Know Your Onions: An Exploration of How Students Develop Vocational Knowledge During Professional Performance

3 authors:

W. T. Heusdens
Utrecht University

3 PUBLICATIONS   **14** CITATIONS

L.K.J. Baartman
Hogeschool Utrecht

71 PUBLICATIONS   **1,076** CITATIONS

E. de Bruijn
Hogeschool Utrecht

119 PUBLICATIONS   **756** CITATIONS

Some of the authors of this publication are also working on these related projects:

Project   PhD Research View project

Project   Portfolio use and assessment View project

Know Your Onions: An Exploration of How Students Develop Vocational Knowledge During Professional Performance

Wenja Heusdens, Liesbeth Baartman & Elly de Bruijn

Routledge
Taylor & Francis Group

Check for updates

Know Your Onions: An Exploration of How Students Develop Vocational Knowledge During Professional Performance

Wenja Heusdens[a,b], Liesbeth Baartman[a] and Elly de Bruijn[a,b]

[a]Department Research Group Vocational Education, HU University of Applied Sciences, Utrecht, The Netherlands; [b]Department of Education, Utrecht University, Utrecht, The Netherlands

ABSTRACT

How students develop vocational knowledge is a rather under-researched topic in the context of vocational education and training. Vocational knowledge is perceived as the kind of knowledge required to perform in occupational practice. From an activity-theoretical approach to learning, supplemented with ideas borrowed from inferentialism, this article explores how students develop vocational knowledge in terms of a cognitive activity of contextualising. A qualitative in-depth study is presented, which explores students' cognitive processes during professional performance. Hospitality students and culinary students were interviewed and asked to articulate the process of contextualising during their work in a sandwich bar. A detailed description of the characteristics of contextualising is presented, and the process is illustrated with examples from the data.

In recent years, the concept of vocational knowledge has become topic of many debates in educational sciences (Bathmaker, 2013; De Bruijn & Bakker, 2017; Khaled, Gulikers, Biemans, & Mulder, 2014; Lindberg, 2003; Nore & Lahn, 2014; Tynjälä, 2013; Young, 2013; Zitter, Hoeve, & de Bruijn, 2016). In these debates, vocational knowledge is often discussed from a curriculum point of view, for instance, what teachers and educators intend for students to learn as laid down in curricula (Kilbrink, Bjurulf, Olin-Scheller, & Tengberg, 2014; Wheelahan, 2010; Winch, 2013), or students' vocational knowledge is discussed in terms of the differences between school-based learning and workplace-learning (Aprea & Sappa, 2015; Bakker & Akkerman, 2014; Tynjälä, 2013). Much less focus in these debates is on vocational knowledge from a learners' point of view, namely how students develop vocational knowledge. Furthermore, there is hardly any empirical evidence how students develop vocational knowledge, namely the kind of knowledge required to perform in occupational practice.

In the process of becoming autonomous practitioners, students are required to develop vocational knowledge and, therefore, they are required to gain access to the thousands of concepts, procedures, principles, rules, skills, and patterns that are present in the occupation-specific field of practice. Each situation in occupational practice challenges practitioners to use different compositions of knowledge (Guile, 2014). Therefore, vocational knowledge may be perceived as all kinds of knowledge required for practising an occupation and is characterised by knowledge that comes in specific conglomerations at the service of an occupation (Heusdens, Bakker, Baartman, & De Bruijn, 2016). It is displayed in action, and embodied in the practices, people, tools, and instruments that belong to an occupation-specific field of practice (Wheelahan, 2010; Young, 2006).

CONTACT Wenja T. Heusdens ✉ wenja.heusdens@hu.nl, w.heusdens@uu.nl 📧 Department Research Group Vocational Education, HU University of Applied Sciences, Utrecht, The Netherlands; Department of Education, Utrecht University, Utrecht, The Netherlands.

To gain access to vocational knowledge, students are required to learn to recognise knowledge in occupational practices and develop an understanding of the relevance of knowledge for a purpose or in a specific situation (Billett, 2014; Guile, 2014). For that reason, Wheelahan (2015) suggests students should gain access to knowledge underpinning action in practice. For instance, when students learn to caramelise onions for a French onion soup, additionally they are required to learn how the caramelisation of onions can be explained as a concept with roots in the discipline of chemistry. Hence, when students learn to anchor their experiences into wider systems of meaning, they learn to go beyond their individual experiences to locate themselves and their experiences into a broader context (Bakker & Derry, 2011; Wheelahan & Moodie, 2011).

This article aims to explore how students develop vocational knowledge and therefore answers the research question: "How do students develop vocational knowledge during professional performance?" Investigating the cognitive processes by which students develop vocational knowledge contributes to insights into the complex nature of vocational knowledge and is necessary to improve our understanding of learning processes in the context of Vocational Education and Training. However, to explore students' cognitive processes with the aim of understanding how students develop vocational knowledge, the nature of students' vocational knowledge must be determined first. In a former study, the idea to think about the nature of students' vocational knowledge in terms of an ongoing process of contextualising was introduced (Heusdens et al., 2016). The activity of contextualising serves as the conceptual frame of the study presented in the theoretical background in this article and explains what it means to understand students' vocational knowledge in terms of an ongoing process.

To grasp and reveal the abstract concept of contextualising in practice, students were prompted to reflect in and on real-time action. In the Methods section we explain how students' cognitive processes during occupational practices were revealed to gain insight into how they develop vocational knowledge. In the Results section the process of contextualising is characterised and illustrated with examples from the data. This article finishes with some concluding remarks, a discussion of the challenges of the study, and directions for future research.

