaching activities, has been largely adopted by all the teachers participating in the study.

However, a transformation of ideas in the subject originating in UK can be detected in several regards in how the teachers reflect upon and

carry out teaching activities related to the TiS project, and also in how they perceive the nature of Design & Technology as a school subject. In the following, results will be presented within four main areas where this transformation is demonstrated; how teachers interpret technology as a practical subject, the significance they assign to quality in pupils' products, how the teachers' interpretations and actions with regards to technology teaching relate to broader cultural frames and how technology conceptually is positioned in relation to other subjects in the curriculum. It will be shown how the transformation of ideas in these areas directly reflects the specific characteristics of the Norwegian educational culture briefly presented earlier in this paper as well as the national culture more generally.

### *The meaning of technology as a practical subject*

Teachers in this study have largely welcomed technology teaching in their schools due to its *practical* nature. The call for making school 'more practical' is a familiar one in the educational discourse in Norway and more generally. It does, however, have a range of dissimilar meanings based on different concerns and interpretations.

A majority of teachers value technology as a practical subject in the school curriculum as it provides *variation* in teaching activities, and hence represent an improvement of the *context* for teaching. Henry expresses his intention with technology teaching this way (all names used are pseudonymes):

> Henry:
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> "I do it because I believe it is interesting to the pupils and that it is stimulating for them to do something different from what they usually do. So that it is not only theoretical."

This use of the notion 'theoretical' is common but not very concise. When teachers and others talk about school as 'too theoretical' the notion is often not used in an epistemic sense. It rather relate to the nature of activities pupils undertake, corresponding to what Donnelly and Jenkins (1992) have identified as "a form of classroom organization as much as a body of knowledge" (p. 43). Making school 'more practical' hence involves a departure from the delivery of declarative knowledge and extensive use of textbooks often associated with traditional school subjects.

Some teachers relate the need for more variation in content and teaching methods directly to Science as a subject. One of them, Elna, states that pupil should experience the subject as useful rather than a "book-subject":

> Elna:
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> "I think Science has become too theoretical in schools, and that the pupils have too much theory. They should see that Science is not only is a book-subject, but that this can be useful. In practice."

In order to present Science as a subject that appears as useful, Elna includes activities and ideas gathered from her participation in the TiS project as part of her science teaching. This does not imply that she teaches technology as 'applied science', but rather involves a broadening of what is normally seen as the scope of school science in the direction of what Bencze (2001) has labelled 'technoscience' education. In her Science lessons observed in the study, she includes technological topics and activities on their own terms, such as making simple cameras and make them work and investigate electronic devices and learn about components found there. This way, Elna utilises opportunities provided by technology teaching to alter the image of Science as a 'book-subject' towards practical activities related to pupils' technological surroundings and utilitarian perspectives in what Elna sees as ''useful in practice''.

Teachers in this study also express some concerns and intentions related to practical technology teaching that can be seen as parallel to the economic considerations that forms part of the rationale on which Design & Technology is built. However, their focus appears different from these in several ways and represents a transformation of this economic rationale. Not surprising, the teachers' focus is on the pupils as individuals rather than on the nation's economic situation. Further, when considering how technology teaching may benefit pupils in terms of their future career possibilities, none of the teachers emphasise what pupils learn in technology teaching that may give them a 'head-start' on a career in technology. Neither do they emphasise the need for attracting able students to further education and work within technological areas. They rather focus on the need for letting pupils *experience* what technological work means, and the opportunities they have to discover and try out their latent abilities in this direction. For example, Irene states that technology teaching may ''open doors'' into technical occupations:

> Irene:
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> ''They can simply find that 'Wow, I have abilities for this, this interests me', but as long as we don't have it in school at all, right, they don't know that they can, or want to, try it. Thus, perhaps we in a way open some doors for them quite early. 'Oh yes, it is an electrician I want to be!' for example.''

In her expression of how technology teaching may benefit pupils with practical abilities, she also emphasises *social* aspects within her class:

> Irene:
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> ''Those pupils being weak in ordinary lessons, theoretical subjects, they could show other sides of themselves. They could even take the lead position of the group and organize the entire work. While usually they are quiet and anonymous in class, because they knew they would not succeed in languages and math. Suddenly there appeared a completely new arena for them.''

