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Interactions in vocational education: negotiation of meaning of students and teaching strategies

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ABSTRACT

This study aimed to describe verbal student–teacher interactions in vocational education from a socio-cultural perspective on negotiation of meaning. Teaching as part of these interactions is addressed by a combination of diagnosing, checking and intervening strategies. A study was conducted in which students (*n* students = 20) and teacher (*n* teachers = 5) from Social Work (SW) and Information and Communication Technology (ICT) worked together in small groups (*n* groups = 5) discussing vocational core problems. Each group held five discussions (*n* discussions = 25). All discussions were audio recorded and transcribed before they were analysed for negotiation of meaning including teaching strategies. The results showed that 5–8% of the interactions include negotiation of meaning. Interactions in SW groups revealed more negotiation of meaning than in interactions in ICT groups. Teaching strategies mainly included checking and intervening activities in favour of diagnosing activities. Furthermore, teachers used meta-cognitive and conceptual interventions most frequently. The implications of these results are discussed by reflecting on occupational differences and on how negotiation of meaning including teaching strategies can be enhanced.

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1. Introduction

During vocational education, students need to understand and to engage in collective professional knowledge, cultural needs and social practices of a vocational community to become a full-fledged professional (Argyris and Schön 1978; Illeris 2004; Schön 1983; Sfard 1998). Students in vocational education grow into a profession by participating in cultural activities in which interactions with, for example, teachers, workplace supervisors, professionals or peers offer them a variety of sources to learn from (Schaap, Baartman, and De Bruijn 2012). It is generally assumed that teachers need to align their teaching strategies to guide students adequately during internalization and socialization processes (De Bruijn 2012). This article reports a study on verbal student–teacher interactions in vocational education, by exploring how negotiation of meaning occurs and which teaching

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strategies are present. Verbal student–teacher interactions are studied in senior secondary education in the Netherlands, in two different occupational domains, during small group discussions about vocational core problems.

1.1. Negotiation of meaning of students in vocational education

Negotiation of meaning of students is generally conceived as an interactive and continuous intra- and interpersonal learning process in which professional knowledge, cultural needs and social practices can become personalized by giving meaning to new experiences and insights (Aarkrog 2005; Colley et al. 2003; Rogoff 1990). Originally, negotiation of meaning is a philosophical concept, since Bruner (1996) argues that a human mind is formed by narratives for growing into existing cultures around us. Bruner postulates that our meaning is shaped by culture and that culture affects our way of thinking and learning. In addition, meaning is collective, public and communal. Following Bruner, negotiation of meaning involves both personal and collective acts of making meaning. Brown, Collins, and Duguid (1989) postulate that meaning is always under construction in a community. They add: 'The activities of a domain are framed by its culture. Their meaning and purpose are socially constructed through negotiations among present and past members' (34). Negotiation of meaning is studied in different domains and contexts, such as a computer-supported collaborative learning environments (e.g. Hull and Saxon 2009), language teaching and proficiency (e.g. Samani et al. 2015; Van den Branden 2000), assessment of student learning (e.g. Verberg, Tigelaar, and Verloop 2012) and professional learning (e.g. Beers et al. 2006) and communities of practice (e.g. Wenger 1998).

Consequently, different concepts and definitions are used with common elements but also with some different accents. For example, Gunawerdena, Lowe, and Anderson (1997) state that negotiation of meaning 'actually required participants to adjust their ways of thinking to accommodate new concepts or beliefs inconsistent with their pre-existing cognitive schemas' (413). Van den Branden (2000), along with Pica (1994), defines negotiation of meaning as 'the joint efforts that interlocutors make in oral and written interaction to deal with problems or message comprehensibility' (429). In their work on learning in multidisciplinary teams, Kirschner et al. (2008) postulate that negotiation of meaning is a crucial step in reaching common ground and knowledge construction. They define negotiation of meaning as: 'Negotiation of meaning concerns making a private understanding of a contribution public, verifying whether and to what extent one's own understanding differs from what others intend, receiving feedback on this, re-verifying, etcetera' (407). Wenger (1998) distinguishes two interrelated processes of negotiation of meaning, namely reification (e.g. subscribing physical meaning to something abstract) and participation (e.g. participating in social activities including constraints and tensions that need inquiry). Such studies emphasize the importance of negotiation of meaning for students learning, while the different definitions show some similarities. For example, negotiation of meaning is social and collective. It is a higher-order learning process. And it is about subscribing personal meaning to something new.

In this study, negotiation of meaning in vocational education is generally referred to a collective process in which students personally subscribe meaning constructed or reconstructed knowledge in interactions with others, like peers, teachers and practitioners (Billett 2001a). Students need to negotiate meaning, by internalizing different types of

knowledge such as work process knowledge (Boreham 2004) and practical knowledge (Rauner 2007) into a personal professional theory (Schaap et al. 2009). Smith (2012) postulates that students as workers 'negotiate their participation in the cultural practices that constitute their work and learning' (162).

