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Reviewed Article

A Taxonomy for Teaching Transfer Skills in the Danish VET System

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Abstract

The article deals with transfer in the dual Danish VET system. Transfer is defined as the process of applying knowledge and skills acquired in an educational situation to working life.The existence of many identical elements in both training and transfer situations is known as 'near transfer', and is most readily achieved when training is conducted within company premises. Students find the relevance of their theoretical training to in-company-based application highly motivating. Cognitively, transfer is facilitated by the concrete similarities between training and its application. However, the purpose of school-based education is to develop the students' mastery of 'far transfer', i.e., their ability to apply knowledge and skills to a broad range of situations. Therefore the pedagogy of VET should provide a progression from near to far transfer. The aim of this article is to describe and discuss some of the pedagogical challenges for VET of near and far transfer.

Introduction

The underlying theory of school-based education and training is that students can be taught to apply knowledge and skills outside the classroom setting. The Danish dual VETprogramme, which alternates between school-based and in-company-based training, would be a natural starting point for a transfer-focused curricula. This article has been motivated by the need to put transfer on the agenda of vocational education and training.

A review of the literature on transfer reveals a number of factors that impact on transfer. These include factors external to the student, such as the workplace (the "transfer climate"), and the methods of instruction (Burke & Hutchins, 2007; Tennant, 1999; Aarkrog, 2004, 2010). Factors dependent on the student include such personal influences as their motivation for transfer (Kontoghioghes, 2002), career planning (Kontoghiorghes, 1998), and self-efficacy (Busch, 1993; Washington, 2000).

The notion of identical elements in both training and transfer situations (defined in the concepts of 'near' and 'far' transfer) is a central factor in conceptualising and researching these concepts (Barnett & Ceci, 2002; Ellis, 1965; Thorndike & Woodworth, 1901; Yamnill & McLean, 2001). Even though the notion of identical elements has been challenged and contradicted (Haskell, 2001; Judd, 1908), it has also survived as a relevant theoretical frame for understanding transfer.

What is required is a tool for teaching transfer skills. This tool is a taxonomy that can be used during training to increase the number of identical elements in training and transfer situations ('near transfer') or decrease the amount of identical elements ('far transfer').

Two Recurrent Challenges in Danish VET

The article takes as its point of departure two recurrent challenges in Danish VET. The first is to teach in a way that students benefit from the dual system. The second is to differentiate teaching approaches for markedly heterogeneous students.

The Dual VET System

The Danish VET system comprises 108 programmes, which are subdivided according to specialisation and interim qualifications. The average programme lasts between three and a half and four years. They are divided into twelve streams, such as building and construction, social health and care, and the like. Most students begin with a school-based course, known as the 'basic course', within one of these streams. The basic course takes approximately twenty weeks to complete within the technical and social- and health programme streams, compared to one to two years for the commercial programmes.

Having completed the basic course, the students continue onto one of the 108 main courses. They apply for an apprenticeship with a company. From then on, training alternates between company-based training, and theoretical and practical school-based learning {Cort, 2008 #241}.

The dual system sets the stage for a close connection between school and workplace, as well as between theory and practice. Since the Danish VET legislative amendment of 1991, there has been a consistent teaching approach to make explicit the coherence between theory and practice. As most students take the school-based pathway into the programmes, their first-hand experience of practice is postponed, making the development of practice-related teaching methods particularly important to the basic courses.

Furthermore, there has been continuing co-operation between colleges and companies. National research and development into the new apprenticeship model shows the importance of the dialogue between college and company in strengthening the students' learning process. However, this dialogue is often poor or non-existent, a problem that Denmark shares with other nations (Winters, Meijers, Kuijpers, & Baert, 2009).

So, if the student is to benefit from the dual system, their learning outcome must include an ability to apply theory in practice; in other words, to transfer what they learn in the school-based modules to their practical in-company-based training.

The Students in VET

The Danish government's main goal for its youth educational policy is to achieve a 95% pass rate by 2015. This target puts enormous pressure on the VET system in particular, given the wide variation in the students' qualifications, expectations and social backgrounds. Compared to the other main youth education track in Denmark, known as the upper secondary general programmes, or the 'gymnasium', VET attracts an extremely heterogeneous group of students.

The VET track caters both for students who are proficient at book learning as well as students who have suffered severe academic setbacks in primary and lower secondary school (Aarkrog, 2008a). Furthermore, many of the students suffer from social and/or psychological problems that impact on their learning. As a result, while some of the students need to be challenged at a high theoretical level, others need only to experience educational success for the first time.

