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The Challenge of Self-Directed and Self-Regulated Learning in Vocational Education: A Theoretical Analysis and Synthesis of Requirements

Helen Jossberger [1, *], Saskia Brand-Gruwel [1], Henny Boshuizen [1], and Margje van de Wiel [2]

[1] Centre for Learning Sciences and Technologies, Open University of the Netherlands

[2] Faculty of Psychology, Maastricht University

* Correspondence concerning this article should be addressed to Helen Jossberger, Open University of the Netherlands, Centre for Learning Sciences and Technologies, P.O. Box 2960, 6401 DL Heerlen, The Netherlands. T: +31 45 5762730; F: +31 45 5762907; E: helen.jossberger@ou.nl

Abstract

Workplace simulations (WPS), authentic learning environments at school, are increasingly used in vocational education. This article provides a theoretical analysis and synthesis of requirements considering learner skills, characteristics of the learning environment and the role of the teacher that influence good functioning in WPS and foster students' learning. WPS appeal to students' self-directed learning (SDL) and self-regulated learning (SRL) skills, as students are required to work and learn independently in these settings. To achieve individual learning, the environments should be adaptive to the learners needs. Furthermore, the teachers should support learners to become competent in the domain but also guide them to become self-directed learners. To do so the interaction between the student, the teacher and the environment is of importance. The proposed model depicts the different elements and their relations.

Introduction

It is a pedagogical necessity to develop employees that are qualified and adapted to the needs of the workplace (Achtenhagen and Oldenbürger 1996). However, the business community expressed little satisfaction concerning the quality and adaptation of knowledge, skills, and performance of young employees and postulated that school and work were not enough linked to one another (Biemans, Nieuwenhuis, Poell, Mulder, and Wesselink 2004; Gruber, Harteis, and Rehrl 2008; Van Zolingen 2002). In the Netherlands, this situation was recognized in the beginning of the 1990s and has led to an extensive debate.

Policy development was given a boost and the Education Council and the Ministry of Education, Sciences and Cultural Affairs in the Netherlands introduced a national action plan, in which vocational competencies, learning competencies, and career and citizenship competencies got a central role in vocational education (Education Council 1998). Furthermore, technological, economic, and social developments force the educational system to adapt continuously to new contents and requirements. The ministry saw competence-based education as a solution to both problems, that is, to reduce the gap between the dynamic labor market and education and to stimulate lifelong learning (Ministry of Education, Sciences and Cultural Affairs 2004). This trend toward competence-based education is also seen in the USA (US Department of Education, National Center for Educational Statistics 2002) and in various countries in Europe (Descy & Tessaring 2001). In the Netherlands, vocational educational programs have to be competence-based from the first of August 2010. As a consequence, the traditional out of context practical and theoretical lessons are more and more replaced by internships and workplace simulations (WPS). WPS are authentic learning environments at school, which should attract, inspire, and challenge students to acquire knowledge, (learning) skills, and attitude relevant for a vocational

profession. The idea is that students work independently and self-direct their learning (Teurlings and Van der Sanden 1999; Vrieze, Van Kuijk, and Van Kessel 2001). Students are on average fourteen years old when they start working in WPS in pre-vocational secondary education and they continue in upper secondary vocational education. Depending on the professional track, students are aged between eighteen and twenty when they finish upper secondary vocational education.

Many vocational schools have implemented WPS, but the execution varies considerably as the pedagogical concept and approach is not yet sufficiently worked out. And while the innovations have a direct impact on teachers and students, the problems they might face in accomplishing their new tasks and roles have not been considered sufficiently in advance. This lack of knowledge bears the risk that the innovation is doomed to fail before the necessary pedagogical knowledge can be developed.

Difficulties arise when WPS do not function optimally. Teachers have the responsibility to adapt their teaching and acting rather autonomously (Ministry of Education, Sciences, and Culture Affairs 2004), but a lack of deeper insights into workplace simulation learning may lead to educational solutions that do not fit the new formats, as these solutions are rooted in beliefs, experiences and in a teaching skills repertoire developed in traditional environments. This problem, for instance, appeared very persistent in the context of a curriculum innovation in medicine (Dornan, Scherpbier, King, and Boshuizen 2005; Dornan, Hadfield, Brown, Boshuizen, and Scherpbier 2005). For vocational students, the implementation of WPS means that they are required to work independently; yet research has pointed out that especially students in vocational education face difficulties as they do not know what to do or have preferences for specific activities at the cost of key activities (Beckers, Jacobs, and Kerkhoffs 2005; Rozema,

Sniekers, Meijs, Van Son, and Kerkhoffs 2004). Thus, it became clear that the policy developments introduced new problems in vocational education that require a solution. We propose that a solution needs to take into account characteristics of the learning environment, the teacher, and the student and should identify requirements to learn and work effectively in WPS. Research in other fields identified self-directed learning (SDL) and self-regulated learning (SRL) as key skills to keep on learning and to achieve high quality performance (e.g., Knowles 1975; Van de Wiel, Szegedi, and Weggeman 2004; Zimmerman 2006). These skills also seem relevant for students to engage actively in WPS learning to cope with individual independence and task demands (cf. Van Grinsven and Tillema 2006). To foster the development of SDL and SRL skills in WPS, the learning environment and the guidance of the teacher play an important role and need to be designed accordingly, but so far not much is known about how the teacher can best support the development of these skills in vocational education. Previous empirical research on SRL and SDL has focused primarily on academic learning, but it appears important to explore the concepts also in the context of vocational education to help improve learning from practical experience and engage students in processes that are desirable in occupational settings (cf. Biemans et al. 2004; Kuipers and Meijers 2009).

The central aim of the present study is to develop an understanding of SDL and SRL, the design of the learning environment, and the role of the teacher and explore how these factors can shed light on workplace simulation learning. A theoretical model of requirements is developed that identifies success factors related to learning in WPS. More specifically, we want to answer the following question: Which characteristics of the student, the learning environment, and the teacher influence good functioning in WPS and foster students' learning? To optimize student learning, it seems important to look further than the influence of isolated factors or the sum of

parts. Student learning takes place in a social environment, in which students and teachers interact with each other in a learning environment.

First, we describe the role of SDL (a concept prevalent in adult education) and SRL (a concept prevalent in educational psychology) and their relationship to determine the characteristics of skillful learners in workplace simulations. Then, we focus on the design of the learning environment, the role of the teacher, and the interaction between the student and the teacher in the learning environment to develop new and effective teaching-learning processes in the direction of SDL within vocational education. These theoretical elaborations result in a model to foster successful learning in WPS in vocational education. Throughout the article, three personas – that is, constructed practical examples based on observations in a professional cooking training – are provided to illustrate studying behaviors, the design characteristics of the learning environment, and the role of the teacher. These personas, Lisa, Mike, and Kevin are used to enhance reality and show how a learner in vocational education might look like (Grudin 2006).

Skills for Learning in Workplace Simulations

Workplace simulations put emphasis on independent learning. What and how students learn seems to depend on their own ability to create learning opportunities independently and actively. They should be able to identify and formulate their learning needs. Moreover, insight into their own learning processes is essential to plan, monitor, and evaluate their task performance, to choose an appropriate learning path and to focus on performance aspects that need improvement (Ericsson 2006; Kicken, Brand-Gruwel, and Van Merriënboer 2008). These processes are related to the concepts of SDL and SRL.