1.2. Teaching strategies in relation to negotiation of meaning

For negotiation of meaning to occur, it is important for teachers to align their teaching strategies to actual students' knowledge level (Sherin, Reiser, and Edelson 2004), since they possess more vocational expertise than their students (Billett 2001a; Bruner 1996; Lave and Wenger 1991). For example, monitoring students' personal knowledge allows teachers to align shared knowledge and common norms and values of a particular vocational community to students' personal knowledge (Biggs 1999; Colley et al. 2003; Collins, Brown, and Newman 1989). Teachers often use questioning (i.e. posing informative or explorative questions) and prompting (i.e. explicating critical or controversial positions) to reveal students' personal knowledge addressing a specific subject (Van de Pol, Volman, and Beishuizen 2010, 2011; Wittwer and Renkl 2008). Students respond and show a degree of understanding, giving the teacher indications about what students know and think (Lin et al. 2012; Ruiz-Primo and Furtak 2007). Aarkrog (2005) shows that it is difficult for students to learn from the expertise of their teachers since they have to personalize it. She therefore recommends that teachers are explicitly focussed on enhancing students' negotiation of meaning.

Teachers can use different strategies during negotiation of meaning, for example, modelling or demonstrating the thinking and acting of an expert practitioner, give feedback on students' behaviour and thinking as a (prospective) practitioners and monitor, guide and coach students' personal vocational knowledge development (Billett, Sweet, and Glover 2013; Khaled et al. 2015). From in-depth studies toward teachers in vocational education, De Bruijn (2012) and De Bruijn and Leeman (2011) demonstrate teaching strategies like scaffolding (i.e. gradually fading support while students responsibility increases), coaching (i.e. supporting explorative and cooperative learning as well as giving feedback), guiding (i.e. structuring possible learning activities and pathways by offering a transparent set of alternatives), modelling (i.e. demonstrating how to do something and how to think as well as articulating and discussing problem-solving strategies and ways of thinking) and monitoring (i.e. teachers monitoring students' progress and development). They conclude that teachers can use 'the vocation as a framework for synthesizing underlying theory, skills, habits and attitudes. They focused on the formation of their students" vocational identity and often served as a role model themselves' (650). Students then get confronted with or access to explicated vocational expertise of teachers who might also have experience in the particular vocation.

This article addresses three teaching strategies in relation to negotiation of meaning, namely: diagnosing (i.e. determining actual personal knowledge levels), checking (i.e. verifying whether teachers understood students correctly or not, for instance by means of questioning, paraphrasing and summarizing (Ruiz-Primo and Furtak 2006) and intervening (i.e. actual support of teachers containing different interventions) (Wittwer and Renkl 2008). For teacher interventions, we used the framework of Hill and Hannafin (2001), who distinguished conceptual, meta-cognitive, procedural and strategic interventions.

According to Hill and Hannafin, those four scaffolds are of vital importance to assist learners with complex tasks and to exploit the potential of different resources in the learning environment (e.g. theoretical frameworks in books or the expertise of supervisors in the workplace). Conceptual interventions can be used by teachers to deepen and intensify professional problems by introducing new concepts, perspectives or own experiences in a way they represent the vocational community or specific workplace (Billett 2000; 2001b). Using meta-cognitive interventions, teachers may stimulate students to reflect on what they already know and to integrate and reconsider (Baartman and De Bruijn 2011). Procedural interventions can be used by teachers to increase awareness of for instance a solution phase or an evaluation phase. Teachers could use strategic interventions to enhance students to look critically on the consequences of solutions or strategies (Entwistle 2000).

As we consider negotiation of meaning as a collective process in which students personally subscribe meaning constructed or reconstructed knowledge in interaction with teachers, it is important to show how negotiation of meaning of students occurs and how teaching strategies are helpful as part of this process. This article uses therefore three teaching strategies (i.e. diagnosing, checking and intervening, of which the latter includes four interventions).

1.3. Differences between occupations

Acknowledging the vocation-specificity of learning of students in vocational education, one can expect differences between negotiation of meaning of students in occupations (Schaap, Baartman, and De Bruijn 2012). Differences between occupations are partly related to the nature of professional cultures and the way such cultural differences are represented in the knowledge base of professions, vocational curricula and vocational educators in the particular domain (De Bruijn 2004). Consequently this may cause differences in students' learning outcomes (Colley et al. 2003), but also in the adequate use of teaching strategies (De Bruijn 2012). Poortman (2007) showed differences between students' learning paths between the domains of Retail and Care. She showed, for example, that students in the domain of Retail had more difficulties in integrating different types of knowledge.

2. Research questions and aim

The two main research questions are (1) 'How does negotiation of meaning occurs during verbal interactions in vocational education and which teaching strategies can be distinguished?' and (2) 'How do negotiation of meaning and teaching strategies differ between occupations?' For addressing differences between occupations, Social Work (SW) and Information and Communication Technologies (ICT) are included (see Section 3.1). This study aims to systematically explore authentic practices in vocational education to gain insight into how negotiation of meaning occurs in verbal student–teacher interactions and which teaching strategies can be distinguished. Schaap, Baartman, and De Bruijn (2012) showed in their review that becoming a professional is often overwhelming for students, due to for example a large variety of different types of knowledge (e.g. formal knowledge, work process knowledge, norms and values), coming from different contexts (e.g. vocational institutions, workplaces), which they have to internalize (Eraut 2004; Smith 2012).

