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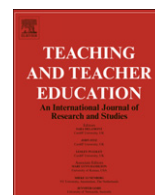
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Authentic and self-directed learning in vocational education: Challenges to vocational educators

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ABSTRACT

This article analyses the dilemmas and practical tensions in implementing competence-based vocational education. Eleven case studies were conducted, including observation of lessons and interviews with teachers and students. The results show that schools meet various fundamental issues in realising this approach. A crucial question is how to stimulate the acquisition and use of a way of knowing and thinking that is based on vocational theory. Reflection, authenticity and coaching are relevant characteristics that are hardly put into practice yet. To understand these results the article reflects on factors that account for the distance between promising concepts and actual teaching practice.

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1. Introduction

Over the last twenty years competence-based education has become a dominant trend in vocational and professional education in Europe and Australia (de Bruijn, 2004; Brockmann, Clarke, Méhaut, & Winch, 2008; Clarke & Winch, 2007; Weigel, Mulder, & Collins, 2007). Pressure behind it has been the supposed lack of relevance of vocational education. The shared problem is the novice who knows a lot but is not yet able to utilize this knowledge fully in the workplace. The term covers various conceptual ideas and practices ranging from technical and managerial thinking in which education is narrowed down to training competency, to emphasizing the development of full vocational competence in which autonomous identity development is crucial.

We, situating ourselves in the line of international research based on the latter, consider that effective competence-based vocational education promotes self-directed and authentic learning both within and beyond the workplace. As Billett (2001a) explained: curricula in vocational education could best be designed in terms of pathways of participation in social practice. According to him knowing in practice (i.e., vocational expertise) can

only be developed if there is ample opportunity to access and participate in that practice (cf., Aarkrog, 2005; Tynjälä, 2008). There is some consensus that engaging in practice and relating acting and thinking also motivate and facilitate continuous learning (Rosendahl & Straka, 2007; Sembill, 2003; Smith, Clegg, Lawrence, & Todd, 2007). Curricula in which enacting in social practice is central make students aware of their own role in learning and of the need to direct one's own development to become a professional right from the start (Cohen-Scali, 2003; Meijers, 2002).

This new orientation of vocational education has led to fundamental changes in the work of vocational educators (i.e., teachers and trainers). These changes include the scope of courses offered, the content, goals, forms of instruction, coaching roles, methods and daily routines at work (de Bruijn, 2004; Biemans et al., 2009; Billett, 2001b).

In this article we analyse the dilemmas and practical tensions in implementing competence-based education in vocational courses, in a context in which conditions are not ideal and the concept is diffuse and still being designed. The courses included in our study were in the technical domain at the highest qualification level in senior secondary vocational education (level 4/5 of the European Qualification Framework, European Commission, 2008) for youngsters aged 16 or older who have completed the first compulsory cycle of secondary education. In the Netherlands these courses are part of the formal education system. Students obtain their qualification by learning in school and in the workplace. The courses are four-year,

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full-time programmes comprising at least 20% learning in the workplace. Graduates of these programmes are allowed to enter the bachelor programmes in higher professional education.

2. Powerful vocational learning environments

We used the *model of powerful learning environments* to delineate a concept of competence-based education which pays attention to both authentic and self-directed learning. The model is grounded in the idea of cognitive apprenticeship (Collins, Brown, & Newman, 1989), that is acquiring complex knowledge and skills within a social and functional context. This idea of cognitive apprenticeships stresses both learning to perform in practice and going beyond these specific situations thus acquiring understanding, meta-cognitive skills and flexibility. The aim of the model, inspired by sociocultural theory (e.g., Billett, 2001a; Collins et al., 1989; Raizen, 1994), is the development of vocational identity. Important elements are reflective, authentic and constructive learning from a situative perspective on cognition (e.g., Lave & Wenger, 1991; Putnam & Borko, 2000).

This model was the result of previous research on competence-based vocational courses in various domains such as business administration, health care and technology (De Bruijn & Moerkamp, 2000; de Bruijn et al., 2005). Theoretical principles were validated by practice in terms of enrichment, adjustments and specification. The result of this previous research project was a *model of powerful learning environments* for vocational education. This model comprises a mix of traditional features, such as instruction, with new features, like active and reflective learning:

Programme characteristics

1. Formation of vocational identity as the starting point for learning
2. Authenticity
3. Reconciliation of thematic and subject-oriented contents

Learning activities of students

4. Construction
5. Reflection

Guiding activities of teachers

6. Adaptive instruction and modelling
7. Coaching
8. Supporting self-regulation skills

Evaluation

9. Instrumental testing of partial knowledge, insight and skills
10. Assessment of competencies

This article portrays the educational practice of the vocational courses included in the study in terms of these characteristics of *powerful learning environments* and aims to investigate the dilemmas and practical tensions that arise when implementing them.