In order to challenge the broadest range of students, curriculum designers need to differentiate both course content and teaching methods. VET pedagogy is rooted in the firm belief that students' learning processes are enhanced when theory is underpinned by practice.

Accordingly, the main principle of VET pedagogy is "coherence" or "practice-related teaching".

Studies of the Coherence between Theory and Practice

Over a number of years, many Danish studies have focused on students' perceptions of the coherence between the school-based and in-company-based components of the dual programmes. Most of the studies have concentrated on the students' learning, but few on the training methods employed (Støttrup Jensen, 1994; Tanggaard, 2007; Aarkrog, 2005).
A study of practice-related teaching (Aarkrog, 2008b) showed that the students are generally more motivated by theory if they perceive its coherence with practical problems they encounter in their workshop-based college training, or in-company based training. However, the study also showed that practice-related teaching is a necessary, but not sufficient condition for improving the students' learning outcome.

One important reason for this is that even though the teachers may use a practice-related approach as a training method, they do not necessarily teach the students themselves how to interrelate theory and practice.

This article's fundamental argument is that there is a strong need to focus on teaching for transfer; in other words, to teach students *how* to apply knowledge and skills in practice. We need to move on from practice relation as a teaching method to practice relation as part of the curricula. A taxonomy for practice-related teaching is one way of differentiating practice related teaching and in that way improving and refining the students' ability for transfer.

The Purpose of the Taxonomy

The taxonomy for transfer in VET is inspired by Susan Barnett and Stephen J. Ceci's article, "When and Where Do We Apply What We Learn? A Taxonomy for Far Transfer" (2002), in which they define a taxonomy of nine variables for transfer in university programmes; the basic concepts being 'near transfer' and 'far transfer'.

'Near transfer' means that the training situation and transfer situation share many identical elements. 'Far transfer' means that there are few or no elements identical to the two situations. 'Identical elements' includes a number of variables, such as the physical features of the two locations, and the parties involved (Barnett and Ceci, 2002).

Barnett and Ceci also use near transfer and far transfer to describe the time span between the training and the transfer situation (the 'temporal context'), even though the time lapse does not classify as an (identical) element (ibid). The temporal context will be discussed here.

The taxonomy of transfer is a means of differentiating teaching in the school-based courses of the VET programme stream. It should be understood as a scale, ranging from 'near transfer' (many identical elements) at the one end, to 'far transfer' (few to zero identical elements) at the other. Identifying identical elements is fundamental to learning to transfer knowledge and skills from one situation to another.

The basic idea behind this taxonomy is that the more complicated the content of the VET course, the greater is the number of identical contextual elements in the training and transfer situations that should be established. The *training situation* takes place in school, while the *transfer situation* is company-based.

The Complexity of the Course

The complexity of the VET course cannot be objectively determined. Rather, it is a factor of each student's previous qualifications and cognitive abilities. So the taxonomy is meant to inspire the teacher to provide a varied combination of degrees of complication in the course content, and degrees of contextual similarities.

Degrees of complication in the course content can be defined in a scale ranging from '*specific transfer'* to '*general transfer'* (Persson, 1995). 'Specific transfer' is the application of specific knowledge or skills characteristic of the one particular vocation. There is a close, concrete and overt relationship between knowledge/skill and performance. An example is the carpenter's ability to correctly handle different woods based on knowledge of their characteristics. 'General transfer', by contrast, is the application of general knowledge and skills to broader contexts and across a variety of vocations. One example is the ability for problem solving. General knowledge and skills are often indirectly a part of performing in practice, or they may provide background knowledge that underlies skilled workers' feelings of mastery of their trade.

On the whole, students are far more motivated by specific course elements, because they readily identify their usefulness. They can also be demotivated by the general course content if it recalls unhappy memories of failure during their earlier schooling.

Nevertheless, we should not fall into the trap of regarding general knowledge and skills as 'nice to know' but non-essential elements of the VET programmes. Indeed, they are fundamentally important for qualifying students for a broad range of positions within their trade.

Compared to specific content, general content is connected more abstractly to practice. Consequently, the identical elements between the training situation and the transfer situation are often not concrete and salient, but structural and abstract (Holyak, 1987). To identify the elements identical to both situations, students must be able to perceive similarities between practical incidences and structures or principles. They must be able to understand different scenarios from a variety of practices as examples of the same principle. The identical elements are not identical in a concrete sense; rather, they are abstract similarities.