3. Methods

3.1. Design and context

Small groups of students were organized who discussed five vocational core problems in five different small group discussions (*n* small groups = 5). Five discussions (within a time span of five weeks) per small group were expected to gain sufficient insight into teaching strategies and negotiation of meaning (*n* discussions = 25). The 25 discussions of five small groups including student–teacher interactions concerning five different vocational core problems were considered as a sound base for our descriptive research purpose.

The present study included interactions in two occupations, namely ICT and SW. ICT was selected because it is a relatively new and innovative vocation with an instrumental and technical nature. SW was selected because it has a relatively long history as well as a socially oriented character. Both vocations were qualified at the highest level of senior secondary vocational education in the Netherlands for students who have completed full time compulsory education (i.e. levels 4 and 5 of the European Qualification Framework, European Commission 2008).

3.2. Participants

Two vocational programmes (i.e. SW and ICT) in two different vocational schools that were familiar with group wise discussions about vocational core problems participated. Our aim was to connect with existing educational practices as optimal as possible, referring to ecological validity. Within each programme, teachers and students were selected. In total, 20 students (12 ICT students and 8 SW students) and 5 teachers (3 male ICT teachers and 2 female SW teachers) participated in the study. The teachers were selected because (1) they possessed extensive and actual experience, both as professional in the vocational field and as teacher within the occupations ICT or SW (i.e. >10 years of recent experience both as teacher and as practitioner) and (2) they had relevant experience in vocational practices (i.e. guiding internships or collaboration on improvement of curricula). The teachers were on average 57.2 years old, ranging from 53 to 64 old. The students averaged 17.9 years of age, ranging from 16 to 22. The ICT students were all male while all but one the SW-students were female. The students were at the end of the second year in which they had already learned the basic knowledge, skills and habits of the particular vocation. They all had completed a half-year internship in the workplace.

3.3. Instrumentation

Vocational core problems for both ICT and SW were defined and used as input for the small group discussions. Such vocational core problems are authentic since they represent the core of occupational practices (Onstenk and Moerkamp 1999). Vocational core problems are complex because no quick fix and direct solutions are available and since they represent the complexity of real-life professional practices (Griffiths and Guile 2003) and the actual culture in specific occupations like ICT and SW, regions (e.g. different local policies city or village) and organizations (e.g. large or small organization, different types of leadership) (De Bruijn 2004). To deal with these core problems and to develop professional behaviour, students should negotiate meaning to process subject matter

critically, to draw their own conclusions and to form personal judgements (Lonka and Ahola 1995; Sweller 1989). This is precisely where for instance Bruner (1996) and Brown, Collins, and Duguid (1989) referred to: meaning is collectively shaped by actual (professional) cultures, but how to act in specific practices is both a personal and collective act of making meaning. Such vocational core problems can induce a state of doubt (King and Kitchener 2004), also known as a constructive friction (Vermunt and Verloop 1999) or cognitive conflicts (Piaget 1950), since solutions are not straightforward and several solutions could be adequate (Chi, Glaser, and Rees 1982; Ge and Land 2004).

Vocational core problems were developed and validated for both ICT and SW in two successive expert sessions. This procedure was identical for both vocations. During the expert sessions, three experienced professionals and one educational researcher (i.e. the first author) collaboratively constructed five vocational core problems per vocation. The professionals were primarily included to bring in the actual content of the vocational problems. The educational scientist was primarily included for increasing the educational quality of the vocational core problems (i.e. authenticity, relevance and complexity). The first session was preceded by an assignment in which both professionals and educational scientist were asked to formulate their personal vocational core problems. Subsequently, the first session was primarily used for sharing and brainstorming. In-between both sessions, the educational scientist summarized and structured the input of the first session. During the second session, these summarized and structured vocational core problems were further developed or confirmed for their relevance by the same professionals and educational scientist. The duration of each session was approximately two hours. Two identified vocational core problems and examples of developed and used illustrations are included in Appendix. The vocational core problems included dilemmas which directly or indirectly can affect professional performance. For instance, dilemmas between short-term and long-term solutions or between personal, organizational and costumer needs are frequently experienced by SW and ICT professionals.

Four transcribed discussions were randomly selected to obtain agreement among two assessors regarding negotiation of meaning and teaching strategies. This selection included four discussions that lasted 99.87 minutes (i.e. at average 24.97 minutes per discussion), in which vocational educators as well as students generated 922 utterances (i.e. approximately 231 utterances on average per discussion). The four transcripts were coded by two assessors independently (i.e. the first and second author of this article).

3.4. Procedure

In total, five teachers and 20 students were randomly assigned to 5 small groups participated (i.e. 3 in the ICT domain and 2 in the SW domain). Thus, in each small group, one teacher and four students participated. Each teacher participated in one small group during five discussions concerning five different vocational core problems, aiming to increase the possibility to observe how teachers and student meaningfully interact with each other.