1. Theoretical Background

In a traditional theory of transfer (see, e.g., Beach, 1999), knowledge development is primarily viewed as a cognitive activity, namely, an individual acquisition of "something." These theories seek to explain the processes of how individuals acquire knowledge, and knowledge is objectified in the individual mind. Knowledge has the connotation of being possessed by the individual or as a commodity (Elmholdt, 2003). In response to this traditional conceptualisation of transfer, situated approaches to knowledge development shift the view from the isolated learner to the learner as a participant in a cultural community (Berner, 2009, 2010; Elmholdt, 2003; Jonasson, 2014; Tanggaard, 2007; Vygotsky, 1978). This means, all forms of knowing emerge from participating in social practices and, therefore, knowledge is an aspect of practice, discourse, and activity (Lave & Wenger, 1991).

Although different scholars nowadays acknowledge the development of vocational knowledge is more than putting bits of theoretical and practical knowledge together, there is still no consensus among educational scientists about how to theorise the nature of vocational knowledge in less dichotomous or dualists ways (Billett, 2014; De Bruijn & Bakker, 2017; Guile, 2010; Schaap, de Bruijn, van der Schaaf, & Kirschner, 2009). Thinking in dichotomies, such as school versus workplace or general versus specific, is not a helpful way to understand the complex nature of vocational knowledge. Furthermore, a rather under-theorised aspect of vocational knowledge is the extent to which knowledge and action are sometimes related, and how knowledge (and language) is spread throughout occupational practices. To do justice to the complex nature of vocational knowledge, a more unified and complementary way of thinking about the nature of students' vocational knowledge is necessary to explore how students develop vocational knowledge.

In an earlier study, a complementary way of thinking about the nature of students' vocational knowledge was introduced in which students' vocational knowledge is conceptualised as a cognitive activity of contextualising (Heusdens et al., 2016). The idea of contextualizing, as presented by Van Oers (1998a, 1998b), was introduced and supplemented with inferentialism, a philosophical semantic theory of meaning. Inferentialism offers a language and theory to gain a deeper understanding of contextualising (Bakker & Derry, 2011; Brandom, 1994, 2000). In the next section, the activity-inferential approach to students' learning is briefly presented. For a more detailed explanation of this theory, we refer to our previous study (Heusdens et al., 2016).

1.1. The Activity of Contextualising

Van Oers' (1998a, 1998b) theory of contextualising is grounded in sociocultural theory in which activities – specifically the cognitive activity of meaning making – are emphasised. Van Oers argues to use a concept in a new and different context means to use that concept in a different manner. By using a concept differently, our interpretation of the concept changes and, therefore, the meaning of a concept is consequently redesigned to better fit its purpose in a new context. Through context making (i.e., contextualising) concepts and actions are tied together. Therefore, contextualising prevents the particularised meaning of a concept from being isolated, as it brings about coherence with a larger whole. This means that meaning derives from seeing the relationships of parts to the whole rather than seeing only the parts (Van Oers, 1998b).

To describe in more detail how students provide coherence between what they know and how to act and, hence, to understand the micro-level processes of contextualising, Van Oers' (1998a, 1998b) activity-theoretical approach of contextualising was supplemented with an inferential perspective on learning (Brandom, 1994). Inferentialism is a philosophical theory of meaning that offers a way to focus on what it means to make judgements and take action in close relation to each other (Bakker & Derry, 2011; Brandom, 2000). The inferential perspective taken on learning in this article focuses on reasons and inferential relations between judgements and actions.

Unpacking concepts through their inferential relations shows concepts are not abstract representations. Concepts are systems of inferences that have norms of what counts as valid, situated in practices. For instance, when a culinary chef asks his student why she is still stirring the onions for the French onion soup, this student responses she is still stirring to develop a rich and tender taste. For a rich and tender taste, onions should be caramelised and cooked until golden brown. The abovementioned example illustrates how meaning is a matter of how a judgment (i.e., an expression of knowledge) is used. Furthermore, the meaning of a concept is constituted by rules and norms governing inferences that people might make involving that concept (Noorloos, Taylor, Bakker, & Derry, 2017). This means, every time one speaker (e.g., a student) makes a claim, it is up to others (e.g., a culinary chef) to assess whether the claim is justified. Therefore, an inferential approach to knowledge development might be perceived as a participatory activity of reason-giving (Noorloos et al., 2017).

In sum, in an activity-inferential approach to learning, students' vocational knowledge development is perceived as a cognitive activity of reasoning in terms of concept formation. Contextualising emphasises the appropriate use of concepts and explains the inferential relations of these concepts in terms of the ability to explain and justify to others the reasons for what you say or do. Therefore, an activity-inferential view of the nature of students' vocational knowledge explains how students learn to master concepts bit by bit and how learn to make more and more appropriate inferences in relation to other concepts and in relation to more and more actions. What make different concepts and actions cohere are the inferential relations between them.

1.2. A Broad Spectrum of Reasoning Activities

To grasp and reveal the abstract concept of contextualising in practice, two perspectives are analytically distinguished: "conceptualising" and "concretising" (Heusdens et al., 2016).

These two perspectives together cover a broad spectrum of reasoning activities relevant for the development of vocational knowledge. Conceptualising involves inferring what follows from understanding what a concept means in a situation in relation to the meaning of other concepts. Concretising is about understanding the use of concepts in a situation. It involves inferring what follows from understanding an aspect of occupational practice in which students are participating and inferring how to interpret that situation to be able to transform and use concepts appropriately.

Together the reasoning activities of concretising and conceptualising allow students to express understanding, ideas, and arguments in accordance with systems of meaning and generative principles, and to use concepts in new ways and in new situations (Wheelahan, 2015). The main reason for conceptualising is to increase the understanding of concepts by inferentially relating them to other concepts, which leads to a deeper understanding of a concept through seeing it in the context of a greater whole. The main reason for concretising is to make a general or key concept better understood, to do justice to local circumstances, and, typically, to act.