At first sight, SDL and SRL seem highly similar. The concepts are difficult to distinguish, as terminology is often used interchangeably or in a similar way in the literature (Bolhuis 2003; Boekaerts and Corno 2005; Dinsmore, Alexander, and Loughlin 2008; Schreiber 1998). The theoretical background and empirical methods, however, differ respectively (Schreiber 1998) and we believe that the concepts should not simply be used synonymously. We propose a coherent perspective and link SDL and SRL, which has practical implications for vocational education. From our point of view, vocational students can and should acquire SDL and SRL skills to work and learn effectively in WPS and in future occupations, but we ascribe these skills to different levels. We suggest that SDL is situated at the macro level and basically refers to the planning of the learning trajectory, while SRL concerns the micro level that deals with the execution of a task. In the following subsections, we review previous research to develop an understanding of the concepts by describing them on a macro and micro level and explore how they can shed light on workplace simulation learning.

Self-Directed Learning: The Macro Level

Knowles (1975) described *self-directed learning* as "a process in which individuals take initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles 1975, 18). Although the concept of SDL was introduced in adult education, Knowles pointed out that SDL does not exclusively apply to adults. Leith (2002), for instance, indicated that once a person starts seeing herself or himself as an adult, s/he has an expectation of being independent in decision-making. When students see themselves as adults who are responsible for their own future, they are more motivated and self-directed.

Knowles' definition of SDL is cited frequently but the concept is fraught with confusion. Both Candy (1991) and Brockett and Hiemstra (1991) stated that a clear distinction between SDL as an instructional process and SDL as a personality construct was needed. Brockett and Hiemstra developed a conceptual framework for understanding self-directed learning, called PRO – Personality Responsibility Orientation – in which they differentiate between personal responsibility, self-directed learning, learner self-direction, and self-direction in learning. The idea was to cover the breadth of the construct within a single framework that includes personality characteristics and instructional method. In this framework *personal responsibility* is seen as a starting point and refers to the fact that individuals need to be owners of their thoughts and actions and they should have - or be willing to take - control over how to respond to a situation without ignoring the social context. The freedom of making choices, however, also indicates that learners need to be able to make good choices during their learning process (Brockett 2006), and they have to be responsible for the consequences of their thoughts and actions. Personal responsibility is closely related to autonomy. *Self-directed learning* refers to an instructional method, which stresses a process orientation that focuses on the activities of planning, implementing, and evaluating learning. A close link between teaching and learning is required. This perspective was the point of departure of Knowles in 1975; however, understanding the personal characteristics of successful self-directed learners was stressed as well. *Learner self-direction* in the PRO model refers to this personal aspect of the learner, the personal characteristics an individual needs to possess to take primary responsibility for personal learning accomplishments (such as intellectual development, self concept or creativity) (Brockett and Hiemstra 1991). A proactive personality was also found to be highly predictive for self-directed learning (Raemdonck 2006). According to Brockett and Hiemstra (1991) the vital link is *self-*

direction in learning, which refers to both the external characteristics of an instructional process and the internal characteristics of the learner. These authors assume that there is a strong connection between self-directed learning and learner self-direction. External and internal characteristics should match, so that the teaching-learning situation fits the needs and desires of the learner and the social context in which learning takes place (Brockett and Hiemstra 1991). The external conditions of the learning environment, which we discuss in more details later, play an important role in allowing self-directed learning, as learners seem to need the freedom to choose their learning activities.

Different authors have described characteristics of a skillful self-directed learner, like initiative, intentions, choices, freedom, energy, responsibility (Tough 1979 in Levett-Jones 2005), the ability to learn on one's own, personal responsibility for the internal cognitive and motivational aspects of learning (Garrison 1997), independence, autonomy, and the ability to control own affairs (Candy 1991). These descriptions highlight a key aspect of SDL, namely that the learner determines planning and execution of her/his learning trajectory on the long term. A learning trajectory in WPS includes several tasks that are selected by students themselves.

From our point of view, self-directed learning is therefore situated at the macro level, which means that it concerns a learning trajectory as a whole; a self-directed learner is able to decide what needs to be learned next and how one's learning is best accomplished. A skillful self-directed learner is able to diagnose learning needs, formulate learning goals, identify and choose human and material resources for learning (cf. Knowles 1975; Kicken, et al. 2008). This indicates that a self-directed learner is able, ready and willing to prepare, execute, and complete learning independently (Van Hout-Wolters, Simons, and Volet 2000). To illustrate this for WPS consider the following persona, Lisa. *Lisa is enrolled in a professional cooking training. She*

likes cooking a lot and in addition to cooking at school, she also prepares dinner regularly at home. So far, she sticks to the recipes in cookbooks and she is able to prepare the dish according to the recipe. But she feels that cooking is more than just following a recipe; it is a creative task that requires a lot of knowledge. She realizes that she needs to learn more about menu principles and decides that she wants to focus on the composition of a menu taking into consideration various international influences. Lisa thinks that she has made a good decision for improving her cooking competencies without neglecting the training of the basic skills. Lisa asks the teacher about the possibilities and informs about useful reading material.

The example of Lisa shows that she takes the initiative to think about her learning needs and learning goals in order to improve her cooking competencies. To accomplish her learning goal, she needs to consider her learning trajectory, which includes a variety of tasks. Along the road, she will diagnose new learning needs and formulate new learning goals to determine the direction of her learning trajectory. This is a complex and difficult process, and it is a misconception to believe that learners are automatically self-directed. One might even argue that it is not always necessary to be self-directed to become a successful learner (Brockett and Hiemstra 1991). But if the goal of vocational education is to achieve self-direction in learning and give learners more freedom to choose their learning activities to suit individual needs (and we believe it is), then learners should learn to self direct. We propose that a first step in learning to self-direct one's learning is the skill to self-regulate learning activities and task performances, because the quality of performed tasks and activities will be input for future learning.

Self-Regulated Learning: The Micro Level

SRL in educational psychology can provide a valuable contribution to our understanding of the underlying learning processes of SDL important in workplace simulations. While SDL is

situated at the macro level, we propose that SRL is the micro level, which concerns processes within task execution. We agree with Loyens and colleagues (Loyens, Magda, and Rikers 2008) that SDL includes SRL, but that the opposite does not hold. In other words, a self-directed learner is supposed to also self-regulate, but a self-regulated learner does not have to self-direct at all. From this point of view, SRL deals more with subsequent steps in the learning process (Loyens et al. 2008). However, providing students with opportunities for self-directed practice can help to improve their self-regulation. Students need to have opportunities (e.g., during homework or studying) to rehearse and practice in order to routinize their skills (Zimmerman 1998; Schunk 2004).

A variety of perspectives on SRL exist and researchers with different foci attempt to model how cognitive, meta-cognitive, motivational, and contextual factors influence the learning process (e.g., Boekaerts 1997; Pintrich 2003; Zimmerman 2002). According to Zimmerman (1989, 329), “students can be described as self-regulated to the degree that they are metacognitively, motivationally, and behaviorally active participants in their own learning process”. This definition is based on social cognitive theory. Within this perspective, human learning occurs in a social environment and is determined by the reciprocal interactions among personal, behavioral, and environmental influences (Bandura 1986; Schunk 2004).

Zimmerman (2000a, 2006) describes three phases and underlying sub-processes that involve behavioral, environmental, and covert self-regulation. Research has indicated quantitative and qualitative differences in regulation processes and activities between more and less skillful learners (De Jong 1992; Schunk and Zimmerman 1998).