3. Methodology

3.1. Participants

Intensive case studies were necessary to understand the teaching and learning processes in educational practice. This method limited the number of courses that could be studied. As teaching approaches differ from vocation to vocation, depending on the standards, culture and habits relating to vocational domains (Billett, 2001b), it was decided to select all courses from the same

vocational sector and to limit the number of vocations the courses train students for. In this way the variation in educational approaches that we wanted to take into account, was less likely to be caused by vocation.

The cases were selected in two phases. Firstly, the domain was chosen by consulting key persons in vocational education. We wanted to know a) which vocational sector was most active in implementing competence-based education; b) which courses within this sector demonstrate most variations of teaching approaches between schools. When the cases were selected (2001–2002), many practices in vocational education in the technical domain appeared to be changing, partly because of shortages of skilled workers, fewer youngsters taking these courses and complaints by industry that the course contents and equipment were obsolete. This first phase resulted in the choice of three courses in the technical domain: middle manager Process Engineering (PE) (4 schools), manager/entrepreneur Automobile Engineering (AE) (22 schools) and middle manager Soil, Water and Road-building (SWR) (23 schools). In addition, one course in the trade sector was selected, branch manager/shopkeeper (20 schools). In total there were 69 school departments offering these four courses.

Secondly, as we only could study a limited number of cases, the coordinators of these 69 cases were sent a questionnaire on the programme and teachings methods so that we could select the courses that varied most. The questionnaire asked about the ideal situation and the actual practice regarding each of the ten characteristics of the *model of powerful learning environments*. Fifty-three of the coordinators returned the questionnaire and 11 courses in different parts of the country were selected for inclusion in the research. On the basis of this self-assessment and an additional interview with the coordinator, five of these courses could be considered to be relatively powerful and six to be less powerful. The 11 courses were on PE (2), AE (4) and SWR (5) comprising about 30% practical training on the job and 70% learning in the school setting. The powerful and less powerful courses were distributed proportionately over the three vocations. In total 200 students between 16 and 22 (mean age 18) of which 97% males, and 11 teams of four to seven teachers were participating in the study. According to the coordinators all these courses were in the process of implementing competence-based curricula and teaching practices.

3.2. Data collection

Data collection was concentrated in two periods, in the first and second semesters of the second year of the courses. Instruments were developed for lesson observations, analyses of curricula and teaching materials, and interviews with teachers and students. The ten characteristics of the *model of powerful learning environments* served as a common framework for defining the research instruments.¹ Each characteristic was specified in two descriptions or vignettes, one indicating the 'powerful' practice and the other indicating the non-powerful practice. Both vignettes were formulated in positive terms, that is instead of formulating which characteristics were *not* present, formulating which (opposite) characteristics *were* present. Except for the observation schemes, all instruments used descriptions that were based on these vignettes. The observation schemes used detailed, visible activities referring to the vignettes and data needed to be interpreted afterwards by the researchers using a format in which the vignettes were applied again.

Six researchers were engaged in data collection with two researchers working on each course. During the observations one

¹ The instruments are available from the first author.

researcher focused on the activities of the students and the other on those of the teachers. The researcher who observed the students' activities also interviewed them. The students were selected at random. Similarly the researcher who observed the teachers also interviewed them afterwards to clarify their teaching behaviour (cf., stimulated recall interviews, see Lyle, 2003; Zanting, Verloop, & Vermunt, 2001). The course coordinator was consulted about the selection of lessons to be observed so that the various ways of teaching, contents and components of the programme would be included. The principle of triangulation (Yin, 2003) was applied by using different sources of information, the researchers working in pairs, and spreading the data collection over the year and types of lessons.

For each case there were four periods of data collection. In the first and last periods two interviews with the course coordinator were held. In total, two days of lesson observations took place during the second and third periods. Teaching material from the observed lessons was analysed. Three to five teachers and practical trainers in schools were questioned after observation of their lessons. Furthermore, three to five group interviews were held with students. Nearly all the team members of the courses in question were involved in the study, including the coordinator, the teachers of general subjects (e.g., languages, mathematics, business administration, physics and chemistry) or vocational theory (e.g., strength of materials, automation, control engineering, electro technology, land surveying) and trainers for coaching practical assignments and teaching practical skills.

3.3. Data analyses

Triangulation was also a feature of the process of analysis. A step-by-step interpretation of the data by the different researchers, increasingly more detailed data collection and analyses (Miles & Huberman, 1994) and a process of constant comparison resulted in the identification of chains of evidence. The pairs of researchers made transcriptions each time data was collected. They discussed the meaning of the data, giving scores for the ten characteristics of powerful learning environments using the vignettes per characteristic (see 3.1) and formulating evidence from the data to validate the scores. During the course of the year an extensive case report was compiled, which was also sent to the course coordinator for verification.

Two of the six researchers independently assessed the ten characteristics of powerful learning environments in the 11 courses again on the basis of the reports and underlying transcripts. They had to fill in a format per characteristic, using the vignettes and composing a chain of evidence from the compiled data to validate their score. During intensive sessions of one hour for each course these two researchers discussed, explained and validated their assessments and calculated the final score. The scores range from 1 (weak) to 4 (strong).