In an instructional meeting, the vocational core problems were plenary explained by one researcher (i.e. the first author, Harmen Schaap) to the teachers and students. Vocational core problems were presented to teachers and students as hypothetical situations in which they were challenged to imagine the situation and context in which the problem

occurred. The teachers and students also received instructions in a procedural manual including how to prepare discussions, how to discuss vocational core problems and how to reflect on their own role during discussions. This procedure was identical for both vocations.

During five weeks, each small group discussed one vocational core problem in one session per week. Each discussion followed a pre-structured procedure (see Table 1 for general information regarding the discussions).

3.5. Analysis

Single utterances in student–teacher discussions were distinguished by turn taking (i.e. when another person begins to speak). Based on the work of Van de Pol, Volman, and Beishuizen (2011, 2012), teaching strategies are analysed on utterance level by looking for utterances indicating diagnoses (e.g. 'What do you know of … ?'), checks (e.g. 'If I understand you correctly, you mean that … ?') and interventions (e.g. 'I think it is more adequate to include that perspective into the discussion'). Four specific interventions were used to deepen the insight into teacher interventions during the discussions with students, namely conceptual (e.g. 'Let's assume that the customer gets angry, what would you do?'), strategic (e.g. 'What do you think that are the consequences of your solution, both in a short-term and a long-term perspective?'), meta-cognitive (e.g. 'Can you explain your thoughts about … ' or 'What is your view on … ?') and procedural interventions (e.g. 'You are now already in the solution phase, but do you even have a common sense of the problem').

For revealing negotiation of meaning, we based our approach on Gunawerdena, Lowe, and Anderson (1997), who used single utterances of students as main objects for segmentation. Single utterances are natural units for analysing verbal interactions (Miles and Huberman 1994). Therefore, negotiation of meaning could be indicated by a singular and literal confirmation of something learned ('Yes, I understand!') or something perceived as valuable ('I can use that in my practice in the workplace'), as well as by reflections, summaries or paraphrases of currently developed insights that are meaningful for a student. Interrater reliabilities were adequate as indicated by relatively high Cohen's Kappa's for negotiation of meaning (i.e. 75), teaching strategies (i.e. .85) including types of interventions (i.e. .76), which were considered as good (Cicchetti et al. 1978).

First, descriptive statistics were presented for negotiation of meaning and teaching strategies. Second, one-way Multivariate Analysis of Variance (MANOVAs) were administered to

Table 1. General flowchart of a small group discussion.

Step	Description
1. Before a discussion	Students had to read the vocational core problem first. Then they had to fulfil a paper and pencil assignment, in which they had to answer two questions: (1) 'What is for you the core of the problem?' and (2) 'Which solutions are relevant for you?' This assignment aimed to stimulate students' critical thinking.
2. During a discussion	The students discussed how they would perform in a particular situation, what they would do to solve the problem, why they would choose for certain solutions and what the possible consequences might be of their intended solutions. Each student was supposed to fulfil the role of chair once, aiming to regulate, structure and facilitate the discussion. Before each discussion, students received instructions on how to fulfil the role of chair.
3. After a discussion	After a discussion, the students made a short reflection assignment on what they learned and what that means for their practices.

determine whether negotiation of meaning and teaching strategies differ per vocation (i.e. SW and ICT). The numbers of utterances indicating negotiation of meaning and teaching strategies were considered as interval data, which allows us to use inferential statistics. Examples of student–teacher interactions were presented as means to illustrate meaningful interactions.

4. Results

The general features of the 25 discussions obtained (i.e. 15 ICT discussions and 10 SW discussions) are presented in Table 2.

The descriptions in Table 2 show that the average length of the student–teacher discussions was longer in the SW groups than in the ICT groups. Consequently, from an absolute perspective, more utterances were performed in the SW groups.

4.1. Negotiation of meaning

Descriptive statistics show that 6.1% (n utterances = 396) of the utterances indicate negotiation of meaning. More specifically, the results show that 5.2% (n utterances = 165) within ICT and 7.7% (n utterances = 257) within SW indicate negotiation of meaning. One-way MANOVA reveal significant differences between vocation concerning negotiation of meaning ($F(7, 161) = 11.26$, $p < .01$; Wilk's Lambda = .67; partial *eta* squared = .07). Bonferroni *post hoc* analyses showed that the SW groups score significantly higher on negotiation of meaning ($d = 5.59$; $p < .01$). Two examples of small group discussions both in the SW domain and ICT domain including utterances indicating negotiation of meaning are presented below.

> Example 1, SW. Student (S1): 'At the same time you all intend to look forward, to include an independent professional. But the question is what your plan of action is. Probably you need some permission from the parents involved, to involve other people in the situation'.
>
> S2: 'That's why I'm looking after, but I really don't know if I'm allowed as a leader of a playgroup; can I involve another professional without communicating it with the parents? There it stops for me, it feels like a boundary. That is why you need formal permission. It's very important that your communication is transparent with the parents so that they give permission. But it's difficult'.
>
> S1: 'It seems to me that you can discuss those kinds of things also with the direct manager involved. Probably he or she has a solution that solves the problem in this particular situation; maybe there is some expertise and experience in your organization of what's allowed and what isn't. After all you indeed intend to keep the relation with the parents

Table 2. General features of the discussions.