The distinction between specific and general transfer should not lead to the conclusion that the specific content is always simple and easy to learn. However, the more abstract the connection between the course content and the students' expected performance in practice, the more difficult it is for students to motivate themselves - both to acquire skills and knowledge, *and* to transfer what they have learned into practice.

To motivate students for general transfer, the teacher should try to render the general content more specific by making an explicit connection between general knowledge and skills and their practical applications.

Thus, the contents of the course will be either more or less complicated for the students to acquire and consequently transfer. If the content is hard to digest, the teacher can simplify the training and transfer processes by reducing complexity in the training situation. This is accomplished by increasing the number of identical elements shared between the training and transfer situations.

The Contexts of the Training and Transfer Situations

The purpose of practice-related teaching is to create identical elements between the training situation at school and the transfer situation in the company. So, when students struggle to comprehend rules of mathematics or physics, the teacher will set up a training situation that shares as many identical elements as possible with the transfer situation; in other words, with practice within the relevant trade or industry. For example, carpentry students might be taught the mathematics needed for the construction of a roof for the outdoor workshop of the college. By increasing the number of identical elements, the teacher makes the content more specific, and thereby strengthens specific transfer.

The construction of identical elements takes its point of departure in the transfer situation, where the students will apply or are meant to apply the knowledge or skills they acquire during the course. Ultimately, the transfer situation is situated within the company. However, transfer situations may include situations at college, for example, in the workshop or the classroom. Furthermore, time is an important factor in transfer: the students may have an opportunity to apply the knowledge they have acquired within a shorter or longer time span, for example, the day after, within a week, or weeks later, and so on. This will depend on the alternation between school-based and in-company-based training. If there is a relatively short time-span between college training and company application, *and* if the college and the company have co-ordinated the training syllabus, students will more easily remember and transfer what they have learned.

The taxonomy offers the possibility of temporary transfer situations — stepping stones for transferring knowledge and skills into real practice. This means that the number of identical elements can be enhanced in two ways. Either the context of the learning situation will share elements of the in-company-based training, or elements of the transfer situation will share characteristics of the school-based training. In other words, near transfer can also be manifested by establishing similarities between the transfer situation and school-based education. For example, students may transfer what they have learned in one classroom-based mathematics lecture into another classroom-based mathematics lecture. The point is that some students may find it much easier to transfer knowledge from one school-based situation to another, than from school-based education to company-based training. So even though the students should eventually develop the ability for the latter, the former scenario may be a useful method for developing their skills for far transfer.

No matter what, the teacher must have a clear picture of the transfer situation at the outset to design a training situation that will share elements more or less identical to the transfer situation.

Variables in the Taxonomy

The near-to-far transfer continuum involves a number of variables that can be adapted to the current VET programme. Four of these will be discussed here: the physical context, the social context, the modality of training and transfer, and the temporal context.

Physical Context

One way of establishing identical elements between the training and transfer situations concerns the physical context of the two situations. This refers to the physical layout, the furniture, the machinery, the colour scheme, and so on. If the training situation takes place in the same physical surroundings as the transfer situation, near transfer can occur.

For instance, in the Danish so-called 'new' apprenticeship model of 2006, some of the programme theory is taught in the company where students undertake their practical training. So the setting of the training situation is the same as the setting of the transfer situation.

Another example is where the students learn a foreign language alongside their practical work in the college workshops. So when, for example, Danish students learn the technical English lexis for bricklaying while practising the manual skill, there is an identical element: the students acquire lexical theory in a physical context that is close to real-life bricklayer practice.

If the teacher wants to establish a far transfer situation, he will teach in physical surroundings that share little or no resemblance to the transfer situation. This is often the case by default, simply because the training takes place at a college and the transfer of training in a company setting.

Social Context

This has two aspects. The first concerns the actual persons (apart from the learner) participating in the training and transfer situations. Are they the same persons or not?

If the students are concrete thinkers and focus on the salient aspects of the situation, then the identical elements of the social context will also influence their ability to transfer what they have learned. When theory is difficult to grasp, these students may depend on precisely *one* way of explanation which is connected with the particular person who provides the explanation: the college lecturer, the company trainer, or fellow students. In very near social contexts, the performers in the training and transfer situations are the same. In very far social contexts, only the learner will be the same person in the two situations.

The *other* aspect of the social context concerns the group dynamics in the two situations; for example, to what degree the level of co-operation in the training situation reflects the co-operation in the transfer situation.