4. Results

There appears to be little differentiation between the courses regarding the actual design of the learning environment and the teaching and learning processes. Table 1 presents an overview of the scores per characteristic of powerfulness in a sequence of decreasing levels of implementation. As the ten characteristics form a consistent scale (Cronbach's alpha is .92), the composite variable 'powerfulness' could be defined, which comprises the mean of all the separate variables.

The mean score of the 11 courses on the scale 'powerfulness' was slightly higher than 2 (= 'slightly more weak than strong'). Only three courses scored 2.5 or higher, 2.5 being the neutral value.

Table 1

Implementation of powerful learning environments in eleven vocational courses.

Ten characteristics of powerful learning environments In a sequence of decreasing levels of implementation (range: 1/weak to 4/strong)		
N = 11	Mean	2.5 or more
Adaptive instruction and modelling	2.48	n = 8
Formation of vocational identity as the starting point of learning	2.32	n = 6
Reconciliation of thematic and subject-oriented contents	2.30	n = 3
Construction	2.18	n = 5
Instrumental testing of partial knowledge, insights and skills	2.07	n = 4
Supporting self-regulation skills	2.05	n = 4
Authenticity	1.98	n = 4
Assessment of competencies	1.93	n = 4
Coaching	1.84	n = 2
Reflection	1.81	n = 1
Composite variable powerfulness (scale, $\alpha = .92$)	2.10	n = 3
Selection instrument ^a	2.05	n = 5

^a This figure refers to the score based on the data from the questionnaire that served as the selection instrument (see 3.1).

Two of these also had high scores for the questionnaire that had been used to select the courses. The third appeared to have more of the characteristics of 'powerfulness' than the self-assessment had indicated. The three other courses that were identified as powerful on the basis of the questionnaire appeared to be less powerful in actual practice.

As for the ten characteristics, Table 1 shows that *adaptive instruction and modelling* and *formation of vocational identity as the starting point for learning* are relatively well established in the 11 courses. These are features that are compatible with a more traditional concept of vocational education but at the same time are not at odds with competence-based education. More innovative characteristics like *authenticity* and *assessment of competencies* are less evident. Only one or two courses succeeded in stimulating *reflection* by students and a *coaching* teaching style of teachers. Below we give a definition of the ideal elaboration in practice of each characteristic and then describe their implementation in the 11 courses.

4.1. Formation of vocational identity as the starting point for learning

In its ideal form the development of a vocational identity provides a framework for the acquisition of vocational competence (Billett, 2001a). The selected courses all focus on functions that not only relate to a particular domain but also to middle-management qualities. In other words, besides domain-related theory and specific instrumental skills, social skills related to leadership are relevant. Ideally, all these aspects should be addressed in the programme, not in isolation but in relation to each other.

In practice it did not appear to be an easy task to reconcile these claims. The courses had different accents. One of the AE-courses (AE1) stressed the acquisition of specific instrumental skills and students received feedback on related attitude aspects, such as working systematically and neatly, and being precise in administrative matters. Teaching staff sometimes were doubtful about the usefulness of paying attention to operational management. "These students should actually be doing practical work for at least half of their time and focusing in particular on instrumental knowledge and skills. They should come back to school later to learn general entrepreneurial skills and business administration" [AE1 teach2, 12-01, p. 2]. This was the opinion of one of the teachers who himself was teaching the subjects mentioned. Another AE-course (AE2) did

almost the opposite. Operational management and business administration were important components of this course and the students themselves were very explicit about their role as managers in this branch. However, less attention was paid to practical knowledge and skills.

In one of the SWR-courses (SWR1) attention to both aspects was more balanced. During the lessons we observed that teachers regularly referred to future practice. “Look, you need to know this if you’re later going to work in...” [SWR1obst,12-01, p. 6]. The students on this course were satisfied with the relevance of the lessons. They were able to say very precisely what the goals of the practical activities were: “You need to get a feel for the materials, you have to know what your men are actually doing when you’re the supervisor” [SWR1stud1,12-01, p. 2]. The teachers of this course considered it their duty to teach students how to plan and take responsibility for their own learning and competencies that are particularly useful for middle managers.

4.2. Authenticity

The courses ideally make use of authentic tasks, preferably performed in realistic contexts. Tasks not only involve the application of instrumental skills but also more general competencies such as arranging, planning, and organization. Authentic tasks are assignments taken from vocational practice. These assignments might need to be re-designed to be accessible to learners (e.g., divided into component parts or sub tasks) but the complexity of reality should remain an essential feature of the tasks (Putnam & Borko, 2000; Raizen, 1994).

The authenticity of most of the courses appeared to be limited. Several courses used learning materials consisting of defined units based on complex practical problems. The materials were developed by the national expertise centre for the branch (which includes industry itself). In this way the first steps were taken towards more authentic learning in these courses. Other courses used projects developed by the schools themselves, which were both practically oriented and included different subjects. Some teachers favoured these methods of working but they had not (yet) been incorporated into the course curricula. Students seemed to appreciate the limited authenticity of the courses, at least in the first years of their course. “The teacher should direct your learning activities. You can’t know everything. That will change in the future of course. The further you get with the course, the problems and issues you have to deal with will get more difficult and complex. At the start you get lots of theory but that’s necessary. You know nothing so they have to teach you the theory first” [SWR3stud2,01-02, p. 2].