Features	ICT[a]	SW
Amount of discussions	15	10
Total length	366.15	275.03
Average length	24.41	27.51
Range in length	12.24–34.44	15.29–42.34
Total utterances	3176	3336
Average of utterances	212	334
Range of utterances	112–343	164–264

[a]Forty discussions in total. Percentages within the groups and number of utterances per level were presented.

good, like we said before. It's complex, because you don't want to push them, but at the same time you want to keep them involved and you want to be honest to them. However at the same time you constantly need to observe the child and the development of it. This is a dilemma, you want to go further but you have to be rational and realistic as well. That's sometimes confusing' [Negotiation of meaning].

S2: 'Yes, indeed. You need to keep in contact with the parents, who are initially responsible. On the other hand, these are parents with problems which directly affect the development of the particular child. So for me the conclusion that you can't constructively work with the parents is the critical argument to successively continue the current trajectory with the child' [Negotiation of meaning].

S3: 'Without informing the parents … ?'

S1: 'Yes, indeed. Imagine that it all went wrong with the child and the parents blame me that I refused to take my professional responsibility. In that case they would have a serious point in my opinion'.

This fragment showed that students interacted with each other in a meaningful way to explore their beliefs and collaboratively formulated a possible solution while exploring some pitfalls and consequences. Additionally, the students used their statements and information in formulating conclusions and solutions.

Example 2, SW. Student (S1): 'Yes, but isn't it relatively early? Can it be imitation behaviour? Maybe there is an older brother or sister involved. Then they could have such an age that they feel that everything is interesting for them'.

S2: 'Experimenting and trying new things'.

S3: 'Yes'.

S4: 'Yes, I indeed think that's the problem, though I don't know if it's just a matter of experimenting or that there is also the possibility for slight intentional behaviour and affections. One solution could be that you observe the girls more intensively and that you discuss the situation with the parents. Why is it a problem, is it a problem at all? So, more observations are needed. What's happening out there?' [Negotiation of meaning].

S1: 'Yes, it is a developmental stage of finding out how the world works'.

S2: 'Yes, precisely. So you have two different situations here, one referring to the child and one referring to the parents' [Negotiation of meaning].

The second fragment from the SW domain showed that relatively short utterances could also indicate negotiation of meaning, since the students formulated a common conclusion that there were two different dimensions in this particular situation. The question if there was indeed a problem was of crucial importance for adequate performance in this particular vocational core problem.

Example 3, ICT. S1: 'I think the doctor has a major problem. And the treatment needs to start immediately and the information of the particular patient isn't still available yet. But as ICT-helpdesk worker you cannot leave the helpdesk, it is formally not allowed but also our manager is against leaving the helpdesk unattended'.

S2: 'I think that the core of the problem is that if you really want to help the doctor you need to go beyond the formal procedures and appointments, even if they are recently confirmed'.

S3: 'OK, same thoughts here. The particular doctor has a major problem now and you can always talk with your manager later on. In other words, I know how to fix this problem, so I'm motivated to do that'.

S1: 'Actually, you need to make a choice between what is formally allowed and what is not allowed. You may not help him, but you can. You have the skills and you already know the problem. And when you follow the rules, you first need to fill in some paper work, for example. And only then you can possibly help the doctor. But I think that it is too late then' [Negotiation of meaning].

T: 'But guys, do you really think that this is the real problem? I don't think so!' [Strategic intervention].

S2: 'The problem is that the doctor has no access to crucial information of the patient'.

T: 'Yes, that is one problem. But I think that there is a second problem'.

S1: 'That you cannot help the doctor'.

S3: 'Yes. If you want to help the doctor adequately, you have to do things that are forbidden'.

T: 'Yes. That is exactly my point. There are two problems: one for the doctor, and one for you as helpdesk worker' [Conceptual intervention].

S1: 'Yes, indeed'.

S3: 'OK, if the doctor comes to me I would go to my manager and explain to him the problem: I know the problem and it takes a short amount of time to solve is. But it is urgent. May I help him? If not, then I would ask a substitute for me, for example a colleague from another department. The doctor needs to get assistance, in my opinion!' [Negotiation of meaning].

In this example, one student (i.e. S1) not only started the discussion, but after input from two other students, he summarized what is already discussed but makes the dilemma even more meaningful by explicating the constraints and consequences. After that, the teacher questioned the way the students addressed the problem so far by using a strategic and conceptual intervention. As a result, the students (e.g. S3) subscribed other or new meaning to the situation and the ways how it can be solved adequately. The professional culture is foremost discussed implicitly. For example, the culture in organizations could be different or more or less influential for ones practices (e.g. in this example: is it an academic or regional hospital?). The teacher distinguished two problems and which one is more dominant could be related to the actual norms, values and beliefs in the particular organization or even department. This could have impact on ones acting in specific situations: is one value prevalent on another, and is this always the case?