The reasoning activities of conceptualising and concretising are complementary, and in some cases, inextricably related (Heusdens et al., 2016). For instance, one might justifiably argue that "to improve flavour" is a practical reason. Simultaneously, flavour is a general concept with a much wider application than preparing onion soup. Therefore, when focusing on concepts more generally, the orientation is predominantly on understanding rather than on immediate action. Since it is not always clear whether reasons are predominantly theoretical or practical, we therefore suggest contextualising vocational knowledge covers a broad spectrum of inextricably related activities that seem relevant in using and developing vocational knowledge.

2. Methodology

The type of research presented here is a qualitative, exploratory in-depth study of how students develop vocational knowledge. The process of contextualising is explored in terms of how students articulate multiple (relevant) reasons for their actions (i.e., expressions of knowledge). The present theory of contextualising focuses on concept formation, and suggests that vocational knowledge develops when students learn to infer from the meaning of one concept to the meaning of other concepts. Therefore, the study focuses on the cognitive dimension of knowledge development, and affect issues such as emotions, identity, and intuition are not considered.

2.1. Setting

The study is set in an entrepreneurial learning environment at an institute for hospitality and restaurant management and culinary arts in the Netherlands. The institute was selected based on a previous study in which potentially powerful learning environments were identified (Heusdens, Baartman, & De Bruijn, 2012). In the selected powerful learning environment, students learn, work, and practice together in real life mini-enterprises. In such practice-based settings, students gain hands-on experience under the guidance of a teacher or a team of teachers, and they are introduced to the knowledge of their future occupations. It was hypothesised that in the selected setting, the participating students are challenged to develop vocational knowledge since they are introduced to a wide variety of aspects of their future occupation.

The selected learning environment was a realistic counter-service catering company part of the on-campus restaurant and called "the sandwich bar." In the sandwich bar the participating students prepared and sold drinks and sandwiches. Customers were served ready-to-eat and pre-packed sandwiches at a fast-track corner, or they could create their own sandwiches at a slow-track corner. The ingredients for the sandwiches were prepared in the on-campus restaurant's kitchen.

2.2. Participants

The sandwich bar was run by a group of management students and culinary students aged between 17 and 22 during their vocational training in 2014–2015. The participating students were enrolled in a school-based learning route with fulltime education. The group of management students ($n = 56$) were in their second and third year of the four-year programme of hospitality and restaurant management, at the highest qualification level in a SSVE-school (level 4 of the Cedefop, Terminology of European education and training policy, 2008). These students were trained to become hotel or restaurant owners or managers. The group of culinary students ($n = 72$) were in their first and second year of training for culinary chef at the school of culinary arts, a three-year programme at the third qualification level at the same SSVE-school school (level 3 of the Cedefop, Terminology of European education and training policy, 2008). These students were trained to become kitchen professionals for a wide variety of work settings in the hospitality industry.

Every six weeks, a group of six management students and two culinary students were responsible for managing and promoting the sandwich bar. The structure of the group of students varied every week because each student received an individual educational track. The management students rotated in different roles, namely general manager of the enterprise, service-manager in the sandwich bar, or executive chef in the kitchen. The culinary students were supervised by the management students and were responsible for preparing, cooking, and presenting the food.

A mixed group of management and culinary students was selected for this study because, together, these students were assigned to run the business, and they were challenged to develop different kinds of vocational knowledge. For instance, compared to the culinary students, management students are required to develop vocational knowledge at a more abstract level because of their higher level of training. Before the data collection, the management students had already received an intensive programme of both theoretical classes and practical training, while the culinary students already had been presented with a lot of practical training in a skills lab, and they had been introduced to basic cooking techniques and procedures. More than half of the participating group of students had part-time jobs in the hospitality industry and, therefore, they had been introduced to some vocabulary and vocational knowledge relevant for the occupation-specific field of practice.

2.3. Data Collection

2.3.1. Procedure of the Pilot Study

A pilot study was conducted to select the most suitable method to reveal how students develop vocational knowledge. The pilot study covered four days of video-recorded interviews in which students were prompted to reflect *in* and *on* real-time action (Schön, 1983) at two institutes of hospitality management and culinary education in the Netherlands. In both institutes, the practice-based settings were student-run establishments, namely, a sandwich bar and a lunchroom, which were both part of the institutes' on-campus school restaurants. The methods of reflection in and on real-time action were selected because they allow the investigation of cognitive processes through inviting participants to recall their concurrent thinking during an event, or when prompted by a video sequence (Fox-Turnbull, 2011). Furthermore, in previous research such techniques proved to be worthwhile to stimulate participants to articulate their thinking (Fox-Turnbull, 2011; Schön, 1983; van Kan, Ponte, & Verloop, 2010).

Reflection in and on action is a method to reveal a mixture of what students know and how they act, described by Schön (1983) as "theory-in-use." The method of reflection *in* real-time action involves interviews in which students are prompted to reflect on their actions at the time of an event or interaction. The method reflection *on* real-time action involves stimulated recall interviews in which students are asked to reflect on their action based on video-recordings of their professional performance. The video recordings are used as cues to prompt students to reflect on and articulate reasons for their actions (cf., van Kan et al., 2010).

In the pilot study, the method of reflection in real-time action proved best in revealing how students develop vocational knowledge. During the stimulated recall interviews (i.e., reflection on real-time action) students experienced a judgmental character that caused them to adopt a defensive attitude, and mentioned to experience the judgmental character to a much lesser extent during reflection in real-time action. Hence, the underlying "good-bad" thinking principal of reflection on real-time action left little room for an open dialogue (van Kan et al., 2010). Based on these results, it was decided to select the method of reflection in real-time action to collect the data for the main study.

2.3.2. Procedure of the Main Study

For the main study, data were collected over a period of four months on eight separate days. All students who were present in the sandwich bar or in the restaurant's kitchen and who were willing to participate during a day of recordings were interviewed, with a maximum of eight students per recording-day. This reflects the principle of convenience sampling (Miles & Huberman, 1994; Patton, 2002). The participating students had to sign a consent form ($n = 64$). All recordings were transcribed verbatim and anonymised.