Learning on the job might possibly improve the authenticity of the courses. Work placements were not included in the second year of most of the courses (i.e., the year we focused on in the study). In the course that did include working on the job in the second year (AE3), the students complained about the timing (in the first semester of the second year). They would have been much happier if they had been given theory lessons first. “In that way we could have done more interesting things in the workplace and the work placement would have been more useful. As it was, we just didn’t know enough” [AE3stud1,01-02, p. 3].

One of the SWR-courses (SWR4) had a robust plan to give real form to authenticity. The teachers not only worked with practical assignments, they also tried to arrange for the students to work on these assignments in existing working conditions. The school actively sought assignments in the work field and also took orders from external clients. If they did not succeed in getting a real assignment then they designed a simulated one. Such an assignment should trigger all the necessary actions, such as planning,

logistics, calculations and negotiations with the client, in an interdependent way. However, the teaching staff became entangled with the external examinations on vocational theory which determined the nature and sequence of learning contents and tasks (see 4.9 about examinations and assessment). Teaching staff had to use simulated assignments in which real practices were anchors for learning, instead of contexts to learn in, far more often than they wanted to in order to handle this vocational theory. Despite the dissatisfaction of teaching staff regarding the authenticity of the course, this particular course was one of the two that scored relatively highly on this aspect. The other course with a high score was on PE (PE2). The students on this course worked on real assignments for three mornings or afternoons a week in their second year.

None of the four AE-courses scored higher than the neutral value of 2.5 on authenticity. “Problem-based learning is not so easy,” one of the teachers stated. “There is little real material and equipment and it costs too much to arrange this properly. I also don’t think it’s absolutely necessary. We can make better use of existing connections between theory and practice” [AE1 doc2,12-01, p. 2]. However, in these courses there was often no fruitful link between theory and practice. One course (AE4), for example, had a well equipped workshop as well as systematically organised tasks. Students very much appreciated the workshop, but there were only a few lessons and they were not well integrated into the programme as a whole. Although the tasks were real, they were highly pre-structured. This also meant that there was little room for students’ own planning, as the following remark of a student shows. “In the practical lessons you’re given set tasks that you have to work your way through from a to z. There’s no possibility to make your own plan. With these set tasks you learn a particular way of working” [AE4stud1,12-01, p. 2]. This course only provided less pre-structured assignments for the well motivated and quick students. “If you’ve finished you might get extra assignments. Then you can work out for yourself how you do it. It’s good when teachers let go and let you do things on your own, at least now and then. You often get the teacher’s car to repair, and then you have to make sure you fix it properly!” [Ibid].

4.3. Reconciliation of thematic and subject-oriented contents

Ideally, authentic learning is supported by learning the underlying knowledge and by training in specific skills. The programme is designed so that the constituent parts relate to each other as far as possible. Mathematics and science support vocational theory, which in turn is related to practice, while learning in practice is a constant factor in the programme. Other elements (such as languages and general entrepreneurial skills) are optimally related to each other and whenever possible support authentic learning. If subject-oriented components of the course, real assignments and training in skills are interrelated it helps students to understand and perform better (de Bruijn & Howieson, 1995; Biemans et al., 2009).

Generally speaking this interdependence is not worked out very well in the courses, although we saw initiatives to do so. One of the PE-courses (PE2) had an interesting design. In the second year of the course six integrative projects were scheduled in which the major subject of the course determined the content of the projects but other subjects also contributed. Teaching staff did not use the syllabi of the national expertise centre for the branch, but designed a coherently ordered course content themselves. They tried to match this course content with real assignments as far as possible.

The AE-courses showed little integration of the various school subjects in relation to authentic tasks. Teaching staff stated that this situation was caused by the inflexibility of the examination procedures imposed on them. Students following these courses all

argue strongly for subjects and training in skills related to real practical tasks to be more integrated. Teachers were of the same opinion but as one of them said: “This isn’t so easy because school subjects, including vocational theory, are structured according to the content and logic of testing and examinations, not on the basis of practical assignments”[AE4obst1,12-01, p. 5]. If integration did occur this was due to individual teachers, especially teachers who taught general school subjects as well as giving practical training. They managed to relate underlying knowledge, practical skills and complex practical issues.

4.4. Construction

Ideally, students develop meaningful, flexible knowledge and skills, which are required for competent professional behaviour, on the basis of course curricula and guidance. Constructive learning is stimulated when course curricula are authentic, i.e., consist of sequences of real and complex practical assignments, calling for problem solving (Collins et al., 1989). Cooperative learning might be an important stimulating factor in these learning processes (Lave & Wenger, 1991).

It was difficult to observe whether constructive learning took place. We paid attention to the opportunities for exploration. Did the students have room to formulate problems themselves and to seek solutions? Did they have the opportunity to plan and organise activities themselves? Did the cooperation necessary for working together in teams actually occur in practice?