Forethought phase. This first phase can be described as a preparation phase, in which the learner orientates on and plans the steps to be taken for a learning task. Self-regulated learners

analyze the learning task, set a clear goal, make a plan, and select strategies for achieving the goal. Task demands and personal resources must be considered before beginning a task so that potential obstacles can be identified (Ertmer and Newby 1996; Zimmerman 2000a, 2006). Self-motivational beliefs including self-efficacy, outcome expectations, task value, and goal orientation, underlie the efforts to self-regulate (Zimmerman 2000a, 2006). The empirical research of Pintrich (1999) indicates that self-efficacy, task value, and mastery goal orientation are positively related to SRL. Especially self-efficacy turned out to be highly predictive for students' motivation and learning (Zimmerman 2000b) and the desire to succeed is seen as an important factor for success (Zimmerman 2000a, 2006). Motivational beliefs promote and sustain SRL because students are more likely to invest time and effort using various strategies (Zimmerman and Schunk 2008). Research reveals that naive learners in the forethought phase start off with rather non-specific distal goals that focus on performance aspects, while skillful learners apply specific hierarchical goals that focus on learning. Skillful learners in contrast to naive learners perceive themselves to be more self-efficacious and they report significantly greater intrinsic interest in learning tasks (Pintrich 1999; Zimmerman 1998).

Performance phase. In this second phase, monitoring and adjusting are central activities during the learning process. Monitoring is essential, as learners should be constantly aware of what they are doing by looking back at the plan and looking forward at the steps that still need to be performed to achieve the goal in mind. When learners realize that things do not work out as planned, they need to adjust their approach. Strategies and techniques are applied, such as self-control and self-observation that help the learner focus on the task and improve performance. Self-control includes task strategies, imagery, self-instruction, time management, environmental structuring, and help seeking, whereas self-observation includes self-monitoring and self-

recording. When learners gain experience with a task, self-regulation can become partly automatic (Zimmerman 2000a, 2006). Skillful learners are able to concentrate and focus their attention on the learning task and their performance, they are more likely to use systematic guides or techniques, and monitor their process (Zimmerman 1998). Therefore, they are more likely to detect discrepancies in learning and changes in their progress. As a consequence, the learner can adjust, adapt, fine-tune or abandon her/his learning strategy and identify, retrieve, and seek new information (Winne 1995). Naive learners are easily distracted by internal or external factors, such as their thoughts or surroundings, and there is some evidence that they even tend to adopt self-handicapping strategies, such as deliberately exerting low effort to make failure attributable to circumstances instead of one's own ability (Garcia and Pintrich 1994). Systematic monitoring of the learning progress is not carried out (Zimmerman 1998).

Reflection phase. Assessing and evaluating are key activities in the third phase of the learning cycle and are comparable with the terms self-judgment en self-reaction that Zimmerman uses. Self-judgment includes self-evaluation and causal attribution and self-reaction includes self-satisfaction/affect and adaptive/defensive inferences as predominant processes. After having accomplished the task, it is essential that learners evaluate the effectiveness and efficiency of the plan and their strategy use (Ertmer and Newby 1996; Zimmerman 2000a, 2006). Evaluating their process and reflecting on experience can increase learning from actual experience and can eventually be used in the future (Ertmer and Newby 1996; Fowler 2008). Reflection is therefore critical for the link between previous learning experiences and future learning experiences because by reflecting a learner can draw on previous knowledge to gain new knowledge (Ertmer and Newby 1996). During the reflection phase skillful learners seek opportunities to self-evaluate their learning progress and they strive to enhance their performance. A negative

outcome is attributed to wrong strategies and these learners can systematically improve their performance based on the adaptive strategies used, which results in a positive approach in the next forethought phase. In contrast, naive learners have difficulties to self-evaluate their learning progress; they avoid opportunities to do so or judge their performance on the basis of normative comparisons. Naive learners tend to attribute a negative outcome to a lack of ability. Consequently, they are unsystematic in their methods of adaptations, which can lead to negative self-reactions (Zimmerman 1998).

In Table 1 we illustrate, using the phases of Zimmerman (1989), the differences between learners by introducing the personas Mike and Kevin. We take a look at their approaches upon hearing that they need to prepare the appetizers for the graduate party the next evening.

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When students use self-regulated learning skills and are able to assess their own performance, they can gather information about their level of understanding, evaluate their effort and use of strategies, take into account attributions and opinions of others, and check how they improved in relation to their goals and expectations (Hattie and Timperley 2007). It might be easier to start with learning to apply self-regulation skills to a task first instead of learning to plan the learning trajectory at once, because it is closer to a specific goal. When learners are skilled enough to regulate their learning on task level, they have accomplished important skills that function as foundation, from which students can proceed to self-direct their learning.

Combining Self-Regulated and Self-Directed Learning for Learning in WPS

Students' SRL and SDL skills are regarded relevant to become successful in workplace simulations. At the micro level, that is the task level, important self-regulatory processes are orienting and planning in the forethought phase, monitoring and adjusting in the performance

phase, and assessing and evaluating in the reflection phase. Skillful learners direct the regulatory processes to the task, the self, and the context. Especially setting specific goals that focus on learning, planning the learning task, organizing information and resources, and adjusting the process by reflecting and assessing strategy use appear to be important student activities at the micro level in workplace simulations. In fact, SRL appears to be the foundation for self-directed learning.

At the macro level, the scope is wider as it exceeds the task level by the planning of the own learning trajectory. SDL therefore encompasses SRL. Feeling responsible and taking initiative are relevant characteristics to self-direct one's learning but, at the same time, self-direction also indicates two prerequisites. We suggest that a first prerequisite is a will to learn, which refers to a desire to learn, openness and curiosity to try things out, and being alert and fully mindful to new influences and ideas. According to Van Eekelen, Vermunt, and Boshuizen (2006) teachers differ remarkably in how they approach their own learning and deal with experience. Some of them are eager to learn, others do not see a need to learn or they do not know how to learn. This might also be the case for students in workplace simulations; willingness seems to be an important factor for successful learning. A second prerequisite for self-directed learning is the possibility to choose (Brockett 2006) and the degrees of control learners have (Loyens et al. 2008).

Research reported so far suggest that SRL and SDL skills can be useful in all learning situations – no matter if it concerns professional or academic settings – as they make individuals enter learning situations more purposefully. We claim, however, that in workplace simulations, SRL and SDL may get an extra edge because these learning environments require students to learn from practical experiences and they need to seek information and opportunities for learning

more actively in contrast to traditional practice rooms. Consequently, by being able to self-regulate and self-direct one's own learning students can create more structure to deal effectively with the independence, which can finally also help them on their road to becoming qualified and adaptive employees. As much of the learning is supposed to take place at the learner's own initiative and students who are self-directed should benefit more from their learning experiences (Mala-Maung, Abas, and Abdullah 2007). Those who take initiative are likely to "(1) learn more, and learn better, than those who wait passively to be taught; (2) enter into learning more purposefully and with greater motivation, and (3) tend to retain and make use of what they learn better and longer than do the reactive learners" (Knowles 1975, 14). Research showed that young people with relatively more self-initiative, flexibility, purposefulness, and agency have better vocational and life trajectories (Blustein, Phillips, Jobin-Davis, Finkelberg, and Roarke 1997; Blustein, Juntunen, and Worthington 2000; Pinquart, Juang, and Silbereisen 2003).