Both a teacher, who was responsible for the training of the participating students in the sandwich bar, and a researcher (i.e., the first author) interviewed the students together. In this way, we aimed to gain as complete a picture as possible of students' cognitive processes during professional performance. The teacher was up-to-date on the current level of students' knowledge and was therefore able to ask in-depth or follow-up questions. The researcher played the role of "naïve-other" and asked questions about students' activities that might be all too often implicit or tacit in nature for both student and teacher (cf. knowledge encapsulation, Rikers, Schmidt, & Boshuizen, 2000). For practical reasons, the teacher had to withdraw from the interviews. It was hypothesised that the researcher was sufficiently trained during the overall research project and inducted into relevant applications of concepts and gained familiarity to the language of the occupation, to independently conduct the second half of the interviews.

2.4. Data Analysis: Development of Coding Scheme

A coding scheme was developed following a stepwise procedure (see Table 1). This stepwise procedure involved a combination of a deductive and an inductive approach (Miles & Huberman, 1994). In a first step, the transcripts of the interviews were first divided into articulations of speakers, namely interviewers' questions and students' articulations. Only students' articulations were analysed, and the unit of analysis was determined as students' articulations, namely students' verbalised accounts of vocational learning practices. A student's articulation involved one or more utterances between a turn of speakers.

Since this study aims to gain insight into the process of contextualising and, therefore, the relevance of students' vocational knowledge is not at focus, it was hypothesised the participating researchers could analyse the process of contextualising. Furthermore, an intensive form of debriefing was applied, in which the first two authors discussed conjectures and conclusions and, in cases of doubt, verified with the third author until agreement was reached (Guba, 1981). The first two authors applied two rounds of coding sessions on randomly selected articulations of students from data of the pilot study. The idea of sensitising concepts was introduced to provide an analytic frame without pre-fixed concepts (Bowen, 2008). Two sensitising concepts were selected: conceptualising, defined as articulations involving conceptual-related reasons, and concretising, defined as articulations involving action-related reasons.

Using an inductive approach, the two sensitising concepts were operationalised into nine different labels (see Table 1).

Next, another two rounds of coding were conducted and, based on the results, the sensitising concepts were redefined. For instance, the initial coding scheme involved levels of conceptualising and

Table 1. Procedure of the analysis.

	Deductive (study 1: 2 rounds)	Inductive (study 1: 2 rounds)	Combination (final) (study 2: 3 rounds)
Labels	Conceptualising: inferring what follows from understanding what a concept means in a situation in relation to the meaning of other concepts. Concretising: inferring what follows from understanding an aspect of the occupational practice in which students are participating and how to use that concept.	Conceptualising: Level 1: Articulating a concept or idea and relating the concept to an action. Level 2: Cause-effect argumentation. Level 3: Clarifying how a concept or idea relates to other concepts or ideas. Concretising: Level 1: Articulating what one is doing or what is going on and what products, materials or methods are involved. Level 2: Articulating alternatives for acting, adapted to the situation. Level 3: Articulating a decision and the consequent actions.	Conceptualising is a movement towards understanding involving predominantly conceptual-related reasons. Conceptualising is when students: • mention or link concepts to actions; • explain or clarify actions with concepts more generally in cause and effect reasoning. Concretising is a movement towards action involving predominantly action-related reasons. Concretising is when students: • articulate what one is doing (actions) or what is going on to interpret the situation; • explain or clarify concepts and their appropriate use. Inextricable relationship: • articulate with both action-related reasons and conceptual-related reasons.
		Other/not applicable: Articulations not related to vocational knowledge or reasons for acting or confirmation words, repetition questions of students, et cetera.	Other/not applicable: Articulations not related to vocational knowledge or reasons for acting or confirmation words, repetition questions of students, et cetera.
Level of analysis		Articulations	Articulations
Number of assessors		3	3
Research software		Moviemaker and Excel	Excel

concretising. However, we did not intend to develop a ranking system and, therefore, the developed "levels" of conceptualising and concretising were deleted. Furthermore, a third label, namely "inextricably-related," was added to the coding scheme to label students' articulations that could not be distinguished into conceptualising or concretising but illustrated articulations with both conceptual-related reasons (i.e., conceptualising) and action-related reasons (i.e., concretising).

A third round of coding was conducted on 10% of students' articulations, stemming from the data of the main study. At the end of this third round, a good level of interrater reliability (Cohen's Kappa) was reached (κ: 0.90). With the final coding scheme, the first author analysed half of the randomly selected data ($n = 924$ articulations). After coding half of the articulations saturation was reached, meaning no new labels were found, which suggests that all labels were adequately explained (Bowen, 2008).

3. Results: Characteristics and Illustrations

The results show how conceptualising was found in 15% of all articulations and concretising was labelled in 42% of all 924 articulations. In all, 34% of students' articulations received the label "other/not applicable." These labels involved articulations that did not relate to occupation-specific knowledge. Furthermore, articulations with this label involved confirmation words, repetition, yes- and no-answers, or questions of students. Of these articulations, 3% were indicated to relate to a hunch, a feeling, or to something intuitive. For instance, students articulated: "I guess that is about 50 grams. I do not have to weigh the salmon, I just know it is 50 grams," or "I just know," or "I can sense it."

Table 2. Labels of contextualising vocational knowledge.

	Label 1	Label 2
Conceptualising	Students mention concepts or link concepts, stemming from either academic disciplines or occupationally contextualised disciplinary knowledge, to actions.	Students explain their actions in more general terms and link new concepts to the vocational activity in cause-and-effect reasoning.
Concretising	Students mention what they do (actions) or what is going on to interpret the situation.	Students explain or clarify the appropriate use of concepts.
Other/not applicable	Articulations not relating to occupation-specific knowledge or reasons to act, confirmation words, repetition, yes- and no-answers, or questions of the students themselves.	