Courses that had a relatively high score for authenticity also scored highly on this characteristic. Nevertheless, we question the extent to which constructive learning really took place in these courses. We asked the students on the SWR-course that scored highly on authenticity (SWR4), how often they had spent time on problem solving, which necessitated drawing on both theory from various subjects and practical experiences, in the last few weeks. “Nearly always, oh well, at least every Tuesday and Thursday. I have to admit that you mostly pack it in after an hour or so. There’s so much distraction and we don’t plan very well. Just before the deadline we start working very hard. Then we catch up again”[SWR4stud2,02-02, p. 2]. Students have to sort things out for themselves and plan their work. “You can find everything you need in the books,” students say. In answer to the question whether they really understand the theory, they state: “No, you look for an illustration or diagram to see how to deal with something and usually you are able to work it out then. When you have a test they mostly tell you precisely what you need to know and what the test is about. Then you know what to learn and we do”[Ibid.].

Another SWR-course that was typified as particularly traditional (SWR5), nevertheless appeared to stimulate constructive learning. In the course students work extensively in groups of four with teaching materials comprising problem-based assignments. These teaching materials not only deal with instrumental knowledge and skills, but also address competencies typically required by middle managers, such as problem solving, group responsibility, interaction with others, cooperation and decision making. Teaching staff stimulate students to find their own solutions that are different to standard rules and procedures. During the lessons we observed there appeared to be a lot of constructive interaction. Students discussed solutions and discussed each other’s efforts.

The AE-courses provided little room for explorative learning but in one of the courses, which included a lot of training, students had to work together on standard tasks. “During the practical training the idea is that you try as far as possible to find a solution together. The principle is that you first try and find an answer together, then you look in the books and only then ask the instructor if you don’t succeed. There are enough instructors,

either teachers or assistants and trainers. It depends on your motivation whether you succeed without asking an instructor. Some instructors like to help, but you’re supposed to work it out on your own or together”[AE4stud1,12-01, p. 2].

4.5. Reflection

Reflective learning is the fifth characteristic of the model. Through reflection on their learning and work experiences (together with peers and teachers and trainers), students gradually develop an autonomous work attitude and vocational habitus. Therefore students have to be stimulated to explicate their learning and work experiences systematically (Raizen, 1994). Learning activities like integrating, generalizing and articulating are expressions of reflective learning.

The PE-course that scored highest on this characteristic (PE2) did indeed ask students to explicate their experiences. During the project work teachers systematically raised the issue of students’ attitude to work and their way of cooperating with other students. Most courses, however, had a relatively low score for this feature. We could quite often observe that reflective learning is at odds with students’ working method, which focused strongly on solutions and left no time for thinking. The students seemed to have little need to think about their way of working and when they had to work together were inclined to allocate tasks as quickly as possible and to get on by themselves. The following remark could have been made by most of the students in our study. “You work together in small groups, but most of the time you are not dependent on the work of the others. Most things you can do on your own. We do help each other and sometimes we give feedback on the work of others. But we don’t all sit together talking about each other’s work or method of working”[SWR4stud1,01-02, p. 2]. Even in the PE-course with the highest score (PE2), peer coaching scarcely occurred, although it was intended to.

Integrating, generalizing and articulating could be observed during detailed, planned discussions between teacher and students in the classroom during lessons that were more subject-oriented. Such teaching and learning activities were part of all the courses and the quality of the discussions depended on the teaching competence of the individual teacher.

4.6. Adaptive instruction and modelling

Teachers ideally support students when the contents of the course present problems in the acquisition of knowledge and understanding. They also act as role models with regard to the acquisition of vocational competence. In this respect teachers are adaptive: their role decreases as the learning materials become increasingly self-directed and/or self-regulated and students’ knowledge improves (Collins et al., 1989). Important teaching activities to stimulate understanding include contextualization, generalization, integration and modelling (with respect to either practical or cognitive skills).

Many students find vocational theory and the accompanying mathematics and physics particularly difficult to grasp in the opinion of many teachers, especially subject teachers. “Strong support is necessary for mastering vocational theory, maths and physics,” one of the AE-teachers stated. “The textbooks assume too much prior knowledge. Students really need to have insight, also when they’re doing practical work. They’re not going to be mechanics, they are going to supervise them. That isn’t going to work if they don’t stand out” [AE4obst1,12-01, p. 5].

Students very much appreciate teachers who are good at the aforementioned teaching activities that stimulate understanding, especially when they manage to bring together the prior

knowledge of students and the theory in the textbooks (e.g., by working with examples and concrete materials). We were able to observe some good examples. More frequently, however, we saw teachers merely superficially discussing assignments afterwards and restricting themselves to summing up the contents of the next chapter.

Students naturally differ in the extent to which they need support. This requires flexible methods of instruction and support which are not easy to realize when there are large numbers of students to teach. Students often had the opportunity to receive additional tuition after school, sometimes digital and other self-instructive material was available and teachers were present in the study hall to offer extra support if necessary.

