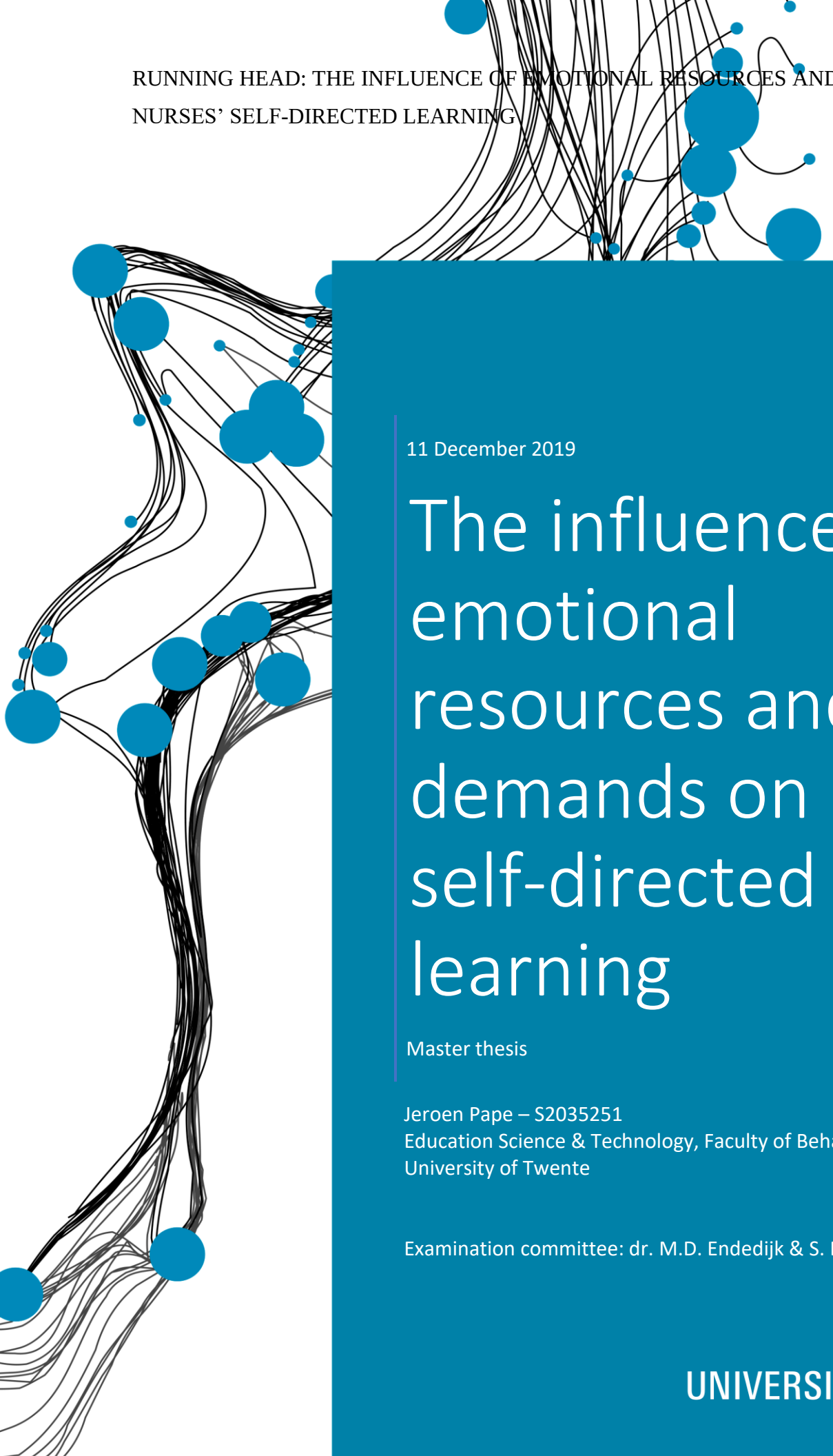

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The influence of emotional resources and demands on nurses' self-directed learning

Master thesis

Jeroen Pape – S2035251
Education Science & Technology, Faculty of Behavioural Sciences,
University of Twente

Examination committee: dr. M.D. Endedijk & S. Brands

UNIVERSITY OF TWENTE.

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Foreword

Het tot stand komen van deze scriptie was een leerzaam proces. Ik had dit niet kunnen afronden zonder de hulp van vrienden, familie, mijn begeleidster vanuit de Universiteit Twente: Maaike Endedijk, en mijn begeleiders vanuit het Deventer Ziekenhuis: Bart Talens en Lianne Ilsink. Bedankt.

"All's well that ends better" - J.R.R. Tolkien

Summary

Changes in society and health care organisations increase the importance of continuous learning in the workplace, parallel to increased responsibility of employees for this process. Self-Directed learning (SDL) is an approach which can fit this need. SDL is a process where employees take initiative to diagnose their learning needs, find resources, use learning strategies and evaluate learning outcomes. Organisations need new knowledge to design a work environment that stimulates SDL. This study examines the effect of two job factors: *co-worker support* and *emotional job demands* on the level of SDL, by means of the JD-R model. The research question is: Are co-worker support and emotional job demands related to the level of self-directed learning of nurses? The question is studied on a general and on a daily level, as the measurement of SDL as a daily event promises more valid results and predictors appear to fluctuate between days. Results indicate that on a general level, co-worker support influences work engagement, and this effect is moderated by emotional job demands. Work engagement in turn influences SDL. On a daily level, a direct effect of co-worker support on SDL was found. The results are discussed, and practical and scientific implications are highlighted.

Keywords: Self-Directed Learning, Job Demands-Resources Model, Diary Study, Nurses

Problem statement

Learning and development are beneficial for the performance of organisations and individual employees, and jobs and workplaces should be designed to stimulate learning (Ellinger, 2004). Learning is an ongoing life-long process and increasingly, organisations start to acknowledge the importance of it (Marsick & Volpe, 1999). Also for nurses, a career may start with an initial formal schooling, but nurses then start off in a busy environment, with the same tasks and responsibilities as experienced nurses, and many skills still have to be learned (Eraut, Steadman, & Furner, 2004). In addition, nursing is a dynamic job, which requires professionals to adapt to new developments in order to do remain competent (Adriaansen, 2018). This responsibility is included in the professional code of nurses in The Netherlands, where it is stated that nurses should keep their knowledge and skills up to date, for a responsible and adequate execution of their profession (CGMV et al., 2015). Research shows that informal learning is growing among nurses (Berings, Poell, Simons, & van Veldhoven, 2007). However, organisations need an approach to facilitate this new way of learning.

The concept of self-directed learning (SDL) is a promising concept to approach continuous learning in workplaces (Ellinger, 2004). First, parallel to the increased importance of knowledge, employees' responsibility for their own development increases (Kessels, 2004; Poell, Van Dam, & Van Den Berg, 2004). Second, technological developments, global competition and continuous change call for more flexible learning and the responsibility of individual employees to engage in continuous learning (Guglielmino & Guglielmino, 2001; Marsick & Volpe, 1999). Additionally, investing in SDL in organisations is said to be efficient and effective and to reduce the overall costs of remaining up-to-date, while also improving job-performance (Guglielmino & Guglielmino, 2001). SDL is "…a process in which individuals take the initiative in diagnosing their learning needs and goals, using resources and strategies, and evaluating learning outcomes" (Knowles, 1975, p. 18; as cited in Ellinger, 2004). A meta-review showed that in health professions self-directed learning was slightly more effective than traditional teaching methods in increasing knowledge, and that learners who were involved in choosing their learning resources also showed greater improvement in knowledge acquisition (Murad, Coto-Yglesias, Varkey, Prokop, & Murad, 2010). Also, among the benefits of SDL for employees are increased choice, confidence, autonomy, motivation and the development of skills for lifelong learning (O'Shea, 2003).

A barrier for promoting SDL in organisations is the lack of knowledge about fostering it. Most scientific research has been focused on correlating person variables and SDL, such as age and work experience, while ignoring organisation factors, such as size and opportunities for growth (Raemdonck, van der Leeden, Valcke, Segers, & Thijssen, 2012). Also, the research of task factors and their relation to learning has yielded mixed results, which may be due to the relationships between task factors and learning which are not always linear, as is often assumed (Ellinger, 2004; Poell et al., 2004). Job factors that are related to SDL may interact with each other and with person factors, which may explain two employees with similar jobs to differ in exhibited learning. As such, a task factor may result in more learning, but only up to a certain level, or only in combination with other factors. To increase the reliability of results, it has been suggested to depart from a specific model and to investigate the specific conditions under which employees prefer to engage in SDL (Poell et al., 2004). To address the issues of interacting job factors, the effect of two job factors on SDL is studied with the Job Demands-Resources (JD-R) model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001).