Furthermore, students ought to learn from experience through active involvement, solving problems, and working independently. Learning by doing is important in workplace simulations but students also need to think and reflect on actions so that learning becomes more meaningful (cf. Mayer 2004; Schön 1983). Research on learning in academic settings suggests that learners need to make sense of "the presented material by selecting relevant incoming information, organizing it into a coherent structure, and integrating it with other organized knowledge" (Mayer 2004, 17), which seems also applicable to vocational education. Learners, who use appropriate learning strategies, are able to regulate and direct their learning, and practice vocational skills deliberately, are expected to reach higher levels of performance as they gain better practical insights and skills. For learners poor in these skills, workplace simulations are likely to pose difficulties because they do not know how to get the best out of learning

possibilities. If it becomes too difficult or students do not know how to handle the challenge, they might lose track. As a consequence, it seems possible that students lose their interest and motivation so that they might eventually drop out.

To be successful in workplace simulations, we expect learners to take responsibility for learning both at a micro and a macro level and are expected to approach a task independently and actively with intrinsic interest and a will to learn. They should seek assistance when needed and hold positive beliefs about own capabilities. SRL can help learners to develop both knowledge and skills more effectively, but using self-regulatory processes will not automatically produce high levels of performance. Both external support and self-directed practice is needed for optimal learning and a superior performance (Zimmerman 2006).

Both concepts, SRL and SDL, do not concern a dichotomous condition of present or absent but rather regard a collection of processes and levels of control that may be present in varying degrees on continuums. By viewing the concepts as continuums, it is possible to help learners to achieve SDL and help them improve their skills to be self-regulating (Candy 1991). A meta-analysis of Dignath, Buettner, and Langfeldt (2008) found that training interventions of self-regulated learning were most effective when they had a social cognitive foundation or were based on a combination of social cognitive and metacognitive theories. To foster the development of SRL and SDL skills in workplace simulations, an adaptive learning environment and teacher support play an important role and need to be designed accordingly.

Design of Workplace Simulations for Self-Directed Learning

Imagine the following situation. You enter a school building and are welcomed at a reception desk, on your right you see the entrance to a restaurant and next to it there is a big kitchen. When you look inside the kitchen you can spot a cold-storage room, a dishwashing area,

and several individual kitchen units. Each kitchen unit has a cooker, a baking oven, a compartment for pots and pans, a drawer for cooking utensils, and a working station. Teenagers in cooking uniforms are all around the place, looking up information in a cookbook, cutting vegetables, garnishing plates, roasting or frying something. Teachers help when necessary, explain, give instructions, guide students' learning processes, and finally evaluate the students' work attitude and their task performance.

This scenario is a description of a professional cooking training in vocational education, which implemented WPS. WPS are authentic and practical learning environments at school, in which the (future) work situation forms the basis (Hoogenberg and Teurlings 2002); they differ from traditional practical learning settings as they go beyond mere practice. The traditional practical learning setting is characterized by a teacher-directed approach, an emphasis on transmitting knowledge by lecturing. That means the teacher demonstrates the task first, while all students observe and then perform the task themselves. The traditional practical learning environment does not resemble the future workplace setting and all students are dealing with identical study material (tasks out of context) at the same time, which leaves little room for the individual needs. In WPS, a student-centered approach, however, several new pedagogical principles are introduced to make learning more active including 1) authentic setting, 2) integration of theory and practice, and 3) adaptive learning (cf. Vrieze et al. 2001). In the following subsections, these principles are described and it is elaborated on what they mean for the design of WPS.

The Principle of Authentic Setting

The concept of powerful learning environment is increasingly used to describe learning environments that aim at the development of complex skills, deep conceptual understanding, and

metacognitive skills. These learning environments are based on a constructivist learning approach, in which learning is seen as an active and constructive process. Learning should be embedded in an authentic context that is problem-based and offers opportunities for social interaction through collaborative learning (e.g., Dochy, Segers, Gijbels, and Van den Bossche 2002; Könings, Brand-Gruwel, and Van Merriënboer 2005; Van Merriënboer and Paas 2003; Vermunt 2003). WPS can be described as powerful learning environments in which students learn with each other by practicing realistic everyday tasks of a work field. Simulated learning environments in comparison to a real work setting have the advantage that students can develop and improve skills by practicing with well-designed tasks in a safe and controlled environment (Van Merriënboer and Kirschner 2007). Students can experiment actively with realistic problems and can experience essential elements of the workplace without being too afraid of making errors (Cairns 1995; Ogg and Kollaard 2001). Simulations are also expected to increase arousal, motivation, task-engagement, and the quality of problem-solving (Cairns 1995).

The authentic nature of WPS brings the workplace situation into school. It is not only important that students learn the know-how of the subject; they should also get acquainted with the working situation, which includes a certain work attitude of students concerning aspects such as collaboration and communication (Vrieze et al. 2001). Although the level of authenticity and implementation may vary, the advantage of learning in these practical formats is that traditional vocational skills, generic skills, and domain knowledge are integrated. In WPS, students fulfill different roles (e.g., workplace assistant, dishwasher or chef cook) that comprise a variety of tasks. A workplace assistant, for instance, captures organizational or administrative tasks such as controlling the storage and stock or distributing foodstuffs and kitchen utensils, while a chef cook is responsible for activities in the kitchen such as timing and the visual presentation of

dishes. The different roles make learning more authentic, because students encounter similar tasks and activities as professionals in the work field. Additionally, students are required to take over more responsibility from the teacher, for example dealing out learning material and checking multiple choice assignments (Vrieze et al. 2001). To realize the principle of authenticity, it is important to design the learning tasks accordingly.

Learning tasks should be complex, realistic, and challenging (Van Merriënboer and Paas 2003) and should foster high-quality learning (Vermunt 2003). WPS by their very nature should provide students with whole authentic tasks that are realistic in correspondence to the real world. Working with whole tasks is thought to be advantageous because learners immediately acquire a complete view of the whole skill and are confronted with all constituent skills. However, whole tasks can be rather complex and in order to simplify task performance, they can be organize from simple-to-complex (Van Merriënboer and Paas 2003; Van Merriënboer and Kirschner 2007). Take for example a menu that students need to prepare. A menu can have various different courses and it is easier to prepare a three course menu than a five course menu. Moreover, the preparation of the dish can be more or less complex; making a fruit salad is less difficult dessert than making a pudding.

In WPS, a task usually starts with the description of a case such as '*In the restaurant you are working, the manager informs the kitchen that a group of regular guests has reserved a table for the next evening. Instead of choosing courses from the fixed menu, they would like to have a four-course seafood menu. The chef cook gives you and your colleague the task to compose the seafood menu and to think about a dessert that nicely goes with it. '* This fictive case can trigger students to think about several matters like planning, products, preparation, presentation, method, and expenses. Because of the similarity between simulation and real-life, students can train

general skills (such as collaborating and communicating in a team) and vocational skills (such as applying menu principles and preparing seafood).