In the following section, the two reasoning activities involved in contextualising are described separately in terms of labels and portray respectively conceptualising or concretising (see Table 2). Additionally, the labels of conceptualising and concretising are illustrated with examples from the data of three students, named Anne, Sven, and Jasper (pseudonyms). In general, the results show how conceptualising is characterised by a movement towards understanding and concretising by a movement towards action. The labels together portray how students articulate the process of contextualising and provide insight into how students develop vocational knowledge. Furthermore, the sometimes-inextricable relationship between concepts (i.e., knowledge) and action is illustrated with examples from the data.

3.1. Conceptualising

Conceptualising involves articulations with a focus on more general concepts, and involves a reasoning process towards understanding (see Table 2). Conceptualising is portrayed by two labels and involves conceptual-related reasons. The first label involves articulations in which students mention concepts or link concepts to actions. For instance, concepts stemming from either an academic discipline (i.e., mathematics, chemistry) or occupationally contextualised disciplinary knowledge (e.g., cooking processes, technical terms, and tools). An example is the response of Anne to the question whether she registers all menu items: "Yes, I do. It is called menu engineering." This articulation was labelled as conceptualising because Anne links a culinary concept to an act.

Additionally, the following three examples illustrate label 1 of conceptualising:

Interviewer	What are you doing?
Sven	First I cut it [A hot pepper] into strips, that is a Julienne cut. And then in dices, in a Brunoised cut.
Interviewer	Why should you stick to the recipe?
Anne	I should stick to the recipe because of the food allergy legislation law.
Interviewer	Why should you cut out the fat of smoked salmon?
Jasper	This piece of fat? Yes, well, that does not taste good. So, I cut it out to improve the flavour of the salmon.

In these examples, students mention concepts such as Julienne cut and Brunoised cut, food allergy legislation law, and flavour. Students connect these concepts to actions (e.g., the concept Julienne cut is linked to the action "cutting into strips"). In this way, students show how they connect concepts to vocational activities. These articulations therefore suggest how students understand concepts in relation to specific actions.

The second label of conceptualising shows how students explain their actions in more general terms, using concepts stemming from academic disciplines, or how students mention occupationally-contextualised disciplinary knowledge. This label illustrates how students connect new concepts to a vocational activity in cause-and-effect reasoning. In cause-and-effect reasoning, students often connect other relevant concepts within the occupation to the specific vocational activity to gain a deeper understanding of the vocational activity. In the following examples, illustrations of label 2 of conceptualising are presented.

"Otherwise, yes well, otherwise it is unhygienic. Then cross-contamination might occur" – this is an answer of a culinary student named Sven who responded to a question about the existence of different cutting boards for different food groups. In this answer, Sven explains a consequence of using one and the same cutting board for different ingredients, and introduces new concepts, such as "unhygienic" and "cross-contamination." In the next illustration, the culinary student Jasper connects several new concepts, such as shelf-life and oxygen, to the vocational activity of preserving food. Jasper explains the effect of using vacuum sealer bags, and uses concepts rooted in the disciplines of chemistry and biology:

Jasper	I preserve smoked chicken breast in a vacuum sealer bag because it is air free!
Interviewer	Air free. Why is that important?
Jasper	Then, it has a longer shelf life.
Interviewer	Why?
Jasper	[Silence]
Interviewer	What do you take out of the bag?
Jasper	The air, err … oxygen!
Interviewer	And with oxygen, what might survive?
Jasper	Micro-organisms can survive.

Anne, a restaurant management student explains why she did not manage to open the bar at 10 am: "We had a lot of mise-en-place to do, and we put the baguettes in the oven too late. So yeah, well that's a shame because now we miss out on our daily profit." In her response, Anne illustrates how she connects a relevant, more general concept, namely, daily profit, to the vocational activity of putting everything into place (i.e., mise-en-place) in cause and effect reasoning. Anne illustrates how she has a deeper understanding of the specific activity because she can position it in the context of a greater whole.

3.2. Concretising

Concretising focuses predominantly on action. It involves the reasoning activity of inferring what it means to understand an aspect of a situation, and to understand the kinds of actions that are required to perform the vocational activity. Concretising is portrayed by two labels that involve action-related reasons. The first label of concretising shows how students articulate what they do (actions) or what is going on to interpret the situation.

The following examples illustrate label one of concretising:

… I just sliced a shallow X and if I put it (tomato) in boiling water now, then the X will split open wider. And then I put it in here, to cool it off [the student points at a bowl of ice water]. And then, I can very easily peel off the skin of the tomato.

I am cutting chicken for the spicy chicken [salad]. He is preparing chili sauce, so, I am preparing the chicken.

I am using a regular onion, but it can also be shallots. And then … Yes, well, I always add 2 tablespoons of mayonnaise and then I mix it, and then I add salt and pepper and, *voila*, there you have your tuna salad!

Right now, I still should make a cheese sandwich, and … let me see, not the chicken curry, they are preparing that already.

In these illustrations, the individual students interpret the situation and articulate what they are doing or what should be done, and the choices they make. Label one of concretising is portrayed by articulations in which students articulate their actions at a very practical level. Concretising is not about explanations or articulating the purpose of actions, that is, to explain why specific things are done and certain products are used.

The second label of concretising shows how students explain what the appropriate use of concepts is or explain the practical applications of concepts:

Err, yeah, each cutting board has its own colour, so, yellow is for poultry, that means, for chicken. Red is for meat, white is for bread. Green is for vegetables … and fruit.

I am slicing smoked salmon. … That means, cutting it in equal and thin slices. I am still not good at it, but I am doing my best.

I am going to peel the skin of tomatoes. Actually, that means taking off the skin of the tomato.