In JD-R model, psychosocial job factors are categorised as resources and demands, with the main proposition that the balance between these resources and demands has influence on job outcomes through work engagement and exhaustion. The model has often been used to investigate how job factors interact in their relation to favourable job outcomes, some of which are similar to SDL (i.e. Bakker, Demerouti, & Ten Brummelhuis, 2012; Blanco-donoso et al., 2017). Different factors can be added in the model as either job resources, which are supportive for employees in meeting work goals, handling demands or stimulate development, or job demands, which are the aspects of a job that demand effort (Demerouti et al., 2001). In this study, co-worker support is studied as a job resource, and emotional job demands as job demand, because these are prominent resources and demands and resources among nurses (e.g. McVicar, 2016). SDL might be a possible job outcome that can be explained by these factors. The current study may provide an indication whether the JD-R theory can be used in further research in organisations to explain and predict the SDL-behaviour of employees and provide input for interventions meant to stimulate SDL.

From a methodological perspective, SDL has often been approached in research as a stable personality trait and measured with self-report surveys, ignoring the context of specific learning situations, which may create validity risks (Endedijk, Brekelmans, Sleegers, & Vermunt, 2016). Furthermore, job factors turn out to be less stable over time than what was first assumed (Ohly,

Sonnentag, Niessen, & Zapf, 2010) and appear to fluctuate over different days (Sonnentag, 2003). This includes job demands and resources. Studies with the JD-R model provide further evidence that differences in job demands and resources and their related outcomes can indeed only be explained partly by differences between persons, and differences also stem from fluctuations between days or weeks (i.e. Bakker & Sanz-Vergel, 2013; Simbula, 2010). To address these issues, in the present study a multiple-event instrument of Endedijk et al. (2016) is used to measure SDL as an event on a daily level. Studying the daily fluctuations of SDL resembles reality closer than the usual cross-sectional methods, and opens the possibility to study proximal predictors; the daily events that are related to an increase or decrease in SDL (Ohly et al., 2010).

The goal of this study is to examine the effect of daily fluctuations of job factors on nurses' daily self-directed learning by means of the JD-R model. The results may prove SDL to be one of the outcomes of the JD-R model, determine the effect of co-worker support and emotional job demands on nurses' SDL, and give further support for the usefulness of a multiple-event measurement of SDL. The research question is: Are co-worker support and emotional job demands related to the level of self-directed learning of nurses?

Theoretical framework

Workplace learning.

Learning can be seen as an ongoing life-long process. Although nurses receive initial schooling before they start working, this is often just the start of their career, and many skills have to be attained at the workplace (Adriaansen, 2018; Eraut et al., 2004). It was found that there is a range of activities through which nurses learn, such as team days, clinical lessons, skills trainings, e-learning modules and tests, courses, external congresses and postgraduate education. These activities can been distinguished as learning from experience, social interaction, consulting media or organised learning activities (Pool, 2015). In the workplace, a distinction can also be made between formal and informal learning (Marsick & Volpe, 1999). Formal learning, or training, refers to planned events in which employees are instructed how to perform their job. However, this does not suffice when jobs are constantly changing, which is also the case in healthcare institutions (Adriaansen, 2018). More attention is given to informal learning, which is learning that occurs during the daily work, and which is characterised as unstructured, experiential and noninstitutional (Marsick & Volpe, 1999). Research supports the growing role of informal learning, as it showed that nurses would most frequently engage in learning from work experiences and reflection (Berings et al., 2007), and spend on average 100 hours per year on their own learning projects (Dixon, 1993). Informal learning is usually driven by personal intentions, preferences and choices of employees (Marsick & Volpe, 1999). For nurses, it appears that there are three main triggers to learn: their daily work, extra tasks and experiences in their private life, which can be extended into nine different motives, of which increasing competence, compliance with job requirements, deepening knowledge and enhancing career opportunities are the most prevalent ones (Dixon, 1993; Pool, 2015). Major barriers that were identified are finding the time and determining what to know precisely (Dixon, 1993).

Learning is not an individual process (Marsick & Volpe, 1999), and it was found that nurses learn from each other by discussing technical nursing skills, putting things in perspective, organising patient care, finding information and taking initiatives. Of these, talking about technical matters and putting things in perspective would result in the most learning (Berings et al., 2007). Furthermore, informal learning is often unplanned, and happens when a problem, challenge or

unanticipated need is encountered (Marsick & Volpe, 1999). This calls to question how healthcare organisations can support employees in this form of learning.

Self-directed learning.

Because learning has long been directed by organisations, effective informal learning may depend on employees gaining a renewed mindset and complementary skills, where they define their own learning (Marsick & Volpe, 1999). Self-directed learning is a promising concept to approach this.

Definition. Self-directed learning is a form of learning that encompasses an active engagement and goal directed behaviour of the learner, the activation of metacognitive skills and a vital role of intrinsic motivation (Loyens, Magda, & Rikers, 2008). Even so, there is no universal definition for it, and it is seen as a multifaceted concept that has been conceptualised differently over time (Ellinger, 2004). At first, self-directed learning was mostly studied as a personal trait, accompanied by the assumption that as learners mature, they become increasingly self-directed (Knowles, 1970; as cited in Merriam, Caffarella, & Baumgartner, 2012). Later, more attention was given to self-directed learning as a state. SDL was conceptualised as a process in a specific situation, and models were created to understand it in this way. The distinction between the two approaches is not a hard boundary, however, as there is a relation between the personal trait and the occurrence of the process in its' context, under influence of situational factors, so that adult learners do not always engage in self-directed learning behaviour (Merriam et al., 2012).

As a process, SDL is seen in a specific context. It is defined by Knowles as "…a process in which individuals take the 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" (1975, p. 18; as cited in Ellinger, 2004).

The process in detail. Knowles' definition of the process of SDL (Knowles, 1975; as cited in Ellinger, 2004) shows much parallels with the concept of self-regulated learning (SRL), as he defines an almost stepwise process that a learner engages in. It has indeed been argued before that both concepts are closely related, with the vital role of metacognition as a mutual factor (Pilling-Cormick & Garrison, 2007). Loyens et al. (2008) identified differences and similarities between the two concepts, arguing that SDL is highly similar to SRL and both processes follow roughly

the phases of (1) goal setting and task analysis, (2) implementation of the plan, and (3) self-evaluation of the learning process, which are called forethought, performance and self-reflection in self-regulation literature (i.e. Zimmerman, 2000). As such, the SRL-literature that has elaborated these phases is used in this study to provide insight in the process of SDL.

The widely used model created by Zimmerman (2000; 2002) constitutes of the three phases that are identical for SDL and SRL. In the model, learning is seen as a cyclical process constituted by three main phases. In the forethought phase, a learner analyses and determines goals and strategies to approach the learning task and motivates himself for the performance. Self-beliefs of a learner, outcome expectancies and expected benefits of learning are involved. In the performance phase, the execution of the learning task follows. The learner monitors and executes the tasks and implements methods and strategies that were chosen during the planning shire

phase. Self-control and self-observation are important. The last phase, the self-reflection phase, refers to the learner evaluating and valuing the performance and responding to this. The valuation of a performance can be based on different criteria, and success and failures can be attributes to different causes, which influences the subsequent response of the learner (Zimmerman, 2002).

Influencing factors of self-directed learning.

General factors. Since the benefits of SDL have been shown, it is relevant to know the factors that stimulate it. Influencing factors can be categorised as personal and organisational factors (Raemdonck et al., 2012). Extensive research has been done into personal factors (Aagten, 2016). Also, factors such as cognitive skills, personality, learning style, career goals, earlier learning experiences and attained competences have been shown to be related to SDL (Poell et al., 2004). Furthermore, a desire for knowledge work, mobility wish and career happiness are influencing individual factors (Raemdonck, 2009). From a review study in the healthcare sector, it was found that intrinsic motivation and goal setting have a positive influence on SRL, whereas problems with personal reflection, goal setting, and making or implementing plans were found to be barriers (van Houten-Schat et al., 2018).