When Irene describes technology teaching as a "new arena" for pupils, it is not in terms of new types of activities to work with. Rather, it represents contexts where practical oriented pupils may fill the roles of being in charge and exhibit themselves as successful among their peers. This way technology teaching may contribute to *social* equity between different groups of pupils.

A similar concern for social equity is expressed by Benny, who describes the value of technology teaching as the opportunity it gives for pupils to express their skills and knowledge:

> Benny:
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> "Technology teaching is, as I see it, a possibility for the kids to engage with practical work. And what I see from the kids who maybe otherwise struggle a bit with the traditional school subjects, there is a clear difference that they can use... technical skills, and that they in fact have knowledge that they are otherwise not given the chance to express during the school day."

In this quotation, Benny talks about practical skills and knowledge, but not as something pupils should *learn* through technology teaching. Rather, the skills and knowledge appear to be attributes of the pupils themselves. The pupil already *has* the knowledge, which the school should value and allow the pupil to demonstrate. This means that the teachers may see technology as a practical subject as an instrument for enhancing justice and social balance between pupils rather than developing their capability in technology.

In sum, the teachers describe the benefits of technology as a practical subject in various ways that are not directly related to technology as a domain of knowledge and skills. An important transformation of the rationale of Design & Technology as a subject can be seen in how the teachers connect technology as a practical subject to social status as described above. Their ideological position involves a concern for the less academic-minded pupils. This shows some parallels to what has earlier been referred to as the "rehabilitation of the practical" (Layton 1984) that formed part of the foundation for the establishment of technology as a compulsory subject in England and Wales. This was associated with a desire to raise the status of technology-related *work* and counteract the drift of able pupils away from industrial areas seen as a keystone in the nation's economy. As shown above, the Norwegian teachers' perspectives as they have emerged in this study appear to include a somewhat different rationale, which perhaps can be described as a *social* rehabilitation of the practical *pupil*. The teachers appear to consider pupils as different in nature – some are practical while others are academic minded – and rather than encouraging so-called able pupils to pursue a career in technology, they call for a school system that value pupils who at the offset are likely to go into practical occupations. The ideology underpinning this position clearly mirrors the emphasis on equity, justice and democratic values earlier described

as a characteristic of the Norwegian educational culture and is likely to form part of the teachers' professional frames for teaching. Thus the value of technology as a practical subject is considered by teachers with regards to its potential for enhancing equity in social status between their pupils.

### *The significance of high quality products*

Teachers in this study express a strong approve of the high quality products made by pupils that they observed in English schools. Many of them have adopted the focus on technical and aesthetic quality in their teaching activities. This necessarily involves teaching activities that are time consuming and that occupies lesson time that could be used on subject elements actually specified in the formal curriculum. Frederic explains why he still chooses to let pupils spend the required time to make quality products:

> Frederic:
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> "I think we should take the time to make nice things that we are somewhat proud of. That is certainly motivating! And...if all the time in school, because we have a lack of time, we never make anything that is nice, then it is no fun, there is nothing to display, nothing to be proud of! If all the time we are in a hurry and just keep rushing through our work."

Frederic strongly values that pupils should be proud of their products, and emphasises the effect this has on pupils' motivation and self esteem. A similar focus can be found in the case of Ann, a teacher who was observed to put much effort into making her pupils learn to use tools properly and to work accurate with their products. When she is asked about whether she sees such practical skills as an important outcome of her technology teaching, she agrees, but only indirectly. Practical skills are not important in themselves:

> Ann:
>
> "It has to do with whether you will be proud of your product afterwards or not. When one puts much effort into a thing, then it is important that the kids have an opportunity to be proud of their product, I think."

Like Frederic above, the important aspect of high quality product is that it allows pupils to be proud of their products. The technical procedures she teaches them are not learning objectives in themselves but rather a means for enhancing pupils' confidence with their own product.