These two aspects are interdependent, hinging on whether the learner will ultimately work alone or in a team. Thus, if the students will be expected to transfer knowledge or skills in a situation where they work alone, near transfer would mean that the students should also be trained alone. If the students will need to transfer knowledge or skills in collaboration with others, near transfer would mean that the students should also be trained alongside others. For example, carpenters and bricklayers often labour in work gangs, so near transfer will be established if the training takes places in work gangs too.

When the two aspects of the social context are put together, *very* near transfer is obtained if both the constellation and the persons are the same; for example, the same actual persons, working in pairs in both situations.

Modality

Modality concerns the medium of training and transfer. Near transfer is obtained if the medium is the same in the training and transfer situations. One example is when the auto mechanic student learns how to change the oil filter in a car of the same brand as the cars in the garage where he trains as an auto mechanic.

Often VET is characterized by far modality. By reading texts and attending lectures (one kind of medium), the students adopt procedures or principles which they are expected to transfer into practical skills (another kind of medium).

This taxonomy should inspire the teacher to match to a greater or lesser degree the media through which the students acquire and transfer knowledge and skills.

The Temporal Context

If the temporal distance between the training and transfer situations is relatively short, students are expected to transfer what they have learned with more success than if the distance is relatively long. In near transfer, training and transfer take place on the same day. As an example, near temporal transfer takes place when the students tackle assignments or exercises immediately after they have been introduced to a new rule, principle or skill.

In the far temporal context, there may be weeks, months or even years between the training and transfer situations.

There are a variety of methods of shortening the gap between the training and transfer situations. One way is to draft the course in close co-operation with the companies where the students will conduct their practical training. Close contact between school and companies supports the students in applying their school-taught knowledge or skills immediately. In practice, however, there is often only intermittent contact between company and college.

Another means of shortening the time lapse between the training and transfer situations is to incorporate learning to transfer as part of students' school-based education. This may include encouraging them to visualise the transfer situation, or may entail devising activities for them to put recently-learned knowledge and skills into practice. Transfer can take place in the college's workshops, or in co-operation with suitable companies. Near transfer is obtained by situating classroom teaching close to the workshops. Students will alternate between short modules of theoretical training in a classroom, and associated practical training in a workshop next door. In that way the students learn only what they need to transfer right away in order to accomplish a practical skill in the workshop.

Differentiation

The four contextual variables are shown together in Figure 1 below. The variables should be defined so that they are relevant for the VET programme and the specific course. The horizontal axis ranges from near transfer (level 1) to far transfer (level 4). The number of levels of transfer, and their definitions, are determined by the course in question. As this taxonomy is developed primarily to support the students' alternation between school-based training and in-company-based training, the temporal context stretches from the same day to months after theoretical training. In other courses, the scale may differ.

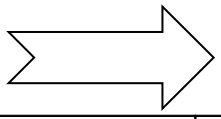
	Near transfer: many identical elements in training and transfer situations	**Increasing difficulty** 		**Far transfer**
Physical context	Same classroom/ workshop/ company etc. in both situations	Workshop vs. company	Classroom vs. workshop at school	Classroom vs. company
Social context	The students work in the same pair grouping in both situations	The students work in different pair groupings in both situations	The students work in different groups in both situations	The students work in groups at the college and with colleagues in the company
Modality	Written exercises in both situations	Reading vs. oral presentation	Teaching at the blackboard vs. experiments	Training based on texts vs. accomplishing a practical task
Temporal context	Immediately after training	Next day	Two weeks later	Half a year later

Figure 1: Taxonomy (near transfer to far transfer) exemplified in four levels within four variables.

This taxonomy is designed to aid the teacher in planning the course based on the students' qualifications and the learning outcome targets. The greater the number of concrete identical elements the teacher is able to establish between training and transfer situations, the better the transfer.

Near transfer is a means of supporting the weaker students' acquisition of knowledge and skills; far transfer can be used to challenge the brighter ones. Basically, school-based training of skills and knowledge that will be transferred to a company should be labelled 'far transfer'. Far transfer is often too difficult for students with poor academic qualifications to accomplish, and creating near transfer situations may ease the training and learning processes for them.

An Example

The following example of the transfer taxonomy in action is taken from lessons about voltage drop measurement in a programme for auto mechanics. Voltage drop measurement is a troubleshooting method for light circuits. If the lights on a car are weak or not working, the solution is to determine which of the components in the electrical circuit are responsible for causing the voltage drop. It might be a poor electrical connection, a broken wire, or some other malfunction.