Organisational factors may be more relevant for organisations that are interested in simulating SDL than the personal factors, because knowledge about these can be used to shape jobs, create an organisational culture and rewarding system (Poell et al., 2004), whereas knowledge

of the personal factors is more difficult to translate to practical interventions, besides recruitment decisions. Influencing organisational factors include the amount of task variance and width, opportunities for development, and co-worker or supervisor feedback (Raemdonck, 2009). Furthermore, a higher level of autonomy is related to positive learning outcomes and motivation. In addition, it is shown that higher task variation and opportunities for development are related to higher SDL, and that the width of a task was also related for higher educated employees (Wielenga-Meijer, Taris, Kompier, & Wigboldus, 2010). The physical and mental demands of a job have also been shown to be good predictors of the extent to which someone partook in formal- and informal work-related learning activities (Raemdonck, Gijbels, & van Groen, 2014). In health care settings, the amount of patient-contact was often mentioned as a factor to stimulate SRL, whereas time pressure functions as a barrier (van Houten-Schat et al., 2018).

Context factors. Another type of influencing factors are those that fluctuate between different learning moments. For example, practical and mental social support from co-workers was shown to result in increased learning in jobs with low demands, whereas this resulted in decreased learning in jobs with high demands (Raemdonck et al., 2014), which is explained by the hypothesis that employees who experience high job demands are more challenged and must learn more. Also, these employees must adapt to new situations, which creates gaps between their competence and the competences that are desired in their work. These gaps can be bridged by learning (Wielenga-Meijer, 2010; as cited in Raemdonck et al., 2014). A meta-analysis showed strong evidence that higher task demands are related to motivation, goal setting and to positive learning outcomes among employees (Wielenga-Meijer et al., 2010). The same meta-analysis also provides evidence that the frequency of feedback relates to learning outcomes, although not all research supports this (e.g. Raemdonck, 2009).

It is noted, however that some factors may have an optimum level, and too high levels may also decrease learning outcomes, Because of this, the results of research into job factors have often been contradictory (Ellinger, 2004) and research is needed to investigate the specific relations between job factors and learning (Poell et al., 2004). To increase the reliability of results, it has been suggested to depart from a specific model and to investigate the specific conditions under which employees prefer to engage in SDL (Poell et al., 2004). Based on classical HRM-literature of job design (Hackman & Oldham, 1980; as cited in Bakker & Demerouti, 2014) it is expected that job factors do not influence SDL in isolation, but that a mix of factors affects employees and

their learning. For these reasons, a model is used in this study to test the effects of job factors on SDL.

The JD-R model.

The Job Demands-Resources (JD-R) model is a suitable model that is used for occupational well-being. It can be used to understand, explain and predict wellbeing and performance of employees in different jobs and work environments (Bakker & Demerouti, 2014). Developed by Demerouti et al. (2001). In this model, all psychosocial job factors can be classified as resources and demands, which can then be modelled to predict job outcomes, such as SDL. The main proposition of the model is that the balance between job resources and demands has influence on the job outcomes through work engagement and exhaustion, which can be seen in figure 1. The model is used in this study because it is a flexible model which can be applied by researchers to model other job factors (Bakker & Demerouti, 2014), and because it can easily be understood and applied to real life workplaces. These qualities make it suitable as a starting point for studying the influence of job factors on SDL. Also, the model has been studied extensively, among which to predict SDL-related outcomes (e.g. Bakker et al., 2012).

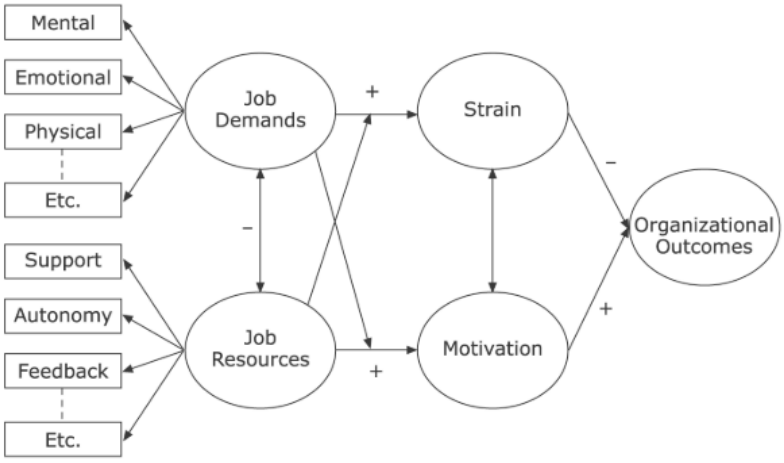

Figure 1. The Job Demands-Resources model (Bakker & Demerouti, 2007).

Job demands and resources. In the model, job factors are categorised as demands and resources. Job demands and resources both trigger a different process. Job demands usually are the most important predictors of exhaustion and other health complaints, which is called the health impairment process. Job resources are the strongest predictors of work engagement and

motivation, through a motivational process (Bakker & Demerouti, 2014). Job demands and resources also interact in their influence on job outcomes, as job resources can buffer the impact of job demands on stress, and job demands can reinforce the positive influence of resources on engagement and motivation (Bakker & Demerouti, 2014). Demerouti et al. (2001, p. 501) describe job demands as "…those physical, psychological, social or organisational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs". Demands are the things that must be done. They are not intrinsically negative, but demands may become job stressors when it requires much effort to meet them, which triggers negative consequences such as burnout (Bakker & Schaufeli, 2004). Examples of these are time pressure and patient contact. Job resources are: "those physical, psychological, social or organisational aspects of the job that may do any of the following: (a) be functional in achieving work goals, (b) reduce job demands at the associated physiological and psychological costs; (c) stimulate personal growth and development" (Demerouti et al., 2001, p. 501). So, these are factors that help meeting or reducing the demands of a job and even stimulate an employee to develop. Examples of these are supervisor support and feedback. From the definitions, it is clear that both subjective, perceived factors, as well as objectively measurable factors can be modelled as demands and resources.

To test the model, emotional job demands are chosen as demand, and co-worker support as a job resource. These factors were found as important demands and resources in earlier studies amongst healthcare employees (e.g. Demerouti et al., 2001; McVicar, 2016). By Eraut, Steadman, & Furner (2004) it was stated that because of the high risks, high pressure and the nature of nursing work, the emotional dimension has a prominent role, and equally prominent is the need for supportive relations with colleagues. However, this need is not always met, since the atmosphere on a ward can be anywhere in between very positive, very negative or highly fluctuating.

Co-worker support. Co-worker support is a form of social support, which is one of the most well know job resources to potentially moderate the negative effects of job demands on strain, and helps to achieve work goals (Blanco-donoso et al., 2017). In this study, it is seen as the provision of emotional assistance by a colleague. And as such it is distinguished from instrumental support. Examples of this are: expressions of caring, encouragement, attentive listening, reflection, reassurance, and an avoidance of criticism or excessive advise giving (Dennis, 2003). Co-worker support can be given in interactions between individuals, in groups, or in a learning environment,

and with a variable amount of involvement and structure. In addition, the effects are usually an increased feeling of being accepted, taken care of, admired, respected and appreciated despite personal problems (Dennis, 2003). According to Eraut, Steadman, & Furner (2004), emotional support from co-workers is central in the development and retainment of a culture of care and a critical factor for learning of novice nurses, which cannot be substituted by clinical supervision.

Emotional job demands. Among the core job aspects of health care workers is their social interaction with patients, in which the regulation of emotions plays a vital role (de Jonge, Le Blanc, Peeters, & Noordam, 2008; Zapf, 2002). Emotional job demands are interesting for employers because the emotional aspect can help to fulfil an overall task and increases task effectiveness, as it often plays a secondary role in a task, for example when a patient needs to be calmed to perform a medical treatment or diagnosis (Zapf, 2002). Zapf (2002) defines the concept as emotion work: the quality of interactions between employees and clients, during face-to-face or voice-to-voice interactions in which employees are required to show desired emotion as part of their job. It is distinguished from other types of emotion regulation, because emotion work implies that employees are required to show certain emotions as a part of their job, even when clients or patients are difficult, when the employee is tired or after a conflict with a colleague. In addition, emotion work is not limited to the expression of emotions as visible signs, but also incorporates the internal feelings that are a precondition for the visible aspects. Several aspects are distilled, and emotion work seems to be more demanding following an increase in the frequency in which emotions need to be shown, the intensity and duration of these moments, the variation in expected emotions in a job and the dissonance between expressed and experienced emotions (Zapf, 2002). Following the demands-resources categorisation of the JD-R model, the term emotional job demands is used as it refers to all the demands that stem from the emotional part of the work of nurses, which was also the approach in the study of de Jonge et al. (2008).