These articulations were coded with the second label of concretising because these articulations involve action-related reasons. Students explain or clarify the practical use or applications of concepts. Although one could argue these articulations are in some way still at a conceptual level, the articulations involve explications of concepts in terms of actions and their appropriate use, and therefore received the second label of concretising.

3.3. A Continuous Movement

In our attempt to grasp and reveal the process of contextualising, analytic distinctions were made between conceptualising and concretising. However, the results show that 9% of the 924 articulations involved both action-related reasons and conceptual-related reasons. These articulations illustrate how the process of contextualising is a continuous movement of reasoning activities between understanding and action, and vice versa (see Figure 1). The two examples below illustrate the continuous movement between conceptualising and concretising:

Interviewer	One last question: how can you tell whether you can use that hot pepper? I mean, do you just grab a hot pepper and start cutting?
Sven	No, I first check if the hot pepper is not bad.
Interviewer	And how can you tell?
Sven	Soft. Based on the firmness of the product. And I check if I don't see any growth of fungus or rotten spots.
Interviewer	Right. So, you examine by touching and looking?
Sven	Yes, you look, and you can also smell the product. It is all about the freshness of a product.

In the abovementioned example, the culinary student Sven first articulates the activity of checking whether a hot pepper is bad or not. Sven both conceptualises and concretises, for instance, he connects the softness of the pepper to the more general concept of firmness of products. Then he concretises firmness into growth of fungus and rotten spots. Additionally, Sven mentions that he "looks and smells" and he introduces a more general concept, namely the freshness of products. In Figure 1,
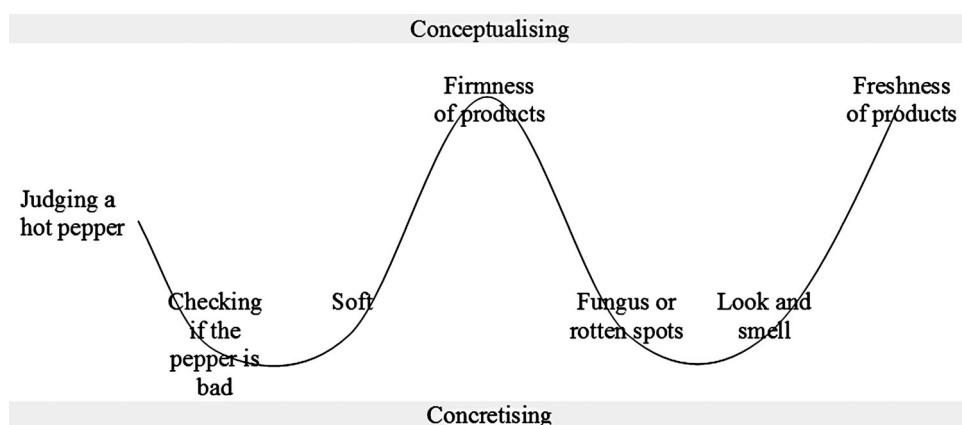

Figure 1. The ongoing process of contextualising vocational knowledge.

the wave illustrates the ongoing process of contextualising, and illustrates how this student moves back and forth in his reasoning between conceptualising and concretising.

In the following example the restaurant management student Anne asks her teacher for help while she is slicing smoked salmon. The episode starts when Anne's teacher has taken over the task and shows Anne how she should cut the smoked salmon.

Interviewer	If you use the straight cut and you end up here, then … ?
Anne	Then you get thinner slices.
Interviewer	Not only thinner … ?
Anne	And fatter, I think?
Interviewer	If you end up here, will it be thin or thick?
Anne	Thinner?
Interviewer	What will happen to a salty flavour during a curing process? And the smoky flavour will be … ?
Anne	That will be … well, stronger?
Interviewer	Stronger. Thus, I want the flavour evenly divided over the slices and that's why I cut in somewhat longer slices. Use a horizontal cut.
Anne	Now I get it!
Interviewer	What is curing? And what is smoky flavour?
Anne	Well, curing is … I don't know if I can explain it correctly, I just had a few theoretical lessons. Err … to cure is, well, it is the same as with smoking I think. A layer of salt is put around the product. Yes, I think that is exactly curing! I learn each day …
Interviewer	Of course.
Anne	But yeah, well, with curing you put a layer of salt around, and err … I don't know if this is done immediately or separately, but smoking is done above a smoker or in a smoker, so the smoky flavour can get inside the product. And the product is also being cooked.
Interviewer	So, smoking is done for the cooking of products?
Anne	Yes, and to add flavour. That's the same with meat. That's also possible. You should not smoke the meat, to cook it and the aim can also be adding a smoky flavour.
Interviewer	How do we call these methods, curing and smoking?
	[Silence]
Interviewer	Pre …
Anne	Preservation of food!

In the beginning of this episode, Anne articulates several action-related reasons. In the line of questioning, the teacher models, and adopts a think aloud technique and explains what he is doing and why. Furthermore, the teacher tries to prompt Anne to do the same. Several relevant concepts are introduced, such as a curing method, salty and smoky flavour, a horizontal cutting technique et cetera. And finally, Anne can connect the more general concept of food preservation with the techniques of curing and smoking.

4. Conclusion

In this article it was explored how students develop vocational knowledge during professional performance. To contribute to a way of thinking about the complexities of vocational knowledge, an activity-inferential approach to learning in terms of contextualising was introduced. Van Oers' (1998a) socio-cultural idea of contextualising was enhanced and supplemented with inferentialism (Brandom, 1994). In this approach, the activity of contextualising is perceived as a participatory process of reason-giving between students and others (e.g., fellow students, teachers, and other educators). This means that contextualising emphasises the appropriate use of concepts (i.e., an individual cognitive activity), and the inferential relations of these concepts are explained in terms of the ability to explain and justify to others the reasons for what you say or do (i.e., social participation). Through contextualizing, students learn to communicate in the language of the occupation-specific field of practice and act according to its norms (Bakker & Derry, 2011). Hence, students learn to "know their onions."[1]

---

[1]"Know your onions": to be experienced in or knowledgeable about a subject.