The Principle of Integrating Theory and Practice

Integrating theory and practice seems especially relevant for vocational education. Ogg and Kollaard (2001) describe students in vocational education as 'do-learners', which suggests that learning of theories alone is insufficient for these students to connect and apply the theory to the context. Experiential learning plays an important role in WPS. Research in other fields (e.g., medical education) has also indicated that students perceive active involvement or learning by doing as a valuable learning process (Wagenaar, Scherpbier, Boshuizen, and Van der Vleuten 2003). It seems essential that students have the opportunity to develop practical skills and gain experience with vocational practice. WPS can provide this opportunity because these learning environments offer students the possibility to apply knowledge and skills in an authentic practice-oriented context. In WPS, theory and practice are integrated as much as possible; students learn the theory so that they can accomplish the practical tasks. Through the experience, students can imagine the requirements of further education and for future work settings more easily (Ogg and Kollaard 2001). The underlying idea is that students are more motivated when they see the link between theory and practice. Teachers indicate that students are more attentive and able to learn independently in WPS (Vrieze et al. 2001). Although this is promising, Fowler (2008) points out that it is not just any experience that results in learning. Learning depends on a meaningful interaction between high quality experience and reflection and this interaction should therefore be facilitated to enhance learning (Fowler 2008; Ertmer and Newby 1996; Schön 1883; Schunk and Zimmerman 1998).

Departing from authentic learning tasks, supportive information is an important design aspect that should be considered when realizing the principle of integrating theory and practice. The given information should provide a bridge between the theoretical knowledge of the student and the knowledge they need for performing the practical task (cf. Van Merriënboer and Kirschner 2007). Complex learning involves the development of a rich, interconnected knowledge base in which knowledge, skills, and attitudes are integrated. The information provided for the learner is dependent on learners' prior knowledge and necessary knowledge about a certain domain (e.g., you can only "compose a seafood menu" if you know enough about seafood considering preparation, season, menu and taste principles). Supportive information can help learners to develop an understanding of a domain and a subject matter problem so that they are able to work successfully on the learning task (Van Merriënboer and Kirschner 2007). In our example, supportive information might be a variety of textbooks and cookbooks with recipes, film material or websites with information about seasonal food. The theoretical information and knowledge should match the requirements of the practical task in WPS.

The Principle of Adaptive Learning

The idea behind adaptive learning, based on Vrieze and colleagues (2001), is that independent and self-directed learning in WPS is supported. Learners are regarded active participants, but they vary in how much they have accomplished SRL and SDL skills in order to work and learn independently. Therefore, an adaptive approach seems appropriate to allow students to work at their own level and pace (cf. Vrieze et al. 2001). Worksheets are used to facilitate independent work of students in WPS; they integrate a theoretical task, a preparation task, and an executive task. This study material should direct and guide students' learning process of vocational skills (Vrieze et al. 2001), so that they can develop vocational competence.

Consequently, it is important to assess competencies including traditional vocational skills, generic skills, domain knowledge, attitude, and learning skills that are relevant qualities for the labor market. Assessment should be used as a "tool for learning". The underlying argument is that assessments can drive and foster learning. There are many different ways to assess performance, such as formative (assessment for learning) and summative (assessment of learning) assessments that also serve various purposes (Segers and Dochy 2006). Formative assessments, such as self-assessments, peer-assessments, performance assessments, learning journals, and development portfolios, seem more suitable for workplace simulation learning as they focus on the learning progress and the quality of performance rather than on pass/fail decisions like in summative assessments (Birenbaum 2003; Segers, Dochy, and Cascallar 2003). Although formative assessments are expected to improve learning they can occasionally fail if students do not know how to accomplish a task (Birenbaum 2003).

Although learning tasks clarify what learners need to do, more support for the learning process can be provided by making performance and assessment criteria transparent, so that learning intentions and success becomes clear (see Table 2). But telling students what they need to learn is not enough; information on how learning looks like when it is successful can help learners in understanding the processes and strategies of getting to a certain answer (Hattie 2009). Students need to be aware of their own strengths and weaknesses to be able to choose a learning task and plan their learning trajectory (Knowles 1975). An integrated set of performance objectives can provide detailed descriptions of what is expected as acceptable performance outcomes (Van Merriënboer and Paas 2003; Van Merriënboer and Kirschner 2007).

According to Kicken et al. (2008) a development portfolio can be a useful tool for students to help them assess their learning process, diagnose learning needs, and formulate

learning goals. Being able to self-assess prior knowledge and performance is a necessary SDL skill to determine the next steps to be taken in the learning process. In an optimal situation, the degree to which learners are self-directed is congruent to the possibility of being self-directed in the learning environment (Hill and Song 2007). This indicates that learners should be able to choose from a pool of learning tasks. Students need to be familiar with the possibilities and need to know which sources they can select so that they can determine their own learning trajectory (cf. Hill and Song 2007). Only if the learning environment is adaptive, it can account for student differences, allow students to make choices in order to become self-directed learners. Therefore, WPS need to be designed accordingly.

<INSERT TABLE 2 ABOUT HERE>

To realize the three basic principles of WPS, they need to be carefully designed so that they can take into account the prior knowledge and skills of the learners. It is necessary that the educational setting provides the external conditions that foster the development of vocational competencies and facilitate SDL. The interaction between student and leaning environment will further define the activities and strategies of the student that influence learning (Hill and Song 2007). Important components in WPS are well-designed learning tasks, supportive information, as well as assessment and performance criteria. A pool of authentic learning tasks can trigger active involvement and offers the opportunity to make decisions about the learning trajectory. Performance and assessment criteria that are clearly stated can make the learning process more visible and learning needs become more transparent which should enable optimal learning (Kicken et al. 2008; Hattie 2009; Sluijsmans, Brand-Gruwel, Van Merriënboer, and Martens 2004). A well-designed learning environment functions as a tool, but it is important to use instructional methods that promote appropriate processing in learners, account for learner

differences, and trigger SRL and SDL so that optimal learning can be achieved. Here, the teacher comes into play.

The Role of the Teacher

Teachers have various tasks in preparing students for the labor market. On the one hand, teachers are expected to teach students vocational competencies and on the other hand, they need to support the development of SRL and SDL skills, because these skills are instrumental for vocational competencies. Helping students to become self-directed learners should therefore be seen in the light of developing vocational competence.

Some students struggle with their SDL skills or might not even have acquired them yet and therefore prefer to be instructed by a teacher. SDL can be difficult, because students have to perceive a learning need and estimate how much they already know and how much they want and need to learn. As SDL skills do not develop by chance, support by a teacher is needed to guide students in diagnosing learning needs, formulating goals, and planning their learning (Timmins 2008). Whether and how much self-direction learners develop, therefore, depends on the assistance and support they get, which in turn should be adapted to the learner's level.

The teacher can take different roles when guiding students' learning. Based on the results of a synthesis of 800 meta-analyses, Hattie (2009) has a preference for teachers as activators rather than facilitators. An activator acts as a change agent, who engages in reciprocal teaching. The following characteristics of an activator have been identified to be effective: feedback, direct instruction, and teaching students meta-cognitive strategies (Hattie 2009). In terms of SRL and SDL it is suggested to be advantageous to start off with an activating form of guidance in the beginning and to move to a more facilitating one when students are on their road of becoming self-directed learners, because then students will take over responsibility for their own learning

and only need a teacher as facilitator who stimulates the learning progress. In the following subsections, we zoom in on teachers' role in supporting SRL and SDL skills by considering giving feedback, providing direct instruction in SRL, and increasing responsibility of learners to become self-directed.