Research shows the effects of these two job factors on health outcomes. For example, among health care workers, emotional job demands are positively related to emotional exhaustion, but also to creativity and work motivation (de Jonge et al., 2008). Among nurses, co-worker support was found to enhance perceived job satisfaction, and to buffer the negative effect of job stress on job satisfaction (Abualrub, Omari, & Abu Al Rub, 2009). Emotional resources in the form of co-worker support were even found to buffer the effect of physical demands on emotional exhaustion (van den Tooren & de Jonge, 2008). In addition, co-worker support was negatively

related to emotional exhaustion (de Jonge et al., 2008). It was found among nurses that co-worker support can buffer the effect of emotional demands on emotional exhaustion (de Jonge et al., 2008) and even on a day-level, co-worker support buffered the effect of difficult emotions in the morning on emotional exhaustion in the afternoon, which was not the case for supervisor support (Blanco-donoso et al., 2017).

Theories for predicted effects. The interaction between emotional job demands and co-worker support is expected to influence SDL based on two theories that are derived from the categorisation of job factors as demands and resources.

Hindrance and challenge demands. Research also shows that it might depend on the way that a demand is perceived in a specific job or by an individual, whether it results in positive work outcomes (Bakker & Sanz-Vergel, 2013; Lepine, Lepine, & Jackson, 2004). A study of Lepine et al. (2004) shows that two kinds of stress have different effects on learning. Stress that is perceived as hindrance for growth was negatively related to learning performance, whereas stress perceived as a challenge was positively related to learning performance. A similar mechanism was found to function among nurses, where demands where investigated on a weekly basis (Bakker & Sanz-Vergel, 2013). Emotional demands functioned as a challenge demand, so that high resources combined with high emotional demands resulted in higher engagement. Work pressure was classified as hindrance demand, as flourishing among employees was higher when more resources were combined with less work pressure. It was concluded that emotional demands are central to the nursing work and may thus be seen by nurses as a challenge that calls for personal development and learning, whereas hindrance demands are perceived as unnecessary and to block growth (Bakker & Sanz-Vergel, 2013). It can be explained that a situation with challenge stress is perceived as positive and something that can be changed, and thus responded to by in increased effort in learning (Lepine et al., 2004). These results strongly support the idea that emotional job demands are a challenge demand for nurses, and that higher levels of this demand will result in more self-directed learning, when combined with high co-worker support.

Triple match principle. In addition, the effect of the interaction between emotional job demands and co-worker support on SDL is expected to be strong because of the matching principle (de Jonge & Dormann, 2006). According to this theory, resources, demands and the performance outcomes can be grouped along a cognitive-, emotional-, and physical dimension, and the interaction effect that resources and demands have on outcomes will be the strongest when the

demand, resource and outcome are all categorised as either cognitive, emotional or physical. This is called the triple match principle (de Jonge & Dormann, 2006). The theory has been supported by empirical research (e.g. Chrisopoulos, Dollard, Winefield, & Dormann, 2010; de Jonge & Dormann, 2006) also among nurses (van den Tooren & de Jonge, 2008). Emotional job demands and co-worker support are predominantly emotional, whereas self-directed learning is expected to be at least partially cognitive. This is called a double match, but it is still expected that the matching job factors will have a stronger effect on self-directed learning.

Based on the theories above, the following hypotheses are formulated, which are shown in the conceptual model in *figure 2.*

Hypothesis 1a: Co-worker support is positively related to self-directed learning

Hypothesis 2a**:** Emotional job demands moderate the relationship between co-worker support and self-directed learning. High levels of co-worker support will be more positively related to self-directed learning when emotional job demands are also high.

Work engagement. An often used definition of work engagement is "…a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption." (Schaufeli, Salanova, González-Romá, & Bakker, 2002, p. 74). Herein, vigour means having much energy and mental resilience, and a willingness to persist and put effort into work. Dedication refers to a sense of significance, enthusiasm and pride. Absorption means that a person is fully concentrated on the work, is not easily detached and time passes quickly (Schaufeli et al., 2002). Engagement is modelled in the JD-R model as a mediating factor between job demands and resources and positive work outcomes (Bakker et al., 2014). It is reasoned by Bakker et al. (2012) that employees who are more engaged will experience positive emotions and be more open to new experiences, and thus will perform better on their job. Engagement was also shown to fully mediate between job resources and proactive behaviour (Salanova & Schaufeli, 2008), a concept that emphasises employee initiative.

The active learning hypothesis. An important job outcome that has received attention in the theory and research of the JD-R model, is active learning. It is based on the active learning hypothesis, which expects that when high job demands are matched with high resources, it will foster active learning (Bakker, Demerouti, & Sanz-Vergel, 2014). This motivational process is

interesting, as the job performance outcomes are increased through engagement, leading for example to active learning and proactive behaviour (e.g. Bakker et al., 2012; Sonnentag, 2003). Some evidence has been found for the active learning hypothesis. Salanova and Schaufeli (2008) showed work engagement to fully mediate between job resources and proactive behaviour, a concept related to on employee initiative and the improvement of circumstances. And Bakker et al. (2012) found that work engagement is positively related to active learning in the context of work, which was defined as "self-initiated, self-directed behaviour by means of which employees improve their competencies and work environment" (London & Smither, 1999; as cited in Bakker, Demerouti, & Ten Brummelhuis, 2012, p. 556). This leads to the expectancy that high co-worker support combined with high emotional job demands will lead to higher engagement, and thus to a higher level of SDL.

Following this theory, the following hypotheses are formulated:
Hypothesis 3a: Co-worker support is positively related to work engagement.
Hypothesis 4a: Emotional job demands moderate the relationship between co-worker support and work engagement. High levels of co-worker support will be more positively related to work engagement when emotional job demands are also high.
Hypothesis 5a: Work engagement is positively related to self-directed learning.

Daily fluctuations.

Methodologically, there are arguments to test the hypothesised relations not only on a general level, but to also investigate daily fluctuations. Mixed results in earlier research may for example stem from learners being unaware of their learning and thus giving invalid accounts of it, and because many factors interact with personal differences (Poell et al., 2004). The JD-R model is suitable for this and has been used before to study the daily fluctuations (i.e. Bakker & Sanz-Vergel, 2013; Simbula, 2010).

Self-directed learning. From a methodological perspective, the approach of SDL as a personality trait was accompanied with the use of self-report surveys (Ellinger, 2004). The approach of SDL as a process mimics the developments in the SRL literature, where researchers have shifted from measurement methods such as surveys towards methods that are intended to measure the process of SRL in a specific situation, an event (Boekaerts & Corno, 2005). It has

been argued that measuring SDL with self-report questionnaires results in validity risks (Endedijk et al., 2016). On the one hand, this is because it is not clear which situations are referred to and compared when participants provide information about a general level of SRL (Van Hout-Wolters, 2000; as cited in Endedijk et al., 2016). On the other hand, other types of research have been shown to be more reliable, because SRL is measured in its' context (Zimmerman, 2008). These validity deficits can be expected to also occur when SDL is measured only with a general questionnaire. Researchers recommend the use of diary studies, as they are more suited to study proximal predictors, and because they have been argued to be more sensitive than pre- and post-questionnaires when learning is measured as a process in its' context (Ohly et al., 2010; Zimmerman, 2008) Therefore, in this study SDL is also being measured as an event on a specific day, by use of a very new instrument developed by Endedijk et al. (2016). This approach is in line with earlier research recommendations, stating that it should be investigated under which conditions employees prefer to perform SDL, and that mixed methods must be used (Poell et al., 2004).

The structured learning report that is used to measure SDL as a daily event has been scientifically validated among student teachers (Endedijk et al., 2016), but it has also been used to study SRL and SDL in health care settings (e.g. Aagten, 2016; Bloemendal, 2019). It's categorical items are based on the process model of SRL as conceptualised by Zimmerman (2000), so that different items provide a measure of the amount of self-directedness in the different phases.