4.7. Coaching

Ideally, teachers critically guide students in explorative, reflective and cooperative learning. Students are not left to their own devices as the teacher is available to help them stay on the right track and reflect with them on their results and learning processes. Coaching is not the antithesis of adaptive instruction and modelling (the previous characteristic) but an additional teaching method (Collins et al., 1989).

As is clear in our discussion on reflection, we did not observe coaching frequently. Even staff teaching the SWR-course that had a high score for authenticity (SWR4) did not seem very strong in coaching. The teaching philosophy in this case seemed to be to give students real assignments to work on and the responsibility to plan and organise their way of working themselves, then the rest follows as a matter of course. From the observations, however, it appeared this was not the case (at least for assignments that had to be done at school). Instead of starting to work actively, students continued asking for the attention of the teacher. When the observer asked the students why they still had so many questions, given that they stated earlier that everything is in the books, they said: "You want to know, actually, whether you are on the right track or not. Even when you are doing alright you want to have feedback, it's more motivating, everyone likes a compliment now and then, don't they? We are having enough trouble with self-discipline"[SWR4stud2,02-02, p. 3]. We also noted students' criticism about the absence of proper teaching skills in the PE-course (PE2) with an emphasis on self-responsibility and explorative learning.

4.8. Supporting self-regulation skills

One type of coaching we studied more closely was supporting self-regulation skills in which teachers help students to develop and maintain self-discipline and motivation. A necessary aspect of this might be external regulation and drilling on a temporary basis but this must be seen in the perspective of transfer of regulation to the students themselves. Ideally, teachers gradually withdraw their support without neglecting their supervisory tasks (Collins et al., 1989).

One of the SWR-courses (SWR5) demonstrated good practice with self-reliance and self-responsibility as systematic focal points of the programme. During group assignments, for example, students themselves rang peers to find out why they were absent. Although many things were considered to be the students' own responsibility (including homework and arranging additional support from teachers whenever necessary), teaching staff did carefully monitor whether progress was being made and things were working out well. At the beginning of the course teachers maintained firm control, offering a lot of support, with the explicit aim of students developing more self-support. As the course progressed teachers gradually relaxed this control. Several other

courses, however, in particular those on AE, were tightly regulated externally and included a lot of drilling with no gradual transfer of regulation to the students themselves.

Many teachers seemed to have trouble in maintaining a proper balance between guidance and letting students find their own way. Students scarcely made any complaints about more directive teaching behaviour but they did make critical remarks about teachers' 'laissez faire' approach. "You have to do so much all by yourself. They say, 'This is the learning material, sort it out for yourself'. Some students don't like that. I don't care. It's also quite fun to be thrown in at the deep end, it isn't as if you can't figure things out for yourself. Last year many students dropped out of school because they couldn't handle it. We started the course with twenty-eight students and now there are only ten of us"[AE3stud2,02-02, p. 3].

Student characteristics play an important role in supporting self-regulation skills. The student population of one of the SWR-courses (SWR2) was quite heterogeneous with respect to former education. Students with a more practical background in vocational education thought making your own plan of action was a 'difficult way of thinking'. Students who had done general secondary education were much better at this. These students needed less 'hints and structure' from the teacher to prepare for a test properly.

4.9. Instrumental testing of partial knowledge, insight and skills

Ideally, vocational education requires assessment that focuses on competencies (see the next characteristic in 4.10). However, knowledge and skills also need to be assessed in terms of separate components (Baartman, Bastiaens, Kirschner, & Van der Vleuten, 2007). For educational practice these different ways and types of testing and assessment are inevitable. At the time of the study national examinations for senior secondary vocational education did not exist in the Netherlands. However, a national body and the national Education Inspectorate controlled the quality of examinations. Half of the tasks, tests and assignments that made up the examination programme had to meet specific quality standards that were set by certified examination institutions. The latter developed branch-specific tests for vocational theory based on these standards. To ensure that examinations met these quality standards, many schools bought these tests from the certified centres and incorporated them into their examination programme. Schools can functionalize these tests by providing feedback to the students and identifying the consequences for the content and organization of the educational programme. Such moments are valuable for students as they provide an impression of their knowledge and skills, an awareness of their growing competence and an aid to making further choices.

Teaching staff of a few of the courses succeeded in using the national tests for feedback to the students on their progress or to make adjustments to the programme. Feedback was more common when using self-developed tests and assessments, although the most frequent complaint by students was the lack of feedback, even in the case of practical assignments. "You hand in your assignment and you get a mark for it. There is little discussion afterwards. If you don't agree with your mark then you take it up with your teacher. You ask, for instance, why you've got a low mark for your drawing because you think it could have been marked higher. Then the teachers just say, 'Can't you see for yourself?'" [SWR4stud2,02-02, p. 2]. Students find tests and marks important for maintaining motivation. They like to see a clear relation between their efforts and their reward in terms of marks.