None of the teachers relate product quality to any idea of commercial products needing to be attractive and functional in order to 'sell' in a market. It rather aims at cultivating the pupil's personal confidence and motivation for schoolwork. This aim deviates somewhat from the ideas underpinning Design & Technology as a subject, and hence represents a

transformation of what *motivates* the idea of product quality. This transformation illustrates teachers' focus on the pupils as individuals in a 'here-and-now' perspective rather than placing them as potential contributors to economic development in the future. However, the lack of reference to industrial technology in how the teachers reflect on and realize technology teaching also relates to broader cultural frames within which they interpret new ideas presented to them. These cultural frames and their transformatory effect will be explored in the following section.

### *Cultural frames for technology teaching*

The study indicates that teachers' interpretation and realization of ideas on technology education based on the TiS project are extensively influenced by the cultural setting the teachers are situated in. Language represents an important aspect of culture. In the case of technology education, the notion 'technology' itself is indefinite and carries different associations in its versions in different languages (see e.g. Fores & Rey 1979; Hörner 1985). As pointed out by Sjøberg (1995), a significant proportion of what is referred to as technology education would rather be considered as craft or *technik* (denoted a "missing concept" in English language by Fores & Rey, ibid.) in a Norwegian lingual context, where technology is commonly associated with modern and fairly advanced artefacts and their use.

These divergent meanings of the label of the subject are important in how teachers interpret the content of a subject assigned to the label 'technology'. The present study shows that preconceptions of what technology means to some extent have influenced how teachers engage with ideas obtained from Design & Technology in England and Wales. Typically, the teachers considered the making of products that involved electronics and mechanics, in consistence of a typical conception of technology. Molding with plastic also qualified as technology, probably due to the fairly modern means of production. However, in describing how she looks upon Design & Technology as a subject in England and Wales, Irene questions that a pupil project she observed involving designing and making plastic covers for notebooks can be considered as technology:

> Irene:
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> "I found it very much like Art and Crafts, really, more than technology perhaps. I am thinking of the books they made with a plastic cover. That is design, I mean, what was really technology there?"

Hence, Irene's frames in terms of pre-conception of what technology involves have acted as a filter for her adoption of ideas from Design & Technology, and ideas presented to her have been selectively adopted

rather than leading to a broadening of her frames on what technology teaching means.

Cultural frames not only influence how the teachers interpret technology, but also what cultural context they place their technology teaching within. Though all the teachers have adopted the key idea from Design & Technology of letting pupils create objects, the image of the pupil as an innovative designer in a market – though it might be hypothetical – vanishes in most of their realization of technology teaching. None of the teachers are observed to ask pupils to consider a potential market or to specify the target for their product. Products are rather designed and made for pupils' own use and according to their personal preferences. A corresponding transformation can be seen in the role the teachers assign to drawing in their teaching of technology. Visual communication by means of drawing is an essential feature of Design & Technology. The Norwegian teachers participating in the TiS project express fascination for the quality of pupils' drawing they have observed in English schools, and some of them try to make use of drawing in their technology teaching. Its function in pupils' work, however, appears to be transformed. For example, Eric states why he sees drawing as important:

> Eric:
>
> "Pupils should learn how to draw! Learn to use drawing skills, make working drawings. I try to motivate them with that drawing is a way of thinking."

The teachers look upon drawing as a tool in the process of exploring and planning technical solutions for the product, rather than a way of communicating and marketing ideas and products. As Eric puts it, it represents a way of thinking in the work process.

Hence the commercial aspect of Design & Technology, the idea of designing and making products with a commercial potential, has significantly faded on its way into Norwegian classrooms. The Norwegian teachers place technology teaching in a quite different cultural framework as will be described in the following.

Several of the teachers point to pupils' lack of practical experiences as a motive for technology as a subject in the curriculum, as expressed by Gina in the previous section in her call for a subject in school that can give pupils practical experiences. As with Gina, this is frequently addressed from a retrospective point of view. Benny describes how kids growing up today to a lower degree than earlier get experience with repairing things, as modern objects are complex and "closed" for the user:

> Benny:
>
> "Everything has become so closed; you cannot repair your car anymore. You cannot repair any domestic utensils around you, any tools. Because it is too specialized. Kids who grow up today, they are used to things being closed, and they do not see adults repair anything at all anymore."