Job factors Job factors fluctuate more over days than was first assumed (Ohly et al., 2010; Sonnentag, 2003). This included the factors under scrutiny in this research. A study in daily fluctuations of job resources and demands among nurses showed that co-worker support buffered the negative effects of emotional job demands in the morning on emotional exhaustion in the afternoon (Blanco-donoso et al., 2017). In a diary study among nurses, it was found that during a week, higher support of colleagues, supervisor and physicians was positively related to affective commitment to the organisation (Hoeve, Brouwer, Roodbol, & Kunnen, 2018). Another study showed that better abilities in emotion regulation buffered the effects of emotional demands at work, as nurses with better emotion regulation abilities showed more vitality and positive affect the evening after a work shift with high emotional demands, than nurses with lower regulation abilities (Blanco-Donoso, Demerouti, Garrosa Hernández, Moreno-Jiménez, & Carmona Cobo, 2015). In these studies, the amount of intra-class correlation of both emotional demands and co-

worker support was above 25%, indicating that a substantial proportion of the variation in these factors is due to a difference in days, within the same person. From this is concluded that the effects of co-worker support and emotional job demands should also be studied on a day level.

Work engagement. Work engagement, which has earlier in this study been highlighted as a state of mind, can also be seen as a transient experience that fluctuates over time. Studies show that at least 30% of variance in work engagement can be explained by fluctuations between days or weeks (Sonnentag, Dormann, & Demerouti, 2010). As such, it is also called state work engagement (SWE) and is defined as "… a state characterized by vigour, dedication, and absorption." (Sonnentag et al., 2010, p. 26). One study showed that day level work engagement was predictive for financial returns on the same day in a fast food restaurant (Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Day level work engagement, which differed for over 40% between days, has also been shown to predict personal initiative and pursuit of learning among employees (Sonnentag, 2003), two concepts that bear a lot of similarity to SDL. This leads to the expectation that the mediation of work engagement between the job factors and SDL may also function at a daily level.

Based on this, the hypotheses that were formulated to test the relation between job factors, work engagement and SDL on a general level, are replicated and tested also on a daily level.

Hypothesis 1b: Daily co-worker support is positively related to daily self-directed learning.

Hypothesis 2b: Daily emotional job demands moderate the relationship between daily co-worker support and self-directed learning. High levels of daily co-worker support will be more positively related to daily self-directed learning when daily emotional job demands are also high.

Hypothesis 3b: Daily co-worker support is positively related to daily work engagement.

Hypothesis 4b: Daily emotional job demands moderate the relationship between daily co-worker support and daily work engagement. High levels of daily co-worker support will be more positively related to daily work engagement when daily emotional job demands are also high.

Hypothesis 5b: Daily work engagement is positively related to the level of self-directed learning in a learning experience on the same day.

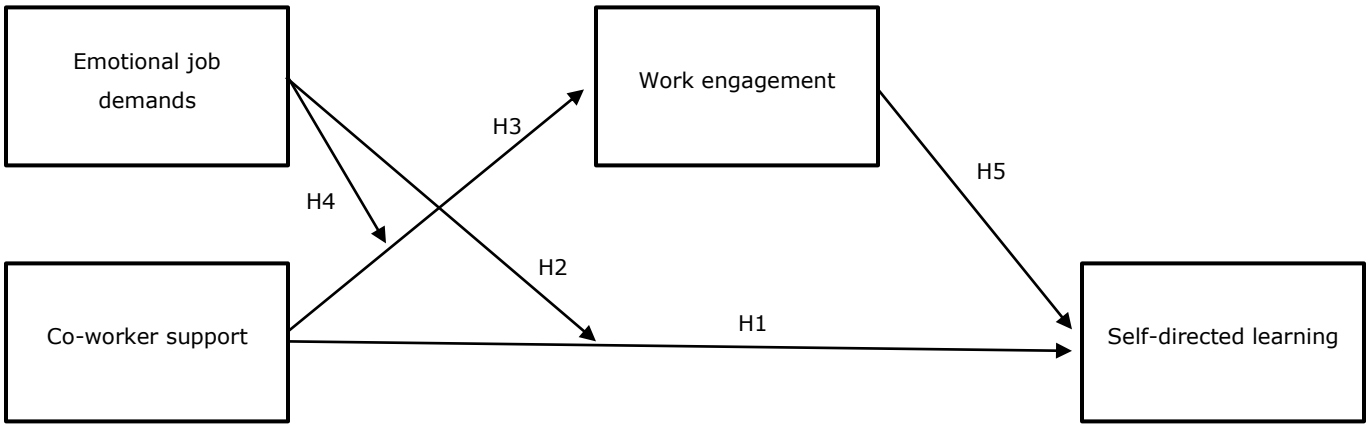

Figure 2. Research design for hypotheses, which are studied on a general level (hypotheses a) and a day level (hypotheses b).

Method

Research design

This is an explanatory study to test the relation between experienced co-worker support and emotional job demands, which are independent variables, and self-directed learning, which is a dependent variable. These relations are tested both on a general level, and on a daily level. A repeated measures design was chosen to measure daily self-directed learning over seven consecutive days.

Context

The study was done in a medium size hospital in The Netherlands. The participants were approached based on the department that they worked in. Five departments were chosen. Four departments were pilot departments for the development of a new learning policy at the hospital, called 'Learning on the move'. This policy is built on the values of self-directed learning, personal responsibility, and learning on the job. These departments are A2 (internal medicine, nephrology and oncology), the intensive care department, MDL (gastroenterology and liver disorders) and the emergency department. The last chosen department, the A1 department (obstetrics and neonatology) was not one of the pilot departments. During the design of the study, two nurses from the chosen departments were interviewed briefly to explore their daily workplace learning, and the factors that influenced this, in their perception. In addition, two managers also provided information about their experience with these factors. Based on these conversations, workplace factors were chosen that are relevant to the organisation and are also recognized by nurses to be of influence.

Participants

The main sample consisted of 44 nurses working at the hospital, of whom 35 were women and nine were men. Their ages ranged between 23 and 57 years (M = 39.16, SD = 10.53). The nurses had at least 1 year of work experience, and at most 37 years (M = 17.50, SD = 10.88). The mean of working hours per week was 28.6 (SD = 5.12), with a range between 20 and 38 hours. Of the participants, 33 were specialised nurses, five were directive nurses, five were regular nurses, and one nurse was in training to become a nurse specialist. In terms of highest completed education, most had finished a bachelor's programme or higher (61%) the rest had finished either

senior secondary vocational education at level 4 (23%) or Inservice training (11%). Most nurses worked at one of the pilot departments (82%).

Instrumentation

Data was collected with two different instruments. A digital questionnaire was taken at the start of the study to measure general level variables, and daily measurements were taken during the study to measure day level variables.

General measurements. In the digital introduction questionnaire, demographic information was collected: participants' age, sex, years of work experience, their function, department, highest education level, and their average number of working hours per week. In this questionnaire, general levels of self-directed learning, work engagement, co-worker support and emotional job demands were also measured.

General co-worker support and emotional job demands. General levels of co-worker support and emotional job demands were measured with two subscales of the DISQ-S 3.1 questionnaire (de Jonge, Willemse, van Iperen, & Gevers, 2018). For both subscales, three Likert-scale items are used, which refer to situations where co-worker support or emotional job demands are present. Participants indicate how often these happen in their job (1 = *[nearly] never* and 5 = *[nearly] always*). A sample item is: "At my work, I have to deal with persons whose problems have an emotional impact on me.". This questionnaire was used because it is available in Dutch, and because it has been used before in research into the interaction between job resources and demands leading to positive job outcomes (Niks, de Jonge, Gevers, & Houtman, 2018).

General work engagement. A general level of work engagement is measured with the shortened version of the Utrecht Work Engagement Scale: UWES-9 (Schaufeli & Bakker, 2003). This 9-item questionnaire is formulated as statements about a job, on which participants can answer how often this happens in their job, ranging from 0 (*never*) to 6 (*always*). An example item is: "My work inspires me.". The questionnaire consists of three subscales, vitality, commitment and absorption, for each subscale, three items are used. The instrument was chosen because it was available in Dutch, thus it would not need to be translated with a risk of decreasing reliability or validity. Also, the instrument has been used before in JD-R model studies where engagement was shown to mediate in the motivational process (Bakker & Schaufeli, 2004). Which indicates that it is suitable for studying work engagement in a JD-R model. In addition, the instrument was tested before among N = 9,679 employees, among whom where nurses, with good Cronbach's alpha

scores (Schaufeli & Bakker, 2003). Furthermore, the questionnaire items could be used for the daily measurements, as it was shown that these are a valid measure of day level engagement, when adapted to the daily context (Schaufeli, Shimazu, Hakanen, Salanova, & de Witte, 2017).