The Strength of Feedback

Feedback has been identified to be the most powerful influence on learning and achievement (Hattie and Timperley 2007). Feedback can be defined as "information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (Hattie and Timperley 2007, 81) and it is "information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies" (Winne and Butler 1994, 5740).

Feedback aims to close the gap between the current level of performance/understanding and the desired one that needs to be reached. In order to reduce this discrepancy, three questions need to be addressed by effective feedback, including "Where am I going?", "How am I going?", and "Where to next?" (Hattie and Timperley 2007). The three questions work together and have the power to trigger learners to initiate further actions. According to Hattie and Timperley, the effectiveness of feedback depends on its focus, which can be distinguished into four levels. Feedback can concern the task level, the process level, the self-regulation level or the self level. Deep processing and mastery of tasks are especially promoted by feedback on process level and self-regulation level because this feedback is related to learning (Hattie and Timperley 2007). The focus should be on the learning process, teaching students how to learn, setting learning goals, choosing and executing learning activities, diagnosing and monitoring the learning

process, and evaluating learning results (Bolhuis and Voeten 2001). It is important that students and teachers set and communicate appropriate, specific, and challenging goals. Challenge gets students engaged and teachers, who assist students with feedback to accomplish challenging goals, enhance students' commitment or increase their efforts. Feedback works powerfully when there is a lack of knowledge and when there is an incredible amount of challenge. But it should be clear that it is not simply the amount of feedback that matters. More important is the nature of feedback, the timing, and the way students receive and perceive the feedback (Hattie and Timperley 2007). Research has indicated that students feel most involved and motivated when they get support from their teachers, including organizational, pedagogical, or affective feedback (Dornan et al. 2005).

According to Zimmerman, Bonner and Kovach (1996) teachers should implement a self-regulatory cycle, in which they assist and empower students to self-observe their effectiveness. Teachers should support and encourage students by providing specific, personalized feedback. Feedback, such as correcting content or learning and rewarding, is important and leads to on-going revisions on executive and regulative elements (Bolhuis and Voeten 2001). Self-regulated and self-directed learners are expected to know when and how to seek feedback from others and are willing to invest effort in looking for and working on feedback. However, when the cost/benefit analysis, reveals negative effects, then students will withdraw from feedback seeking behavior (Hattie and Timperley 2007).

It seems important that WPS are a place, in which asking for feedback and receiving feedback becomes a daily practice in the interaction between teacher and student. Feedback can help students to get actively involved in the learning process and they can acquire learning competencies that prepare them for their future professional life.

Direct Instruction in Self-Regulated Learning

Different aspects of instruction and teacher behavior have been identified in research that effect students self-regulated learning including clarity and pace of instruction, the amount of structure provided, autonomy granted, teacher enthusiasm, humor, fairness, and teacher expectations about students' capacity (Boekaerts and Cascallar 2006). Teachers can provide information, assistance, and opportunities so that students become strategic, motivated, and independent learners, which can be achieved by reducing competition, clarifying appropriate strategies, helping during problem solving, and creating an atmosphere of collaboration (Paris and Newman 1990; Paris and Paris 2001).

Moreover, explicit training in self-regulatory techniques, including (1) self-evaluation and monitoring, (2) planning and goal setting, (3) strategy implementation and monitoring, (4) outcome monitoring and strategy refinement, can be effective if teachers use a systematic instructional approach. Concentrating on the learning process before attending to the learning outcome can encourage students to continue spending effort on the development of SRL and SDL skills (Zimmerman, Bonner, and Kovach 1996).

Bielaczyc, Pirolli, and Brown (1995) found that performance largely improved when training included self-explanation strategies and self-regulation strategies ((a) monitoring comprehension and learning activities and (b) clarifying and addressing comprehension failures). Training improved students' study strategies, which in turn resulted in improved cognitive skill acquisition and performance. Bielaczyc and her colleagues concluded that several factors are responsible for the effectiveness of strategies including prior knowledge, quality of the content of an explanation, cohesiveness and clarity of the learning material and the state of one's evolving understanding.

Teachers can build a learning environment in which students develop self-regulation and error detection skills (Hattie, Biggs, and Purdie 1996). A supportive environment with a positive classroom climate should be created in which the teacher is aware of the emotional and social aspects of learning (Bolhuis and Voeten 2001) and in which teachers provide clear instructions and stimulate the learner's development (Zimmerman et al. 1996).

Moreover, practice turned out to be a crucial element for progress and the development of superior achievement. But mere practice is not enough to overcome weaknesses in performance. Improvement of performance is affected by both how much and how learners practice. Ericsson has called those practice activities that focus sequentially on improving one specified aspect of performance at a time 'deliberate practice'. These are structured goal-directed training activities, which are adapted to the learners' level to maximize improvement. Deliberate practice consists of well-designed tasks, informative feedback, and repetition. Self-reflection, motivation, and endurance are essential characteristics that help the learner to persevere with deliberate practice activities, which are often difficult, laborious, and not always pleasant (Ericsson et al. 1993; Ericsson and Charness 1994). These activities show high overlap with key elements of self-regulated learning (Van de Wiel, Szegedi, and Weggeman 2004; Zimmerman 2006). It became clear that performance level could be increased as a result of deliberate efforts to improve (Ericsson 2005). For example, positive correlations between aspects of deliberate practice (self-study, study resources, planning, study style, and motivation) and study achievements were found in the studies of Moulaert, Verwijnen, Rikers, and Scherpbier (2004) and Ericsson (2005).

So far, however, training interventions for SRL have been mainly directed to academic skills such as reading and writing, cognitive engagement or self-assessment. Although these skills are also relevant for vocational education, there is an additional practical experience

component involved in WPS that needs to be considered. According to Paris and Paris (2001), children can acquire and improve their understanding of SRL in different ways, including indirect experience, direct instruction, and practice. We think that all three aspects are relevant for learning in WPS and should therefore be taken into account when promoting SRL and SDL skills in vocational education. It is the responsibility of the teacher to foster SRL skills in the light of acquiring vocational skills and at the same time supporting SDL skills by allowing students to take initiative for their learning trajectories.

Increasing the Responsibility of Learners to Become Self-Directed

In order to increase self-directed learning, responsibility should gradually be transferred to the student (Vermunt 2006; Zimmerman, Bonner, and Kovach 1996). Gradual transfer can mean that teachers start with modeling, which includes explaining and demonstrating, and then move on to activating students to participate by asking questions, involving them in subject matter, listening to their ideas, and closely monitoring students' activities.

Moreover, teachers should support self-directed learning by allowing students to take initiative and at the same time they should be proactive and comfortable with learners taking initiative in the learning process (Ricard 2007). That means creating possibilities in which learners make choices, as choice can promote motivation and learning. However, controversial findings concerning the effects of choice have been reported. In a review study, Katz and Assor (2007) addressed the controversy regarding the value of offering choices by taking a close look at when choice motivates and when it does not. They state that choice can either be need-frustrating or need-satisfying. They indicate that 'choosing' should not be confused with 'picking'. 'Choosing' refers to 'meaningful realization of individual's desires or preferences' while 'picking' is a type of choice that 'does not involve interests, values, or goals' and should

therefore not affect learning or motivation (p. 432). Based on the self-determination theory (Ryan and Deci 2000), Katz and Assor proposed an explanation for the conflicting outcomes stating that choice is motivating and can enhance learning when the three psychological needs of autonomy, competence, and relatedness are satisfied or at least not ignored. Teachers can support students' motivation and learning by offering choices, which meet these students' needs. Providing explicit choices can enhance intrinsic motivation. However, too many choices may lead to increased anxiety, so providing assistance at appropriate times is essential (Brockett 2006; Katz and Assor 2007).