Some teachers point to a need for making pupils more confident about engaging with technical things in their everyday life, a confidence earlier generations obtained through observing and participating in adults work at home. While 'repairing things' might not be the most pushing need nowadays, teachers nonetheless express a practical confidence and independency in dealing with technical things in the home as an aim for technology teaching:

> Ann:
>
> "...that they should not be so afraid of engaging with technical things in the home. Our society is increasingly specialized, and one calls for experts for the slightest thing, that they might not be so afraid to check things out on their own in a way. (...) There are some who are so helpless that they don't...they need an expert to find out that they have forgotten to plug in the contact or pushed the wrong switch or simple things like that, it is a pity that one needs to use experts for such things."

In general, teachers place their technology teaching largely in relation to utility in home life, rather than in a context of industry and work. This corresponds with how considerations of the market and the commercial potential of pupils' products are not addressed in the teachers' technology sessions. Thus it appears that the teachers have interpreted technology within frames that provides for equipping pupils with knowledge and skills that can be utilized in the home in a broad sense rather than in industrial production. This idea can be traced back to features of Norwegian culture, described earlier in this article as low degree of urbanization and also how education has played part in the building of a national identity built on the past. More specifically, Kramer (1984) has pointed to how Norwegian ethnical identity is still based on an image of the "weather-beaten farmer" (p. 94), and how this self-image has acted as a unifying and mobilising force in the struggle for independence from foreign colonists. The image has some bearing on reality given the country's relatively late industrialisation and an economy that as late as early 20th century was based on two sectors: self-contained small-scale farming and export of raw material. It seems like this self-image has influenced the transfer of ideas on technology education; while Design & Technology as a subject in England and Wales may be seen as reflecting the ideal of an innovative industrial designer, its transformed version in a Norwegian context indirectly conveys an ideal of the independent pre-industrial farmer.

### *Positioning technology in the school curriculum*

Teachers in this study present views on the role of technology in the school curriculum and how it relates to other subjects that appear to deviate significantly from how the subject has been conceptualised and implemented in countries where it is specified as a subject in the curriculum. Some of this deviation must be ascribed to the fact that technology is not a specified subject in Norwegian compulsory education,

and that the teachers hence have to realize technology teaching associated with the TiS project within the opportunities provided in the present curriculum. Accordingly, the teachers emphasise how technology teaching finds a place within existing subjects and as interdisciplinary approaches to these subjects. The discourse related to the TiS project has nonetheless focused on the idea that a new subject is being introduced in Norwegian schools.

However, it appears from the present study that the participating teachers do not, even in principle, consider technology as a new subject that adds a new domain of content knowledge to the curriculum. This emerges from the interviews when teachers are asked about their perceptions of Design & Technology as a subject in England and Wales. For example, Gina characterises the subject this way:

> Gina:
>
> "It is project work within many topics; we don't have much of that type of project work where pupils can work with diverse materials, in our school. That subject takes in subjects, or elements of subjects, that we have in other subjects here. Art and Crafts is within it, home economics - cooking is incorporated in that subject in England, and parts of science are within it. But they have approached the whole thing differently; they see the connection between the parts that by us are distributed in different subjects. There is strictly speaking not so different content perhaps, than what pupils here ideally should learn, governed by the curriculum; they are supposed to touch upon all of it, or at least some of the same topics here. But you have so few opportunities to work practically. They [in England] work with it practically and look at products, look at needs, approach it differently, and put it together as a subject. So it is a successful way of working with projects for the pupils, co-operation and to look a bit beyond the walls of the classroom in fact."

Gina sees Design & Technology as merely a combination of subject elements already present in the Norwegian curriculum. In her view, what makes the subject special is how the subject elements are put together in meaningful contexts that fascilitate practical project work. What one gains with this type of recombination of subject elements is, according to Gina, more practical work in realistic contexts, holistic approaches to project work and more co-operation between pupils. She describes how these ways of teaching are, however, difficult to achieve:

> Gina:
>
> "Ideally we should have achieved a lot through interdisciplinary approaches, but it is a fact that we are mainly subject teachers in lower secondary school, so we keep on with our subjects and then there will be some theory as well, instead of interdisciplinary work and do some practical things and bring the theory into it. And technology certainly is a subject that is interdisciplinary, where pupils have the chance to work that way."