General self-directed learning. The general level of self-directed learning was measured with the Self-directedness in Learning scale, which has been developed by Raemdonck (2006). This questionnaire has been developed as a response to earlier instruments that were mostly used in formal education settings. This instrument has been used before in healthcare-settings (Aagten, 2016), was available in Dutch, and was of suitable length. The questionnaire consists of 14 items which are all rated on a 5-point scale (1 = *completely disagree* and 5 = *completely agree*).

Daily measurements. Daily measurements were done with a mobile application which the participants were asked to install on their mobile phone. In these measurements, daily co-worker support and demands, work engagement and self-directed learning were measured.

***Daily co-worker support and emotional job demands*.** Two subscales from the diary version of the DISQ-questionnaire were used to measure daily co-worker support and emotional job demands. This questionnaire combines items of the DISQ-S 2.0 (de Jonge et al., 2007) and DISQ-R 1.2 (de Jonge, Sonnentag, & Spoor, 2009) that are reformulated for diary measurements. An abbreviated version of this questionnaire has been used before in diary research to study the concepts of emotional resources and demands (Niks, de Jonge, Gevers, & Houtman, 2017). Also, this questionnaire was available in Dutch. Both subscales consist of three items one a 5-point scale (1 = *completely disagree* and 5 = *completely agree*). An example item for co-worker support is: "Today, I received emotional support from others if I experienced a threatening situation". An example item for emotional job demands is: "Today, I had to do a lot of emotionally draining work".

***Daily work engagement*.** A 3-item version of the UWES (Schaufeli et al., 2017) was used to measure daily work engagement. This ultra-short measure was chosen because drop-out is a common problem of diary studies, and it is therefore recommended to use abbreviated versions of scales to minimize the demands on participants (Ohly et al., 2010). The items have been adapted to refer to work engagement on the particular day. This has been tested before with the 9-item version of the scale, also in studies that investigated job demands and resources (Breevaart, Bakker, Demerouti, & Hetland, 2011 ; Breevaart, Bakker, & Demerouti, 2014). Also, the adapted

questions were available in Dutch. A sample item is: "Today at work, I felt bursting with energy". The items had a 7-point scale (1 = *completely disagree*, 7 = *completely agree*).

***Daily self-directed learning*.** Daily self-directed learning behaviour was measured with a version of the Structured Learning Report (Endedijk et al., 2016) that was adapted for nurses. The adaptations are based on versions that were used in healthcare settings before, namely a version by Aagten (2016) and one by Bloemendal (2019). Three subprocesses of self-directed learning are measured, which closely mimic the three main phases of forethought, performance, and self-reflection, as described by Zimmerman (2000). The instrument consists of 11 items, based on three subprocesses of SDL. The questions refer to a learning experience in a working shift of the current or previous day, depending on the moment that the answers are given. However, based on the given answers, some items were displayed optionally. For example, participants that replied "No" to the item: "Were other persons involved in your learning experience?" would not see the item: "Which persons were involved in the activity?". The first item is an open question: "What did you learn?". This was not used in analyses, but stimulated participants to reflect on a specific situation. The other items are multiple choice, with five to eight possible choices. A full version of the Structured Learning Report can be found in Appendix 4.

Procedure

Permission for this study was asked from the managers of the chosen departments. Also, the study was approved by the ethical committee of the University of Twente (request number: 190767). Privacy and GDPR standards were met, for example by using a mobile application that was developed by the University of Twente, which stores data on a safe server. The sample was taken by snowball technique: the managers of the chosen departments were asked to recruit nurses in their department by email and in meetings. In addition, posters were distributed to inform the nurses of the research. This was done in different departments in three waves, for which designated measurement weeks were chosen. In the first and second wave, nurses of the pilot departments were approached, in a third wave the nurses of department A1 were asked to participate. The response rate for the introduction questionnaire was approximately 22%. The participants could apply to participate by following a web link provided on the posters. This address linked to a website were nurses could create a personal account and give their informed consent to participate. Then, the introduction questionnaire was presented. Subsequently, an instruction was shown for installation of the mobile application, and a reminder for the start date of daily measurements.

The researcher then assigned participants to the specific measurement wave that was communicated by their managers and on the posters. Participants received an email with a reminder of the date and instructions for the diary entries, and another instruction for the installation of the mobile application. Upon installation, participants were presented with an introduction module where participants could practice answering the questions, and where an introduction was given about learning moments. Each measurement wave started on Monday and ended on the next Sunday. Starting on the first day, participants received a push notification to fill in the diary every day at 12:00. When a diary entry was not completed before 20:00, which could occur when nurses worked an evening- or nightshift, an extra notification was sent at 20:00. To address the issue of drop-out, after completing the third day entry, the application showed a video message from the researcher to thank participants for participation and encourage them to stay involved. The diary was to be filled in for 7 consecutive days, in order to get a complete view of their work week. However, the first item in the diary was always: 'Did you work today?'. Nurses who reported that they had not worked would not get any further questions. The second item was: 'Did you learn anything today?'. Nurses who reported either *No* or *I'm not sure, give me a hint,* would be presented with examples of learning experiences and the option to report a learning experience or not. This was done to reduce the drop-out of the study, since it would be more demanding to answer all the questions every day, which is a known challenge for diary studies (Ohly et al., 2010). It might also have resulted in unreliable data because nurses might answer they had not learned to avoid further questions about their learning experience. Nurses who reported that they had not learned anything would not get further questions. Nurses who reported that they had worked and had a learning experience, were presented with the full questionnaire.

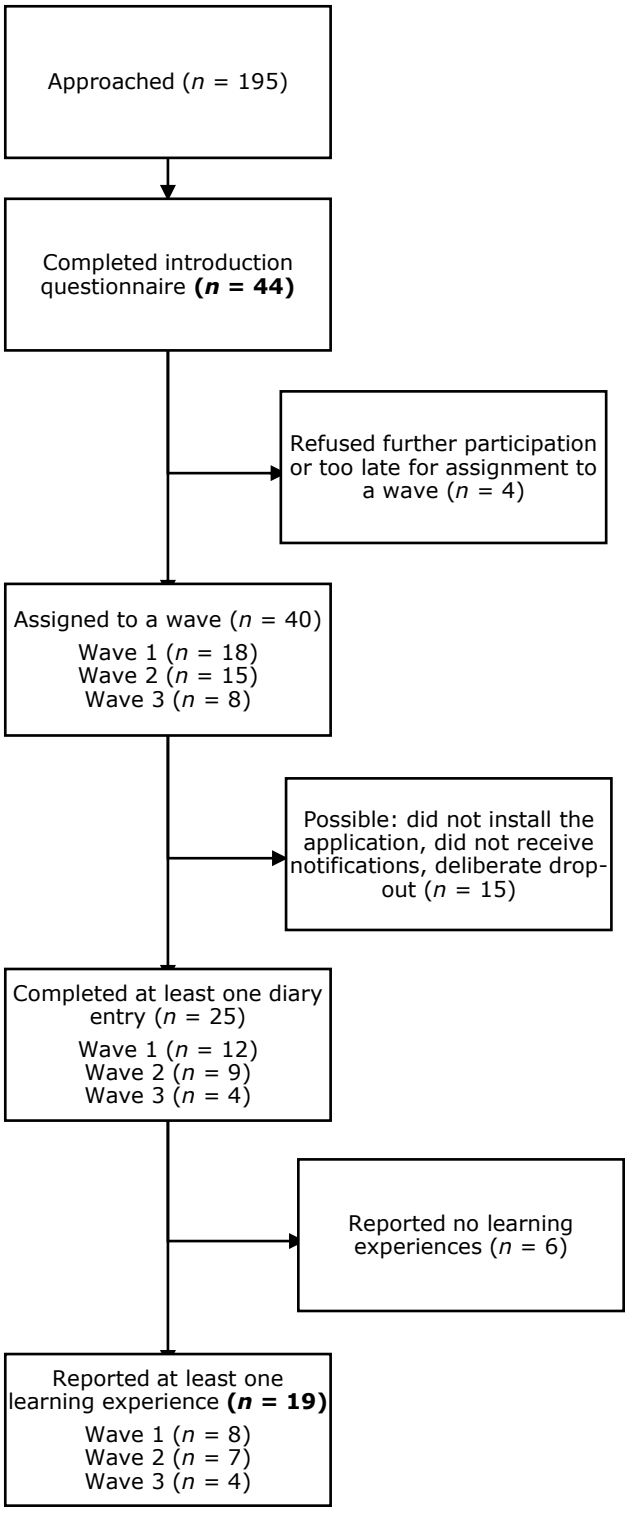

Figure 3. Flow of participants and creation of subsample for day level analysis.