Example 4, ICT. T: 'What do we need to do to run the helpdesk more smoothly?' [Procedural intervention].

S1: 'What we already said before. We can install a coordinator, someone who oversees everything. But simultaneously, we can reorganize our workers by for example hardware and software, keeping our expertise into account. And maybe more workers, because this is a fundamental problem without adequate quick fixes. And finally, documentation of the reported problems of costumers needs to be better' [Negotiation of meaning].

S2: 'So when there is a new problem reported by one of our customers, you need to document this problem properly, because then we help each other in the process' [Negotiation of meaning].

T: 'Yes, but there is a cue. And in the cue a costumer with a relatively simple problem is first, instead of a costumer with a far more comprehensive problem' [conceptual intervention].

S1: 'Yes, but if you have different levels or foci of helpdesk workers you can solve that problem immediately'.

S2: 'So, if you have someone who has no sound experience on this topic, you can let him help the first costumer with the simple problem. And indeed, if you have someone with expertise on this area, you let him solve the more complex problem' [negotiation of meaning].

Here, the teacher used a more open procedural intervention, which allowed two students to paraphrase what they already discussed but also to give focus to their way of thinking by subscribing meaning to relevance of documentation. After a conceptual intervention, the second student negotiated meaning by elaborating their collectively formulated solution to the concrete situation. Interesting to notice here is that the solution elaborated here is implicitly related to the actual cultures in the ICT profession. Having different levels or foci of helpdesk workers looks like a structural solution but has also a strong cultural dimension. For example, one could ask: What is the importance of adequate documentation in relation to helping costumers adequately? What are the common values here and what is my personal position about it?

4.2. Teaching strategies in relation to negotiation of meaning

The scores of teaching strategies are presented in Table 3. It is shown that relatively few diagnoses are obtained by the teachers. Moreover, teacher's guiding is mostly preoccupied with checking and intervening strategies. This is more present in the ICT vocation, since teachers most of the times used conceptual interventions (e.g. to deepen and intensify the discussions), while in the SW vocation, interventions were mainly meta-cognitive in nature (e.g. to stimulate reflection on their actual personal knowledge).

One-way MANOVA on the total teachers' strategies (i.e. frequencies, controlled for the total amount of teachers' utterances) showed a significant main effect for vocation ($F(3, 165) = 5.99$, $p > .01$; Wilk's Lambda = .91; partial *eta* squared = .46). Bonferroni *post hoc*

Table 3. Teaching strategies.

	Occupation	
	ICT	SW
Teaching strategies		
Diagnosing	20.3 (138)	15.2 (120)
Checking	37.5 (255)	44.3 (350)*
Intervening	42.2 (287)	40.5 (320)
Total	100.0 (680)	100.0 (790)
Intervention		
Procedural	2.2 (15)	4.8 (37)*
Strategic	20.3 (137)	25.7 (200)*
Meta-cognitive	37,0 (250)	41.8 (325)*
Conceptual	40.5 (274)*	27.8 (216)
Total	100.0 (676)	100.0 (778)

*$p < .01$.

analysis showed that the groups in the SW vocation scored significantly higher on the strategy 'checking' ($d = 3.67$; $p < .01$). No significant differences were found between diagnosing and intervening.

Significant differences also occurred between the ICT/SW and teacher interventions ($F(4, 164) = 21.88$, $p < .01$; Wilk's Lambda = .65; partial *eta* squared = .27). The *post hoc* scores showed that the ICT groups only scored higher on the conceptual interventions ($d = 2.47$; $p < .01$). SW teachers used significantly more procedural ($d = 1.09$; $p < .01$), strategic ($d = 2.61$; $p < .01$) and meta-cognitive ($d = 3.02$; $p < .01$) interventions. Examples of two fragments including different teaching strategies are presented below. The first example comes from an ICT discussion (Appendix).

> Example 1, ICT. Teacher (T): 'You say that the "customer is always right", is that always your main principle?' [Checking strategy, meta-cognitive intervention].
>
> Student (S1): 'Yes, under normal circumstances indeed. When the customer still emphasized that he doesn't want to buy a new server, then you have to keep that in mind'.
>
> S2: 'Yes, but maybe that isn't the right solution. Is a customer able to determine whether a solution is adequate?'.
>
> S3: 'Anyway, at the end the customer always takes his or her own decisions!'.
>
> T: 'But now I'm a customer who doesn't want to spent too much money, something that concurs to your previously expressed ideas, but I indeed want to be the "customer that is always right"' [Strategic intervention].
>
> S2: 'Yes, but that doesn't fit together'.
>
> S1: 'No, a customer needs to show willingness to invest'.
>
> T: 'And how would you explain that?' [Checking strategy, conceptual intervention].
>
> S1: 'You need to make clear to the customer what the different considerations, choices and arguments are, in order to obtain a clear understanding. Only then you are able to explain your position'.