In preparing students for tests, teachers explicitly pointed out topics ("Pay attention, this is going to come up in your next test!"). In some courses tests were explicitly used as a strategy to make students work regularly and systematically for the whole semester,

by dividing the semester into short periods that concluded with a test. Although this seemed to work well as an external stimulus, it is not what we meant by functionalizing tests for students and identifying consequences for curricula and teaching methods.

4.10. Assessment of competencies

Ideally, in vocational education the quality of performance in authentic situations is assessed. This may be done in the context of evaluation of project work, simulated practical assignments or work placements (Baartman et al., 2007).

Most courses that had relatively high scores for authenticity had high scores for the assessment of competencies too. One of the more traditional AE-courses (AE3) scored relatively highly on this characteristic because the development of professional attitudes was central to the programme, not only in the curricula and teaching methods but also quite explicitly in the assessment methods. Other more traditional courses only focused on professional attitudes when students were in danger of dropping out, or learning or behaviour problems occurred. Even then it was not always clear whether the professional attitude or the learning attitude was the issue.

One of the PE-courses that had a high score for nearly all the characteristics (PE2) used a range of assessment methods, including assessment of competencies. The project work in the course was assessed for performance in competencies such as cooperation. Students also had to do a final presentation for a panel, including representatives from industry.

5. Conclusions and discussion

Curricula have various manifestations (Entwistle, 1991; Goodlad, 1979; Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). There are major differences between the intended curriculum at management level, the curriculum embodied in teaching materials, the curriculum created in the classroom and the curriculum as experienced by students. This was evident in the present study in which we portrayed the intentions and practice of 11 vocational courses, by means of various instruments and including managers, teachers and students. All the courses were intended to present the students with vocational education in a powerful learning environment. However, these intentions were not always recognizable in practice or experienced by the students. In this final section we discuss our findings from various perspectives with a view to understanding the dilemmas and practical tensions that arise when implementing powerful learning environments.

5.1. Dilemmas and practical tensions that arise

At the start of our research we classified five courses as relatively powerful. This classification was based on the self-assessment of the course coordinators. However, when we examined the courses more thoroughly, the model could not be convincingly recognized in practice. The scores for the ten characteristics are all around 2 (less than the neutral value). None of the courses in the study is a positive outlier. Crucial innovative aspects of the model were hardly put into practice. In particular *reflection* of students on their results and learning strategies was missing, as was critical *coaching* as part of teachers' guidance. Many courses only paid lip service to *authenticity*. It was limited and more or less only occurred because of the teacher's hobby or interest. Teachers and students explain the weak development of these aspects by referring to students' characteristics and the straitjacket of the national examination framework for vocational theory.

Few courses combined authentic and self-directed learning, a combination we consider an attractive format for vocational education. In the interviews students stated that they did not yet feel capable of regulating and being responsible for their own learning. Their teachers agreed. Many teachers seek safety in traditional knowledge tests to stimulate students to undertake frequent, systematic and concentrated efforts to learn. They do not dare to rely on other ways of assessment. Here we see a clear inconsistency between ideal and practice.

Some teachers were more or less convinced that all students in the first years of the course were not able to plan their activities themselves. Other teachers modified this general picture. They mentioned the influence of students' previous education and the differentiation between male and female. Self-regulation is, in particular, assumed to be difficult for 'weak learners'. It is questionable, however, whether students' characteristics are the reason for the less developed teaching methods with respect to *supporting self-regulation* and *coaching*.

Authentic learning seems to be unintentionally accompanied by 'laissez faire'. Teaching staff are not sufficiently equipped to offer students the support they need in this respect. They have students who learn best by doing; other students first try to understand and gain insight, or want to know something about the procedures involved before applying their knowledge in practice or working on an authentic assignment. For teachers this is a real dilemma. As far as *authenticity* is concerned, the motivational stimulus of the *model of powerful learning environments* that is assumed in conceptual terms has not been proven in this research.

Reflective learning is important for adequate self-regulated learning and high-quality performance. The 11 courses hardly showed any goal-oriented and effective reflection. We assume that *reflection* has not yet taken shape, neither conceptually nor in terms of concrete teaching and learning processes. Reflective learning is rather focused on personal well-being in the courses, with evaluation questions like: "Are you satisfied with what you have done and your efforts to accomplish this?" Reflection seldom addresses the development of students' vocational identity, the growth of understanding, personal knowledge and beliefs, and the development of professional attitudes and behaviour.

In the traditional model of vocational education students were taught vocational theory, were trained in practical skills and had one or two work placements for a period of six months or a year. They tried to apply theory during their work placements and complained about the inadequate relationship between what they learned at school and what they had to do in practice. Explorative learning was minimal and developing and discussing one's own way of working and problem solving were not issues. The problem of implementing the *model of powerful learning environments* is that posing questions about underlying knowledge and understanding is not something that happens automatically when working on authentic tasks. It too easily remains superficial. Comments by a substantial number of teachers and students show a longing for the basis provided by the theoretical school subjects in the old model. Yet at the same time they see the disadvantages of the old model. During the interviews it was evident that they often wondered what would be the best approach to deal with this dilemma.