For WPS learning this could mean that task selection is gradually transferred to the student, for instance by giving students the possibility to choose from a smaller pool of learning tasks first and provide them with criteria to select appropriate tasks (Kicken et al. 2008). The teacher should also get students involved and shift responsibility to them by asking them to self-monitor, assisting them in analyzing their own task performance, and helping them to choose strategies and set goals that are appropriate considering their prior knowledge and outcomes (Zimmerman et al. 1996).

Feedback and explicit training in how to learn are important tasks of the teacher to foster the development of SRL skills, but that alone seems not enough when considering SDL skills. Additionally, the teacher needs to increase students' responsibility and allow them to make their own choices in their learning trajectories. Bearing in mind, however, that the teacher has also the responsibility to take into account students' capabilities and prior knowledge, and adapt the instruction to students' level, so that they can gradually acquire SRL and SDL skills. Consider Mike and Kevin again, who had to prepare appetizers for the graduate party. Mike approached the task with confidence and was able to plan his activities carefully, while Kevin thought about

different steps but did not write down an organized plan. A strategic teacher could have intervened by asking Kevin how he is going and what he is exactly planning. That might have triggered Kevin to think about the different steps more clearly. If Kevin experienced difficulties with writing down his planning, the teacher could have helped with the first steps and explain why certain steps are important. In the case of Mike, the teacher should not intervene with the planning, because Mike was able to do it himself successfully. Elaborated explanations about the planning would have less effect, because Mike had already enough knowledge. The example shows that the teacher needs to be thoughtful in his support to adapt to the learners' level and it becomes an instructional goal to gradually transfer regulation and direction of the learning process to the learner.

Synthesis of requirements: The Model

The previous paragraphs show that a number of factors need to be taken into consideration when designing and implementing an effective WPS. Figure 1 illustrates the three main interacting factors identified in the theoretical framework, including the learning environment on the background, the teacher and the student. The key skills of the student, the main components of the WPS, and essential tasks of the teacher are put forward in the model in order to achieve the desirable aim of a high-level task performance and the development of SDL and SRL skills.

Students need to acquire vocational competence, and for this learning process SRL and SDL skills are instrumental. In Figure 1, student 1 and student k represent the learners in WPS. They interact with each other, which is shown by the two-headed arrow. The arrow between micro and macro level indicates that SRL is the foundation of SDL. SDL includes SRL, but the opposite does not hold and therefore learning to self-regulate should be the first step.

Three main principles have been identified as relevant requirements for workplace simulation learning including (1) authentic setting, (2) integration of theory and practice, and (3) design for adaptive learning. Authentic and challenging learning tasks, supportive information, a collection of learning tasks, a development portfolio, and clear assessment criteria are necessary design components to foster high-quality learning, active involvement, and SDL. The learning environment functions as a tool for the teacher.

To prepare students for the labor market within this environment, teachers should give feedback, provide explicit training in how to learn by explaining self-regulatory techniques, and gradually increase students' responsibility; these are regarded essential teacher strategies to assist the development of SRL and SDL skills.

The student interacts with the teacher in the learning environment. The interaction between teacher and student, which is shown by the ruler bar in Figure 1, is a crucial aspect for the development of vocational competence and of SDL and SRL skills. Teachers have the power to equip students with these necessary learning skills, but they need to know how to do it and have to have the right attitude to do so (cf. Hattie 2009; Timmins 2008). Especially in workplace simulation learning, in which students are required to work more independently, it is important that sufficient support is provided by high consistency between learning tasks, supportive information, performance criteria, and teacher strategies. Support should be adaptive to learners' level and through the interaction between student and teacher opportunities for optimal learning can be created so that a higher performance level can be achieved.

<INSERT FIGURE 1 ABOUT HERE>

Discussion and Conclusion

We investigated characteristics of and the interaction between the student, the learning environment, and the teacher that are expected to influence good functioning in WPS and foster students learning. A theoretical framework was developed that identifies important requirements related to learning in WPS. As student learning takes place in a social environment, in which students and teachers interact with each other in a learning environment, all three factors need to be taken into account to optimize learning. Although the elements in the model are familiar topics in research, the combination of them in relation to workplace simulation learning in vocational education and the focus on the interaction is new.

Moreover, a coherent perspective of SRL and SDL was developed by integrating the two concepts and we demonstrated that the concepts are clearly distinguished though related to each other. The concepts differ on important aspects and it was shown that self-directed learning encompasses self-regulated learning, but that the opposite does not hold. By describing them on a micro and macro level, it was shown that SRL is the foundation of SDL and concerns the task level, while SDL aims at the planning of the whole learning trajectory. This distinction has consequences for the design of the learning environment and the role of the teacher, because SDL has additional preconditions that need to be taken into account. When teachers want to foster SDL, they need to allow students to take control of their learning and provide them with choices, and, at the same time, students need to feel responsible and have a will to learn. We proposed that becoming a self-directed learner means acquiring SRL skills first.

Research on self-regulated and self-directed learning in vocational education can help to reach the goal of developing employees that are qualified and adapted to the needs of the

workplace. Those who are able to regulate and direct their learning and practice vocational skills deliberately are expected to reach higher levels of performance than individuals who are less skilled. Self-directed learners, who are able to self-regulate learning, can structure their own learning process and should therefore benefit in workplace simulations.

However, learners vary and we believe that it is a risky starting point to assume that students are self-regulated or self-directed learners when they enter vocational education. The opposite is often the case. For students who are poor self-regulated and self-directed learners, workplace simulations are likely to pose difficulties. These learning environments require initiative of the learner and responsibility for learning. Learning how to learn cannot be left to students; it must be taught so that "co-regulation" can gradually be transformed into self-regulation. Therefore, the students need support when they learn vocational competence and develop SRL and SDL skills. The support needs to be provided by the learning environment as well as by the teacher. Students can reach higher levels of performance through the interaction with the teacher if the training tasks are structured appropriately and provide opportunities for repetition and error correction (Ericsson et al. 1993). Effective improvement requires close monitoring of the attained performance by the teacher (Ericsson 2006). It should be clear that the development of SRL and SDL skills takes time and demands a lot of effort from the student as well as from the teacher but we believe that this can be practiced and learned if support is adaptive to the wishes, needs, and skills of the learner.

From a theoretical and practical point of view, the depicted framework can help to explore the best ways to optimize students' learning processes and learning outcomes in vocational education by identifying discrepancies and opportunities in the interaction between student, WPS, and teacher. Future research needs to provide deeper insights into workplace

simulation learning in vocational education. It is essential to explore what is happening in workplace simulations at different schools in practice and investigate perceptions and preparedness of students and teachers to work and learn in a self-directing way in these practical learning environments. Important questions that need to be answered are: What kind of problems do students and teachers experience in workplace simulation learning? Do workplace simulations promote self-directed and self-regulated learning? Do students use SRL and SDL skills and can this be observed? And what are the best ways to support student learning and improve vocational education? On the basis of the theoretical model developed in this study, empirical evidence needs to be gathered that would give an answer to the questions raised.