The purpose of the course is that the students acquire a basic working knowledge of electricity by studying voltage drop measurement. The contents and methods of the course follow an increasing level of difficulty from one to four.

Level 1: Training takes place in the college workshop or the company premises. The students will measure the voltage drop on the car, using a voltmeter to determine the voltage of the car lights and battery and the reasons for the voltage drop.

Level 2: Training takes place in a classroom or a laboratory. The students work with a circuit model containing a car light, and resistors. The students will measure how much lux the light produces when different resistors are placed in the circuit.

Level 3: Training takes place in a classroom or laboratory. The students work at a 'fumble board', where they construct different circuits, experimenting with the impact on voltage of different types of bulbs and resistors, again measured with a voltmeter.

Level 4: Training takes place in a classroom. The students solve mathematical problems derived from auto mechanics practice. By working with mathematical equations based on Ohm's and Kirchhoff's laws, the students acquire theoretical knowledge of basic electricity.

The example outline above illustrates the concomitant association of near and specific transfer on the one hand, and, far and general transfer on the other. This means that the content determines the scope of contextual possibilities: specific knowledge and skills are linked with near transfer, whereas general knowledge and skills can only be mastered if far transfer is possible. Consequently, choosing contextual elements in the training situation that create near transfer will impact on the choice of the course content. Thus the training method will influence students' learning outcome.

Near and Far Transfer as Pedagogical Tools

In a dual system (like the Danish VET system), the common understanding of near transfer is that the training situations should share identical elements with the average company's operational model within its specific trade or industry. Likewise, far transfer signifies that the training situation shares few or no identical elements with such enterprises.

Teachers in VET know how difficult it is to establish near transfer situations within school-based training; that is, situations that the students will perceive as near-to-normal operating practice of the companies themselves. Relating theory to practice, or simulating practice in college, can have the opposite effect from what was intended — by complicating the learning process. In reality, students do not equate simulated practice with real practice; rather, this becomes a third type of training, which is neither school- nor company-based. So, for practically-oriented, concrete-thinking students, simulated practice may share even fewer identical elements with real practice. Simulated practice establishes another community of practice altogether, outside that of the companies' communities of practice (Lave & Wenger, 1991).

What can be learned from this anomaly? That it is important to research the outcome of practice-related training. One may find that the students' learning process would benefit from intervals of non practice-related training. In other words, the teacher should organise training situations that do not relate to practice. Near transfer in this context will mean that the students both learn *and* transfer in school-based situations (in classroom settings). The training situation is simpler, because the students can concentrate solely on learning a

mathematical rule or physical law on its own, without simultaneously trying to deal with its application in skilled professional practice.

This application of the taxonomy flies in the face of established opinion that students' learning process is supported by practice within the trades or industries. However, its purpose is not to skip practice-related teaching, but rather to expand the concepts of near and far transfer.

So, the taxonomy should be regarded as a pedagogical (or didactical) tool in which the perception of near and far transfer does not concern *only* the interrelation between school-based and company-based training. Rather, it should be used more generally and abstractly to denote degrees of similarities between *all* types of training and transfer situations.

Conclusion

To recap, 'transfer', for the purposes of this article, entails the real-life application of knowledge and skills acquired in a classroom setting. One of the current discussions is about how much the transfer situation should differ from the training situation yet still retain the label of 'transfer situation'. As *specific* transfer is connected to specific tasks in specific job functions, one may argue that the specific content excludes real transfer, because the transfer task shares too many concrete identical elements with the training task. Only *general knowledge* enables real transfer, because this kind of knowledge can be used in a broad spectrum of situations. In a nutshell, can near transfer be called transfer at all, or is it merely training? (Detterman, 1993).

In fact, the ability to use knowledge — whether it is in drills, exercises or simulated situations — is an example of near transfer, and so should be regarded as a way of training in the application of skills and knowledge — in other words — of learning transfer skills.

However, transfer should ultimately be interpreted as the ability to apply knowledge and skills in unknown situations; in other words, in situations that the student has not encountered before. For that reason, the learning outcome target of the VET programmes is far transfer.

For this reason, the taxonomy of transfer is mainly a tool for *training* for transfer. Specific to general transfer, and near to far transfer, exist on a continuum, readily lending to the teacher's design of calibrated transfer situations that will guide and support the students along a pathway from specific and near to advanced and expert situations. Ultimately, the students will acquire extensive general knowledge which they will be able to use in solving problems in a broad range of real-life situations. If this is achieved, the teacher can claim success in teaching their students a full mastery of their VET qualification. General and far transfer has been realized.

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