Data analyses

The data from the three waves was aggregated to perform the analyses. To analyse the influence of co-worker support and emotional job demands on self-directed learning and work engagement, linear regression analyses were performed. To analyse these relations, one regression analysis was performed with SDL as the outcome variable and co-worker support and emotional job demands and their interaction as predictors. In the second analysis the same predictors were imputed in a model with work engagement as outcome variable, and a model was created with work engagement as a predictor variable and SDL as an outcome variable. These analyses were performed once for the general level variables, and once for the daily level variables. The average number of working hours per week was included as a control in the regression analyses on a general level. To create a suitable subsample of independent learning experiences for day level analyses, the first reported learning experience was selected for each participant. n = 19 learning experiences were used.

Variables. Preceding the analyses to test the hypotheses, the data was explored and analysed to establish the definitive variables to be used. For *general co-worker support*, exploration of stem-and-leaf plots and box plots showed a negative skewness. The scale for general co-worker support had a good reliability (3 items, α = .87). For *general emotional job demands*, one high outlier was found with a score of 4.67. The scale for emotional job demands had a questionable reliability (3 items, α = .64). However, for scales consisting of few items, the Alpha is often lower (Field, 2009). On *general work engagement*, the scale had an excellent reliability (9 items, α = .90) and one low outlier with a score of 2.22 was spotted in the box plot. A reliability analysis of the self-directedness in learning scale showed it to be of good reliability (14 items, α = .84). For the resulting variable *general self-directed learning*, a low univariate outlier with a score of 3.00 was found. These outliers were not treated, because there was no reason to suspect a clerical error in the processing of the scores, nor a deliberate counterfeit answer from the participants. Furthermore, the UWES-manual indicates that scores between 2 and 3 on the work engagement scale are not uncommon (Schaufeli & Bakker, 2003).

As for the day level variables, four participants had a missing answer on an item of the daily emotional job demands scale. Case mean substitution was used to impute the missing data based on the participants answers on the other two items of daily emotional job demands. This was

chosen as it is suitable for self-report measures with one underlying construct, and because it acknowledges differences between cases (Fox-Wasylyshyn, Susan & El-Masri, Maher, 2005). Preliminary analyses were performed to test the assumption of normality. There was reason for concern, as all Shapiro-Wilk test scores approached critical values to reject the assumption of normality. In addition, it is mentioned by Field (2013, p. 184) that for small samples, these tests often lack power to prove non-normality. It was chosen to perform bootstrapping for all regression analyses. Also, Kendall's Tau-B was calculated to identify correlations between the predictor and outcome variables, as this test does not assume normality (Allen & Bennett, 2012). The *daily emotional job demands* scale did not violate the assumption of normality in the Shapiro Wilk test. On the scale for *daily co-worker support*, one high univariate outlier was found, and two low outliers. One participant had a score of 5.00, whereas two had a score of 1.00. There was reason to suspect counterfeit answers, especially since diary research is susceptible to decreasing motivation among participants (Ohly et al., 2010), and the considered items were the last questions in a daily measurement. However, the small sample size called for thorough consideration before excluding any cases, because of the impact on the stability of the regression analyses. In addition, these outliers could be interesting and helpful in understanding the relation between resources, demands and self-directed learning. Thus, before a decision was made, the other scores of these participants were studied, both on the general- and day level variables. As no decisive argument could be made for counterfeit answers, nor for clerical errors, there was no justification for excluding these cases. These outliers were included in the analyses. For the variable *daily work engagement*, there was no concern for violation of the normality assumption.

Self-directed learning. To create a variable for *daily self-directed learning*, two different methods were applied to analyse the learning reports and compute a measure of day level SDL. A manual scoring method and a multiple correspondence analysis (MCA). Both methods are described below. The resulting SDL-scores are both tested in further analyses. In this way, a comparison of the regression results may show how different methods of computing a daily SDL score may yield different results in subsequent analyses.

***Manual scoring*.** The first method is a scoring rubric, developed by Aagten (2016). With this method, the different answer categories of the structured learning report are classified as either no self-directed learning behaviour, a bit of self-directed learning behaviour or fully self-directed learning behaviour, which are assigned a numerical score of 0.0, 0.5, and 1.0, respectively. This

results in a total score for a learning experience, ranging between 0 and 4. To compute the score, the rubric was applied on the items that are also used for the MCA. Several adaptions were performed on the scoring rubric to fit the learning report used in this study. In the variable *planning*, the category 'Necessary from the organisation' was not applicable to this study. Instead, two other categories were used, namely: 'My supervisor thought it was necessary', which was given a score of 0.0, and 'It was necessary for my role in the team', which was given a score of 0.5. Also, the category 'Yes, I wanted to improve something' was added in this study and given a score of 0.5. The three added categories are based on the adapted version of the Structured Learning Report, by Bloemendal (2019). In the variable *future steps*, the category 'Share my knowledge/skills with others' was given a score of 1.0, as it was reasoned that this step signifies an active self-directed choice for a subsequent step. Since the variable *monitoring* was not used in the current learning report, it was not included in the MCA, nor in the manual scoring. The complete scoring method as applied in this study can be found in appendix 3. In this study, the resulting variable of self-directedness is called the *Aagtenscore*.

***Multiple Correspondence Analysis*.** The second method is a Multiple Correspondence Analysis (MCA). By means of this analysis, underlying dimensions could be studied in the multivariate data that was collected with the learning report. In an MCA, nominal data is transformed into numerical scores so that the most variance is explained. This results in a number of dimensions, which explain decreasing amounts of variance in the data (Di Franco, 2016). All answer categories as well as participants are placed on these dimensions with coordinates, and thus get a numerical score. This method was used before in combination with the structured learning report by Endedijk (2010), to study the self-regulated learning of student teachers. In that study, the MCA yielded two dimensions, which explained 45.1% and 33.9% of the variance in the data. The first dimension was interpreted as discerning passive regulation from active regulation of learning, whilst the second dimension was interpreted as discerning prospective from retrospective regulation of learning, meaning regulation occurring before or after a learning experience. Based on these dimensions, learning experiences could be classified as one of four types, based on their position on the two dimensions (high or low). By measuring multiple learning experiences per person, seven regulation patterns of learning could be distinguished by analysing frequencies of the types within a person (i.e. a prospective active regulation pattern, a combined prospective active and passive regulation pattern etc.).

In this study, the MCA was performed using the FactoMineR package in R (Lê, Josse, & Husson, 2008). Before the MCA was performed, several modifications were performed on the data. A dataset from a similar study was added to perform the MCA, in order to increase the number of cases for analysis. This dataset consists of 82 learning experiences, also reported by nurses in a medium sized hospital, with the same instrument as in the current study. Notable differences between instruments and answer frequencies can be found in appendix 5. Di Franco (2016) recommends to consider a balanced distribution between categories, because categories with very low frequencies may distort the results of the analysis. To prevent this, answers with low frequencies (< 5%) were combined into aggregated categories. To improve the robustness of the MCA, the categories were combined further into aggregated categories. These categories are based on answers could be combined into a more general, overarching category. Several categories were considered, and equal distribution of the categories was also taken into account to decide on the final aggregated categories. In addition, an MCA was carried out with an alternative distribution of the categories, consisting of 16 categories over three variables. The categorical variables *Planning*, *Strategy* and *Future steps* were chosen as these cover learning choices in all three phases of the self-regulated learning process, as described by Zimmerman (2000). Planning describes whether a learning moment was deliberately planned, and if so, what the reason was to learn this. For this variable, item 4 and 5 of the structured learning report were combined, so that there was one category *No* for learning experiences that were not deliberately planned, and six categories based on the reason that was indicated at item 5, when a learning experience was either planned, or when a learning experience was planned, but not for that specific moment. Strategy describes whether a specific strategy was deliberately chosen for a learning experience. This variable emanated from item 7 and 8 of the structured learning report. As in the variable planning, there was one category *No* when the strategy was not deliberately chosen, and five categories for the reason that was indicated at item 8, when the strategy was deliberately chosen. Also, for this variable, the categories were aggregated. The variable Future steps describes the next step that was indicated to be taken after the learning experience. This variable is based on item 11 of the structured learning report. Table 1 describes the original answers that make up the final aggregated categories of three variables.