This fragment started with the teacher investigating the viewpoint of students of customers in general. The second utterance of the teacher includes an intervention strategy, by explicitly posing the actual dilemma (i.e. between high costs and an adequate solution). The student reacted quickly and quite to the point to that intervention, which stimulated the teacher to pose an additional question. This example is representative for the discussions between the teachers and students in our discussions, since students were mainly preoccupied with obtaining arguments and explicating short responsive answers. The second example is a fragment from a SW discussion (Appendix).

> Example 2, SW. Teacher (T): 'OK, I will summarize now what you are saying. It was obvious that you took the needs of the toddler and the group of children into account. However, the situation changes now, because the parents contacted your manager, in order to increase the importance of their request. Today, your manager kindly but strictly asks you to respond adequately to the request of the parents. What are you going to do?' [Conceptual intervention].
>
> S1: 'Yes, then you have to, but then you get an overtired child!'.
>
> S2: 'And then it will keep crying the whole day and it also will become more passive'.

S3: 'But if you are engaged, being good parents, then you as a parent should see by yourself that this is not effective for your child and that this solution does not work at all'.

S2: 'Parents cannot just say that their child, at that particular age, needs only a couple of hours sleep during the day, on definite moments. I expect that parents do know that'.

S3: 'Your manager is not supposed to say that. Since she certainly has some experience with leading a group of children of the same age she will never allow such a request'.

In the previous fragment, the teacher expanded the discussion with putting a new topic or dimension into it, namely that the parents have contacted the manager. The students reacted to this by stating their expectations of the parents. The fragment ended with a critical note to the situation. However, in both fragments, the teachers barely posed explicit diagnostic questions. As a possible consequence, the teachers seem to have little insight into students' personal knowledge about sleeping curves, needs of young children and roles during leading a group of children. The last example was representative for nearly all interactions. Teachers were foremost preoccupied with elaborating the discussion, without explicitly taking students' actual knowledge into account.

5. Conclusions and discussion

This study explored student–teacher interactions in ICT/SW discussions, focusing on negotiation of meaning of students and in that respect supportive teaching strategies. Negotiation of meaning is generally referred to a collective process in which students personally subscribe meaning constructed or reconstructed knowledge in interactions with others. The results showed that student–teacher interactions included 5–8% negotiation of meaning. One can ask whether this is a relatively low of high score. The interactions in our study showed that students and teachers actively exchange information, experiences and personal points of view, which can be seen as necessary activities to ultimately reach negotiation of meaning. In other words, not all interaction can include negotiation of meaning. More specifically, the results showed that negotiation of meaning occurred mostly when students explicitly processed what teachers and other students came up with (e.g. by actively summarizing or paraphrasing), when different viewpoints were combined, when solutions were connected with actual practices and when consequences of solutions were reflected upon. Our results showed that negotiation of meaning is not only a process of reaching agreement or of transferring knowledge from one context (e.g. school) to another (e.g. workplace). It is foremost about constructing and transforming (personal) knowledge (Smith 2012).

The results showed that more negotiation of meaning occurred in the occupational domain of SW compared to ICT. Underlying the differences between SW and ICT could be the different cultures between the two occupations, resulting in, for example, differences in the extent of 'fit' between vocational core problems, vocational curricula and teaching methods (Biggs 1999). Our results and examples showed that negotiation of meaning is a personal and collective act in which personal values, norms and beliefs are constantly related to more collective values, norms and beliefs (Bruner 1996). Differences and communalities between personal and collective values, norms and beliefs are sometimes explicitly but more often implicitly discussed (e.g. see Examples 3 and 4). Working with collaboratively discussing vocational core problems and reflecting on it

could be more aligned to SW students because they were more used and able to work on this particular assignment. De Bruijn (2004) showed that less reflection and collaborative learning tasks are incorporated in ICT curricula than in SW curricula. Billett (2001b) postulated that social interaction and collaboration are important aspects of social occupations like SW in favour of individually oriented assignments in technical occupations like ICT. It is possible that SW students already reflected more during their collaborative work on authentic tasks and during working on assignments for reflection and evaluations (Rozendaal, Minnaert, and Boekaerts 2003). This fit could have caused differences concerning negotiation of meaning between SW and ICT students. However, further research could investigate whether negotiation of meaning occurs differently in more technical-oriented occupations (e.g. ICT, carpenters or metal workers) and in more social-oriented occupations (e.g. nursing, educational assistants and health care). Van Schaik, van Oers, and Terwel (2011) for example showed that the design and impact of vocational tools differ between more technical-oriented and more social-oriented occupations. Likewise, Aarkrog (2005) and Colley et al. (2003) confirmed that dialogues and reflection assignments are more aligned in socially oriented occupations. It is interesting to make (professional) cultures, including personal and collective values, norms and beliefs, more explicit in the vocational core problems and subsequently in the discussions. In fact, the used vocational core problems could be more general in nature and could have neglected the situational dimension of negotiation of meaning.