In general, the results show the process of contextualising covers a broad spectrum of ongoing, sometimes inextricably related, reasoning activities, which are defined as conceptualising and concretising. Together the activities of conceptualising and concretising allow students to recognise, use, and develop vocational knowledge, and how these activities provide coherence between students' knowing and doing. The illustrations of students' articulations of contextualising in this article may seem like simple examples of cooking. However, in the examples students' articulations illustrate many different compositions of different kinds of reasons, which we analytically distinguished to involve predominantly action-related or conceptual-related reasons.

Specifically, the results show how conceptualising involves reasoning activities in which the orientation is predominantly on understanding, while concretising involves reasoning activities with an orientation predominantly on action. Students' articulations of conceptualising indicate a focus on concepts more generally to understand a vocational activity, and students' articulations of concretising illustrate how students reason about their vocational activities, and how they explain in more practical terms, their use of concepts and how they relate concepts to vocational activities.

4.1. Challenges

The results of the presented study show how students were predominantly focused on action rather than articulating concepts stemming from either academic disciplines or relating concepts to action more generally. In previous research results also show how students frequently do not see the point of learning disciplinary knowledge such as mathematics or chemistry, while experts acknowledge the importance in occupational practice (Bakker & Akkerman, 2014). Furthermore, in the workplace, knowledge is mostly restricted to what is applied at work, and knowledge is tied to the present and reduced to contextually specific applications of knowledge. In such settings, the focus is often on workplace tasks, roles or requirements (Wheelahan, 2015). Therefore, to prompt students to articulate the process of contextualising in a practice-based setting might have revealed the kind of knowledge that is tied to workplace situation. And therefore, possibly, not all of students' understandings of vocational knowledge were exposed.

In this study, students were prompted with the interview technique of reflection in real-time action to articulate their reasoning. Together, a teacher and the first researcher carried out the interviews. We should consider whether this interview technique potentially affected the results. For instance, students might have used less specific (jargon) language when they answered the researcher than responding to the questions of the teacher. Furthermore, how students contextualised vocational knowledge did not solely depend on students' abilities to articulate the process of contextualising, it also depended on the interviewers' abilities to prompt students to articulate contextualising. Hence, the strength of the interview technique was simultaneously its challenge.

4.2. Directions for Future Research

In the theoretical framework presented in our earlier study (see Heusdens et al., 2016), the concept of "web of reasons" was introduced. This concept was not further explored in the study presented in this article since the aim was to gain insight into students' learning process rather than characterising the vocational knowledge of individual students. However, the concept of webs of reasons may provide an opportunity for future research to expand the findings of this study. Bakker and Derry (2011) suggest inferences form webs of reasons that include a range of reasons such as the purpose and relevance of actions, techniques, procedures, et cetera. In webs, the range of reasons or elements can be distinguished as kinds of knowledge such as implicit, explicit, codified, embodied, and situated (De Jong & Ferguson-Hessler, 1996), and webs of reasons may be a means to explore the integrated vocational knowledge of individual students.

The activity-inferential approach to vocational knowledge helps us to understand how students develop vocational knowledge in terms of concept formation. Therefore, the focus of this study

was on the cognitive process of contextualising. Components such as notions of hunch, intuition, human senses, et cetera were not considered in this study despite their role in the process of becoming autonomous practitioners (Harteis & Billett, 2013; Harteis, Koch, & Morgenthaler, 2008). For instance, a culinary chef is frequently called upon the senses of taste and sight, to taste for seasoning, or bake until golden brown. Further investigation into the richness of human engagements is required to fully understand how aspiring practitioners develop vocational knowledge. To explore the diversity of vocational forms of knowledge in relation to the theory of contextualising, future research could grasp all aspects involved in students' vocational knowledge.

Disclosure Statement

No potential conflict of interest was reported by the authors.

References

Aprea, C., & Sappa, V. (2015). School-workplace connectivity: Ein instrument zur analyse, evaluation und gestaltung von bildungsplänen der berufsbildung, berufsbildung in wissenschaft und praxis. *BWP-Artikel*, 1, 27–31.

Bakker, A., & Akkerman, S. F. (2014). A boundary-crossing approach to support students' integration of statistical and work-related knowledge. *Educational Studies in Mathematics, 86*(2), 223–237.

Bakker, A., & Derry, J. (2011). Lessons from inferentialism for statistics education. *Mathematical Thinking and Learning, 13*(1–2), 5–26.

Bathmaker, A.-M. (2013). Defining "knowledge" in vocational education qualifications in England: An analysis of key stakeholders and their constructions of knowledge, purposes and content. *Journal of Vocational Education and Training, 65*(1), 87–107.

Beach, K. (1999). Chapter 4: Consequential transitions: A sociocultural expedition beyond transfer in education. *Review of Research in Education, 24*(1), 101–139.

Berner, B. (2009). Learning control: Sense-making, CNC machines, and changes in vocational training for industrial work. *Vocations and Learning, 2*(3), 177–194.

Berner, B. (2010). Crossing boundaries and maintaining differences between school and industry: Forms of boundary-work in Swedish vocational education. *Journal of Education and Work, 23*(1), 27–42.

Billett, S. (2014). Integrating learning experiences across tertiary education and practice settings: A socio-personal account. *Educational Research Review, 12*, 1–13.

Bowen, G. A. (2008). Naturalistic inquiry and the saturation concept: A research note. *Qualitative Research, 8*(1), 137–152.

Brandom, R. B. (1994). *Making it explicit: Reasoning, representing, and discursive commitment*. Cambridge, MA: Harvard University Press.

Brandom, R. B. (2000). *Articulating reasons: An introduction to inferentialism*. Cambridge, MA: Harvard University Press.