Multimethod studies and a combination of qualitative and quantitative approaches can provide us with wider and deeper insights into thoughts and behaviors involved in SDL and SRL. Likert-scale self-report instruments, for instance, cannot show what learners actually do, because people do not always do as they say (Dinsmore et al. 2008; Winne and Perry 2000). Combining methods, however, seems advantageous because phenomena can be investigated from different angles.

To conclude, teachers need to be aware of their own actions and teaching behavior and understand what is required from them to foster SRL and SDL in vocational education. Both, teachers and students, should not perceive the trend toward self-direction as a burden or an impossible goal in vocational education, but rather as a change for the better. The success, after all, depends on the dedication of teachers and students and therefore it is essential that they strive for the same goals. Moreover, theory has to be applicable to the situation in schools, hence, deeper insights into the processes and practices in WPS are needed to take the challenge of SRL and SDL in vocational learning.

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Tables

Table 1

Comparison of a Naive and Skillful Self-Regulated Learner.

	An example of two different learners	
SRL phases	Naive learner	Skillful learner
Forethought phase	When Kevin is told about the task to prepare the appetizers for the graduate party, he is slightly worried. What if people do not like his appetizers? He tries to come up with a couple of ideas and searches examples on the internet. There is a huge variety and he finds it difficult to choose. Finally, he chooses ten appetizers that look interesting. He does not yet think about the exact number of appetizers, because in his opinion that will be seen along the way. In his mind he goes through the different steps, but he does not write anything down. Kevin hopes that everything works out fine and that he is able to prepare the appetizers.	Mike is immediately enthusiastic about the task, although he realizes that it is a challenging task. But he likes challenges, because he sees them as an opportunity to learn. Mike decides to start off with gathering information about appetizers. He decides to prepare six different appetizers (two with fish, two with meat, and two veggies), ten of each kind. Everything needs to be well organized as time for preparing the appetizers is limited. Therefore, he writes down a time schedule so that he knows what needs to be done first. Mike is satisfied with his preparation and thinks he made a good selection of tasty appetizers.

Performance phase	Kevin goes to his kitchen unit and tries to remember the different steps. He decides to start with the preparation of one appetizer and fetches the things that he needs for it without considering the necessities for the other appetizers. Time passes by quickly and the teacher announces that everyone needs to be ready within 30 minutes. Kevin hurries, but he realizes too late that he should have prepared the appetizers in a different order.	Mike goes to his kitchen unit and looks at his time schedule. He fetches everything he needs for all the six kinds of appetizers like ingredients, knives, and bowls. His planning tells him exactly what to do and he focuses on his performance. He pays close attention to how the appetizers look and how they taste. Mike realizes that he has to stabilize some of the appetizers to prevent them from falling apart. He has enough time to solve the problem.
Reflection phase	When time is up, Kevin is glad that the task has come to an end. He is not very satisfied with his work and does not want to deal with the appetizers anymore. He is unsure on what aspects he needs to improve and concludes that he is just not handy enough. Moreover, Kevin thinks that time was too short for the preparation.	When time is up, Mike looks carefully at all his appetizers. Some look better than others and next time he wants to work on and improve the visual presentation. The time schedule helped him a lot in organizing his work and he is convinced that such a planning will be useful in future tasks too.

Table 2

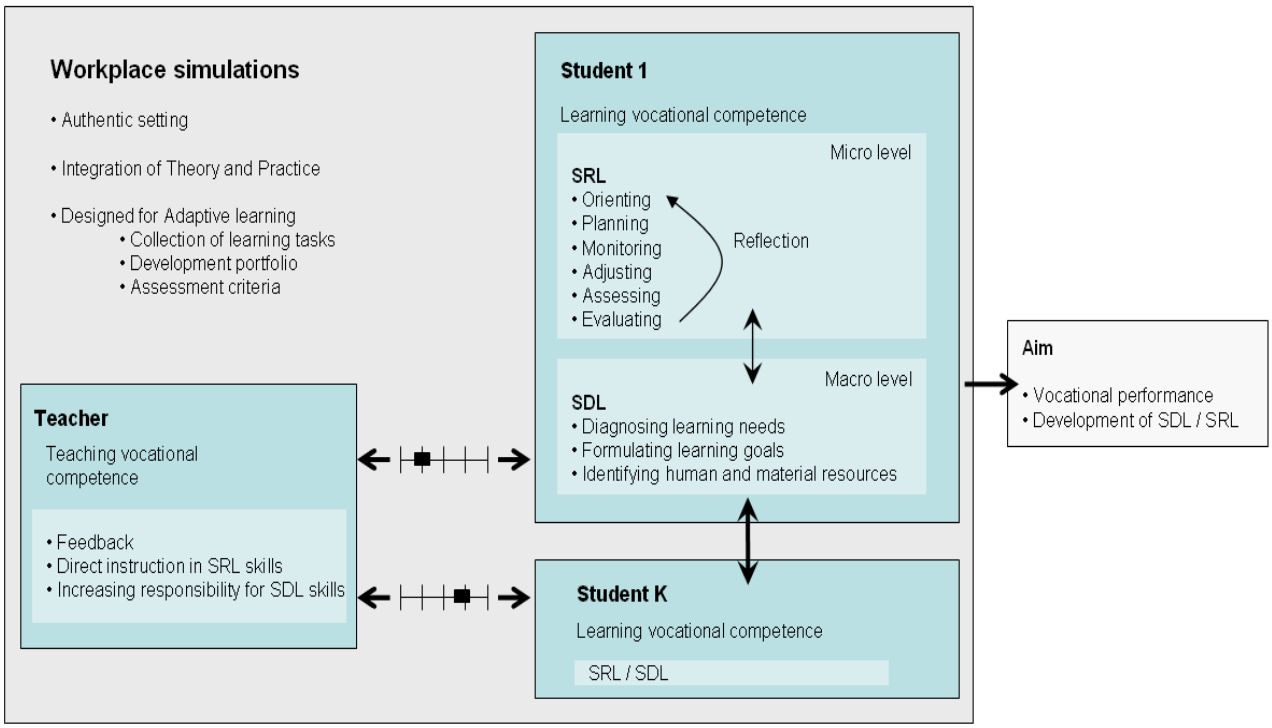
An Example of Assessment and Performance Criteria.

Competency: Composition of a menu	Evaluation				Improvement points
1. Menu principles	0	-	+	++	
Knowledge of the products					
Knowledge of taste principles					
Process of composition					
Variation in the courses					
Creativity					
2. Budget	0	-	+	++	
Use of seasonal products					
Cost and benefits analysis:					
Preparation time					
Workload					
3. Visual presentation	0	-	+	++	

Note that the abbreviations stand for: 0 unsatisfactory, - moderate, + good, ++ very good

Figure Caption

Figure 1. A framework for workplace simulation learning.


Workplace simulations
• Authentic setting
• Integration of Theory and Practice
• Designed for Adaptive learning
• Collection of learning tasks
• Development portfolio
• Assessment criteria
Student 1
Learning vocational competence
Micro level
SRL
• Orienting
• Planning
• Monitoring
• Adjusting
• Assessing
• Evaluating
Reflection
Macro level
SDL
• Diagnosing learning needs
• Formulating learning goals
• Identifying human and material resources
Aim
• Vocational performance
• Development of SDL / SRL
Teacher
Teaching vocational competence
• Feedback
• Direct instruction in SRL skills
• Increasing responsibility for SDL skills
Student K
Learning vocational competence
SRL / SDL