Teachers used different interventions supporting negotiation of meaning. Meta-cognitive interventions in the SW domain and conceptual interventions in the ICT domain are preferred by teachers to enhance richness and intensification of the discussions as well as to enhance student reflections on what they already know and what they need to integrate or reconsider. Furthermore, the results showed that teachers in our study barely use diagnosing strategies but explicated their knowledge and deepened or intensified the interactions by explicating own experiences or just by complicating the discussion by bringing in a new perspective. Here, mainly conceptual interventions were used. Teachers from the two occupational domains differed in their teaching strategies. SW teachers showed more checking strategies than diagnosing and intervening strategies, whereas ICT teachers showed more intervening than checking and diagnosing in their interactions. More specifically, ICT teachers mainly used conceptual interventions, whereas SW teachers mainly used meta-cognitive, procedural and strategic interventions.

Our study showed that negotiation of meaning occurs mostly when students explicitly processed what teachers and other students come up with (e.g. combining different viewpoints, connecting solutions to actual practices and reflecting on consequences of solutions). It therefore showed that negotiation of meaning is a highly interactive process between students and teachers, in which both need to be active and reflective for constructing and transforming (personal) knowledge of students to happen. This means that teaching strategies in relation to negotiation of meaning are not implicit or unconscious, but intentionally and by preference explicit to students. Teachers may act intentionally by consciously transferring, for example, formal knowledge, experiences, values, norms and rules to students (De Bruijn 2012). They can open up, expand and confront students with other meanings (Hull and Saxon 2009). Furthermore, negotiation of meaning included different part processes, which can be considered as learning activities (Edwards 2005). Both insights are new and can contribute to the growing body of research

toward student–teacher interactions. However, still some conceptual questions remain unanswered. It is still unclear whether negotiation of meaning is an interpersonal, intrapersonal or both inter- and intrapersonal process. Or, is negotiation of meaning a means for high-level interactions or is it a high-level interaction by itself? And is negotiation of meaning specifically related to perceived inconsistencies, constrains or dilemmas are present in, for example, vocational core problems or can it also occurs when students have shared interests or concerns? Such future research could use longitudinal observations for exploring negotiation of meaning within larger amounts of student–teacher interactions. Mercer (2010) already postulated that conversations should be analysed longitudinally, within the same setting with the same participants. Future research can also include interventions in quasi-experimental designs to enhance negotiation of meaning, taking students' learning outcomes, such as vocational expertise (Billett 2001a), personal professional theories (Schaap et al. 2009) or professional competences (Khaled et al. 2014) into account.

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No potential conflict of interest was reported by the authors.

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Appendix. Two examples of vocational core problems for ICT and SW

Vocation	Content of the vocational core problem
ICT	Information presented to students: 'You are an employee of a helpdesk in a large production plant. A customer, who you have helped many times before, has a complaint. Previously, his questions were always related to small disturbances of his server. There was always a quite easy solution for the malfunctions. Now it seems that the problem is more fundamental since the server appears to have large defects. The client is very annoyed because he cannot continue his work. The client is also becoming a bit impatient. At first he could handle it, but now you notice that he really needs an adequate solution from you. After some brief questioning and searching the internet you find out that the server is outdated and that the software is not suitable anymore. That means that the entire system must be replaced. A very costly and time consuming task. However, you know that there is a long term benefit to it. On the other hand, with some minor modifications, the customer can still work with it (but you don't know for what time)'. Vocational core problem: possible dilemma's between short-term solutions and long-term solutions, including technical aspects, commercial aspects but also professional relationships with customers and own performance. These are common problems in ICT (in the Netherlands) and ways how to perform adequately seem to differ between, for example, regions and organizations. This is often due to differences in (professional) cultures. For example, is making profit a highly explicit value or is satisfying costumers more important?

(*Continued*)

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Vocation	Content of the vocational core problem
SW	Information presented to students: 'You work at a playgroup in a day-care organization. You see that a child (which is a toddler) has developmental problems (for example aggressive behaviour, poor concentration and subversive behaviour). You have the difficult task to confront the parents with this. You prepared this conversation thoroughly. During the conversation you noticed that the parents do not constructively cope with the message and the feedback you gave them concerning the development of their child. In addition, the parents did not recognize and acknowledge the problems. You can imagine that it is confronting to hear such a message, but you are also convinced that denial of the problem is a serious matter. Two weeks after the conversation you have called the parents because you are determined to pick up the problem, especially after the situation got out of hand when the child recently hit another kid while playing). You are motivated to collaborate with the parents to find sustainable solutions for the problems. However, the parents became even more irritated. Contact with parents is now difficult. They even blame you for the situation: they hold you responsible for a lack of intervening when the situation got out of hand'. Vocational core problem: possible dilemma's between the needs of the child, the beliefs of the parents, the responsibility of the organization and own professional performance. Ethical aspects become explicit, since formal procedures do not subscribe how one needs to perform in such an affective situation. Similar to the ICT example, the way how to act adequately with such dilemma's depends in SW highly on the actual (professional) cultures in regions and organizations. For example, is there a common culture of following procedures or a common culture of pedagogical reasoning?