De Bruijn, E., & Bakker, A. (2017). The role and nature of knowledge in vocational programmes. In De Bruijn, Billett, Onstenk (Eds.), *Enhancing teaching and learning in the Dutch vocational education system* (pp. 157–174). Cham: Springer.

De Jong, T., & Ferguson-Hessler, M. (1996). Types and qualities of knowledge. *Educational Psychologist*, *31*(2), 105–113.

Elmholdt, C. (2003). Metaphors for learning: Cognitive acquisition versus social participation. *Scandinavian Journal of Educational Research, 47*(2), 115–131.

Fox-Turnbull, W. (2011). Autophotography: A means of stimulated recall for investigating technology education. In C. Benson (Ed.), *International handbook of primary technology education* (p. 195–210). Rotterdam: Sense.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Technology Research and Development, 29*(2), 75–91.

Guile, D. (2014). Professional knowledge and professional practice as continuous recontextualisation. In M. Young & J. Muller (Eds.), *Knowledge, expertise and the professions* (pp. 78–92). London: Routledge.

Guile, D. J. (2010). Learning to work in the creative and cultural sector: New spaces, pedagogies, and expertise. *Journal of Education Policy, 25*(4), 465–484.

Harteis, C., & Billett, S. (2013). Intuitive expertise: Theories and empirical evidence. *Educational Research Review, 9*, 145–157.

Harteis, C., Koch, T., & Morgenthaler, B. (2008). How intuition contributes to high performance: An educational perspective. *Online Submission, 5*(1), 68–80.

Heusdens, W. T., Baartman, L. K. J., & De Bruijn, E. (2012). *Krachtige leeromgeving in het middelbaar beroepsonderwijs* [Powerful learning environments in senior secondary vocational education and training]. Paper presented at the Onderwijs Research Dagen conference, Wageningen.

Heusdens, W. T., Bakker, A., Baartman, L. K. J., & De Bruijn, E. (2016). Contextualising vocational knowledge: A theoretical framework and illustrations from culinary education. *Vocations and Learning, 9*(2), 151–165.

Jonasson, C. (2014). Defining boundaries between school and work: Teachers and students' attribution of quality to school-based vocational training. *Journal of Education and Work, 27*(5), 544–563.

Khaled, A., Gulikers, J., Biemans, H., & Mulder, M. (2014). How authenticity and self-directedness and student perceptions thereof predict competence development in hands-on simulations. *British Educational Research Journal, 2* (41), 265–286.

Kilbrink, N., Bjurulf, V., Olin-Scheller, C., & Tengberg, M. (2014). Experiences of educational content in Swedish technical vocational education: Examples from the energy and industry programmes. *International Journal of Training Research, 12*(2), 122–131.

Lave, J., & Wenger, E. (1991). *Situated learning*. Cambridge, UK: Cambridge University Press.

Lindberg, V. (2003). Learning practices in vocational education. *Scandinavian Journal of Educational Research, 47*(2), 157–179.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Noorloos, R., Taylor, S. D., Bakker, A., & Derry, J. (2017). Inferentialism as an alternative to socioconstructivism in mathematics education. *Mathematics Education Research Journal, 29*(4), 437–453.

Nore, H., & Lahn, L. C. (2014). Bridging the gap between work and education in vocational education and training: A study of Norwegian apprenticeship training offices and E-portfolio systems. *International Journal for Research in Vocational Education and Training, 1*(1), 21–34.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Rikers, R. M. J. P., Schmidt, H. G., & Boshuizen, P.A. (2000). Knowledge encapsulation and the intermediate effect. *Contemporary Educational Psychology, 25*(2), 150–166.

Schaap, H., de Bruijn, E., van der Schaaf, M. F., & Kirschner, P. A. (2009). Students' personal professional theories in competence-based vocational education: The construction of personal knowledge through internalisation and socialisation. *Journal of Vocational Education and Training, 61*(4), 481–494.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. London: Temple Smith.

Tanggaard, L. (2007). Learning at trade vocational school and learning at work: Boundary crossing in apprentices' everyday life. *Journal of Education and Work, 20*(5), 453–466.

Tynjälä, P. (2013). Toward a 3-P model of workplace learning: A literature review. *Vocations and Learning, 6*(1), 11–36.

van Kan, C. A., Ponte, P., & Verloop, N. (2010). How to conduct research on the inherent moral significance of teaching: A phenomenological elaboration of the standard repertory grid application. *Teaching and Teacher Education, 26*(8), 1553–1562.

Van Oers, B. (1998a). From context to contextualising. *Learning and Instruction, 8*(6), 473–488.

Van Oers, B. (1998b). The fallacy of decontextualization. *Mind, Culture, and Activity, 5*(2), 135–142.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wheelahan, L. (2010). *Why knowledge matters in curriculum: A social realist argument*. London: Routledge Taylor & Francis Group.

Wheelahan, L. (2015). Not just skills: What a focus on knowledge means for vocational education. *Journal of Curriculum Studies, 47*(6), 750–762.

Wheelahan, L., & Moodie, G. (2011). *Rethinking skills in vocational education and training: From competencies to capabilities*. Sydney: Board of Vocational Education and Training.

Winch, C. (2013). Education and broad concepts of agency. *Journal of Philosophy of Education, 47*(1), 128–146.

Young, M. (2006). Reforming the further education and training curriculum: An international perspective. In M. Young & J. Gamble (Eds.), *Knowledge, curriculum and qualifications for South African further education* (pp. 46–65). Cape Town: HSRC Press.

Young, M. (2013). Overcoming the crisis in curriculum theory: A knowledge-based approach. *Journal of Curriculum Studies, 45*(2), 101–118.

Zitter, I., Hoeve, A., & de Bruijn, E. (2016). A design perspective on the school-work boundary: A hybrid curriculum model. *Vocations and Learning, 9*(1), 111–131.