On the basis of this study and other studies on new teaching and learning processes in vocational education (De Bruijn, 2004; Biemans et al., 2009; Billett, 2001a; Brockmann et al., 2008; Clarke & Winch, 2007; Weigel et al., 2007) we might conclude that a choice between old and new ways of teaching is not the issue. The issue is how to stimulate the acquisition and use of a way of knowing and thinking that is based on vocational theory and its underlying theoretical disciplines. For the performance of

challenging tasks, basic knowledge and understanding of the theoretical key-concepts and the specific ways of thinking in the vocation concerned are needed. How best to acquire these is not yet clear from empirical research. Teachers in this study, who succeeded in motivating students to learn this kind of vocational theory, did so because of their own professional drive to acquire a theoretical understanding of their vocation. In their capacity as practical trainers they acted as mediators.

This study indicates that an effective approach will differ according to the cultural and structural characteristics of the vocation involved. These characteristics are reflected in those of the teachers and trainers and in those of the participating students which results in unique relations between learning and vocational identity formation (cf., Colley, James, Tedder, & Diment, 2003; Hodkinson, Biesta, & James, 2008).

5.2. Understanding dilemmas and practical tensions

Whereas the self-report of the course coordinators shows a strong desire for more powerful vocational education, the conclusion of the study is that such powerful vocational education is not yet part of the studied courses. However, implementation of new teaching methods is generally an issue of concern, partly due to impatience. The process of changing ways of teaching needs time. Furthermore, it is well known that new theoretical concepts are very difficult to translate into daily practice. Windschitl (2002) distinguishes between conceptual, pedagogical, cultural and political factors that might frustrate the implementation of new ways of teaching. New conceptual ideas are insufficiently worked out and tailored to the practice of teachers.

We know from research (Fullan, 1982; Seezink, Poell, & Kirschner, 2009; Van den Berg, Vandenberghe, & Slegers, 1999) that teachers tend to interpret and use innovations from their own perspective. They notice and include aspects that they find attractive in their own teaching practice. It is not because they are unwilling. The practical knowledge of teachers (Verloop, van Driel, & Meijer, 2001), features of the context of teaching and pedagogical factors play an important role. Teachers could also disagree with the concept or maybe they just cannot imagine how 'other' curricula and ways of teaching would be. Then there are cultural differences. In the course of our research project we noticed such conceptual confusion and cultural differences relating to the studied characteristics of powerful learning environment. Sometimes cultural differences corresponded with the distinction between those who taught practical lessons and those who taught general subjects. The teachers of practical lessons then designed a particular format for authentic learning with little room for self-directed learning. Teachers of general subjects, however, had little notion of what authentic learning could be. Most striking was the overall absence of useful pedagogical translations of conceptual ideas.

On the basis of empirical research Windschitl (2002) gives examples of the limited usefulness of conceptual ideas from constructivism for teaching practice. These ideas still need to be translated into practice and they offer teachers hardly any possibilities for changing their teaching practice. Furthermore, teachers are often not competent enough to apply new ways of teaching. They have difficulties with organising individual guidance and monitoring cooperative learning in the context of teaching large heterogeneous groups. Testing and assessing the knowledge and progress of students are also problematic. If students are responsible for their own learning but still developing, what falls within the range of right and wrong and how do you define good development? A new demand on teachers is to have an understanding of a broad knowledge domain. This might be problematic

with authentic learning and integration of subjects. Knowledge construction by students in such contexts demands of teachers a ready knowledge, an understanding of professional expertise in the vocation in question and the ability to improvise. From our study we might conclude in this respect that the *model of powerful learning environments* implicates that teachers should have a detailed knowledge of vocational practice and also expert knowledge of vocational theory to support the learning processes of students adequately. Different relations with vocational practice are necessary and close cooperation between practical trainers, teachers of general subjects and vocational-theory teachers are necessary to design powerful learning environments in vocational education. There was little evidence of this embedding in organisational terms in the schools we studied. Teachers need such organisational conditions and facilitation to be able to deal with innovating teaching practice as these are crucial conditions for innovation (Nijhof, Heikkinen, & Nieuwenhuis, 2002).

To conclude we refer to the political context, which for vocational education is rather paradoxical. On the one hand there are few supporting factors to educate the new, flexible and broad professionals. A culture of accountability prevails, in which the number of diplomas, percentages of throughput and an instrumental concept of the social benefits of vocational education are the main issues. On the other hand there are facilitating factors such as the need expressed by various parties for vocational expertise that is critical, assertive and reflective. Instrumental skill and communicative competence, self-responsibility and creativity are all components of current requirements for those at the start of their working lives.

A very relevant question today is which characteristics vocational courses should have in order to educate qualified and self-confident middle management. Attractive theoretical concepts are available but their representations and implications in practice have scarcely been studied. This research resulted in a description of dilemmas and practical tensions for courses qualifying for middle-management professions in the technical domain and an understanding of why implementation of an attractive concept to educate these professionals, hampers. We need other research, like design-based research, to support teachers to make the concept work in everyday practice.

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