Gina expresses a disparity between what should ideally be achieved and common practice in her school. This reflects what has elsewhere been shown to be the two biggest challenges teachers experienced in this implementation of the present curriculum, that is, to acquire sufficient relevant resources for theme/project work and to find ways to use thematic and project work in meaningful ways (Broadhead 2001). As

teachers appear to in principle share these intentions of the curriculum, the problems with fulfilling them are likely to play a part in the teachers' professional frames for teaching. To Gina, technology teaching associated with the TiS project emerges as a solution to these problems, and hence 'click into' her existing frames. Another teacher uses the methophor of a *catalyst* to describe this process:

> Irene:
>
> "To me it became a kind of catalyst really, in the curriculum. That is, it is a soft transition, it became so concrete to approach, when we work with projects, if you can use such a task then you have in a way connected Art and Crafts, Science, perhaps Mathematics, and you may include a bit Norwegian and maybe other things."

Participation in the TiS project has this way played the role of providing teachers with concrete and accessible ideas for project work that combines several subjects in the curriculum. Hence the idea of Design & Technology as a subject with its own knowledge base emphasised in England and Wales has been transformed to a view of technology teaching as a means for teaching other subjects in meaningful contexts, in consistence with an important objective in the Norwegian national curriculum.

## CONCLUSION

The study reported in this article has investigated the transfer of ideas on technology education from one national context to another by investigating how Norwegian teachers respond to ideas from Design & Technology.

It is shown how transformation of ideas from Design & Technology through Norwegian teachers' interpretations has led to technology teaching with less emphasis on industrial production and connection of pupils' activities to the development of commercial products. Aspects of Design & Technology related to technical and aesthetic quality is instead related to needs teachers see for building pupils confidence and self-esteem. Further, the teachers place their technology teaching in a context of independency consistent with a cultural image of a pre-industrial farmer rather than the one of an industrial designer. This reflects historical differences between Norway and UK.

The educational thinking in Norwegian traditions and current policy is clearly reflected in how the teachers in this study make use of ideas from Design & Technology. The emphasis on equity among pupils is reflected in the transformed version of the 'rehabilitation of the practical' into a 'social rehabilitation of the practical pupil', where technology teaching in schools provide pupils with more practical than academic abilities with arenas where they can succeed and enhance their social position.

It is shown that the teachers in this study largely interpret Design & Technology in terms of combinations of elements from other subjects, rather than representing a new subject in the curriculum. In accordance with the intentions in the Norwegian curriculum, they emphasise interdisciplinary approaches in meaningful contexts, and utilise activities within technology as a means for fulfilling these intentions. This does not only signal that the Norwegian teachers hold a view of technology different from ideas of Design & Technology in England and Wales, but also illustrates differences in how the traditional subjects are looked upon. In accordance with the characteristics of Norwegian educational thinking presented earlier in this paper, the Norwegian teachers look upon the academic subjects as rather flexible units that may well be taught through practical technology projects. The focus on utilitarian values rather than classicism also comes through in how teachers value and utilise the potential for altering the image of academic subjects in utilitarian direction by means of technology projects.

The presented study and its results illustrate a number of issues important for further development in technology education. Firstly, it has shown how specific educational and cultural features of the national context influence how educational ideas are interpreted and realized in schools. The transformation of ideas this brings about is crucial to consider when attempting to understand education in national as well as in comparative perspectives. Further, the study has proposed a view of teachers as active agents in the shaping of a curriculum, as it is shown how their existing frames are decesive for how new ideas are interpreted, developed and realized. These frames do not only comprise conceptions of the nature of technology as a subject of teaching, but also fundamental assumptions rooted in educational ideology and cultural identity. Finally, and more specific to technology education, the results remind us of the great potential of technology education for fulfilling a range of different purposes in schools, wherof some might be specific to each educational and cultural context.

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