Table 1

Variables and categories of nurses' learning experiences, original answers in the learning report, observed frequencies (N), and category loadings on Dimension 1 (Dim 1) of the multiple correspondence analysis.

Variable	Categories	Answers in the learning report	N	Dim 1
Planning	No	No, it happened to me	88	-0.50
	Improve something	Yes, I wanted to improve something	7	**1.67**
	Long term goal	Yes, I wanted to develop myself	15	**1.49**
		Yes, I was curious		
	Environmental signals	Yes, others stimulated me to learn this	15	0.69
		It was necessary for my role in the team		
		My manager encouraged me to learn this		
Strategy	No	No	65	-0.74
	No specific argument for choice	This is the only way to learn this	16	0.72
		Some told me to learn it this way		
		I don't know why		
	The easiest and fastest strategy	Yes, this is the easiest and fastest way	20	**1.02**
	Strategy that fits me	Yes, this way suits me best	24	0.67
Future steps	No new plans (yet)	No new plans yet	24	-0.28
	Use knowledge	I now know exactly what I'm going to do in a similar situation	32	-0.86
		What I've learned, I will continue to do so		
	Improve what is learned	What I've learned, I want to improve further	22	0.40
	Very specific step planned	I will share my knowledge/skills with others	47	0.69
		I will apply my knowledge/skills in practice		
		I have set a new learning goal		
		I am going to try again		

Underlying dimensions. To transform the nominal variables that describe a learning experience into a measure of self-directed learning, the MCA was carried out on the combined dataset of 125 learning reports, with 12 categories in three active variables. In addition, four supplementary variables were used: the Aagtenscore is used as qualitative supplementary variable with all assigned scores as categories. The Aagtenscore was also included as a supplementary quantitative variable, as was the general level of SDL, as measured in the introduction questionnaire. These supplementary variables do not affect the dimensions in the analysis, but their values are estimated, to aid the interpretation of these dimensions (Di Franco, 2016). The scree-plot and explained variance of the dimensions did not indicate a clear cut-off point to select a

number of dimensions, as the scree-plot of Eigenvalues showed a consistent negative linear pattern.

To select the appropriate dimension(s), the R squared scores of the three variables and category coordinates, contributions and Cos2 on the dimensions were studied, as well as the correlation between the dimension and the quantitative *Aagtenscore* and the general level of SDL for the corresponding participant. Dimension 1 appeared to be a suitable representation of self-directedness, as with the quantitative supplementary variable *Aagtenscore* ($r = 0.82$, $p < 0.01$). It had an Eigenvalue of 0.54 and explained 17.84% of the variance. The analysis of R squared scores showed that Dimension 1 was a representation mostly of the variables *planning* ($R^2 = 0.66$, $p < 0.01$) and *strategy* ($R^2 = 0.60$, $p < 0.01$), and to a lesser degree of *Future steps* ($R^2 = 0.35$, $p < 0.01$). Further examination of the category coordinates showed that among the three lowest-scoring categories, two indicate that the learning experience was not planned, and that no deliberate choice was made for a strategy. In addition, the only other categories with negative coordinates showed that either no future step was planned, or that a participant indicated to use the new knowledge or skills. The absence of deliberate choices, indicated by these categories, is strong support that negative scores on this dimension are indeed a measure of low self-direction. The occurrence of the other negative category, indicating that the next step was to use the knowledge, can be explained as such that using the knowledge of a learning experience is an almost inevitable effect of learning, and may thus appropriately indicate low self-directedness. The three highest scoring categories indicate learning experiences that originated from long term goals such as self-development, or to improve something, and were a strategy was deliberately chosen because of convenience or speed. All which indicate a high level of self-direction. Based on these indications, Dimension 1 could be interpreted as a preliminary measure of self-directedness, with low self-direction on end of the spectrum, and higher self-direction on the other end. Additional examination of dimensions 2 to 5 supported this, as no other dimension showed a strong correlation with the *Aagtenscore* or with the self-directedness in learning score. Furthermore, the coordinates and order of the categories on the other dimensions were significantly more difficult to interpret, not to mention a translation to a measure of self-directedness. To transform the result of the MCA to a usable score of self-directedness in a particular learning experience, the coordinates of the individual learning experiences on Dimension 1 were extracted. The resulting variable was *daily SDL*.

Predicting SDL and work engagement on a general level. Preceding the regression analyses, the data was explored. To address the possible non-normality, bootstrapping was performed for the analyses with a 95% confidence interval. Before analysis, bivariate correlations between the variables of interest and control variables *age, working hours per week* and *years of work experience* were tested. Because normality of the distributions could not be assumed, Kendall's Tau-B was used.

Two multivariate outliers were found in the regression analysis for work engagement, where co-worker support and emotional job demands were predictors. The Mahalonobis distance exceeded the critical value of 13.28 for $df = 4$. Further examination of the cases showed that one had low scores on co-worker support and emotional job demands, and one had a very low score on emotional job demands, and a high score on co-worker support. An extra regression was performed with these cases excluded, which gave comparable coefficients as the regression with these cases included. However, with the outlier cases excluded, model 2 had a significant fit when work engagement was predicted by co-worker support and emotional job demands, which was not the case for the models with the outlier cases included. As Field (2013, p. 309) indicates: these diagnostics are a tool to asses a model, and not on their own a justification for the removal of data points. Because of this, further regressions were performed on the data with the outliers included, as they can be interesting to understand the relationships. However, this further emphasises the need for bootstrapping. Post-hoc analyses were performed with PROCESS in SPSS (Hayes, 2012; as cited in Field, 2013, p. 393), to study the interaction effect between resources and demands on work engagement.

Predicting SDL and work engagement on day level. For daily SDL, it was estimated how much of the variance can be explained by daily co-worker support and demands and their interaction. Since daily SDL was operationalised by means of an MCA, as well as by the scoring system developed by Aagten (2016), separate multiple regression analyses were performed. *Daily SDL* as derived from the MCA was chosen as dependent variable for the first regression analysis, and the *Aagtenscore* was chosen as dependent variable in the second regression analysis.

There was no indication of multicollinearity. The Mahalonobis distance of 11.76 exceeded the critical χ^2 for $df = 3$ (at $\alpha = .001$) of 11.34 for one case, indicating a multivariate outlier. For this reason, the regression was performed once including the outlier case, and once without this

case. Since no strong differences were found between the model fit or predictor coefficients, the multivariate outlier was included in the final regression.

Results

Descriptive information on general level variables. The mean SDL score was 3.99 (*SD* = 0.40). With a lowest score of 3.00, and a highest score of 4.93. The mean work engagement score was 4.22 (*SD* = 0.73). The lowest score was 2.22, and the highest score was 5.78. Compared to the database of the UWES (*M* = 3.74, *SD* = 1.17), the participants in this study (*SD* = 0.73) scored almost 0.5 point higher. The mean difference was significant, t (44.010) = -4.34, $p < .001$, two-tailed, $d = 1.37$. On average, participants had a score of 4.30 (*SD* = 0.66) on co-worker support, the lowest score being 2.67 and the highest being 5.00. The average score for emotional job demands was 3.08 (*SD* = 0.58), the lowest score was 1.67 and the highest was 4.67.

Learning moments. Out of 40 nurses who were assigned to one of three measurement weeks, 25 completed at least one diary entry (63%). On average, the nurses completed 1.72 learning moments (*SD* = 1.40). Some nurses reported no learning moments, and the maximum amount of reported learning moments per nurse was four. The frequency distribution is found in figure 4. In total 43 learning moments were reported. Appendix 6 shows the frequencies of participants who reported a number of learning experiences in relation to the reported worked days by that participant.

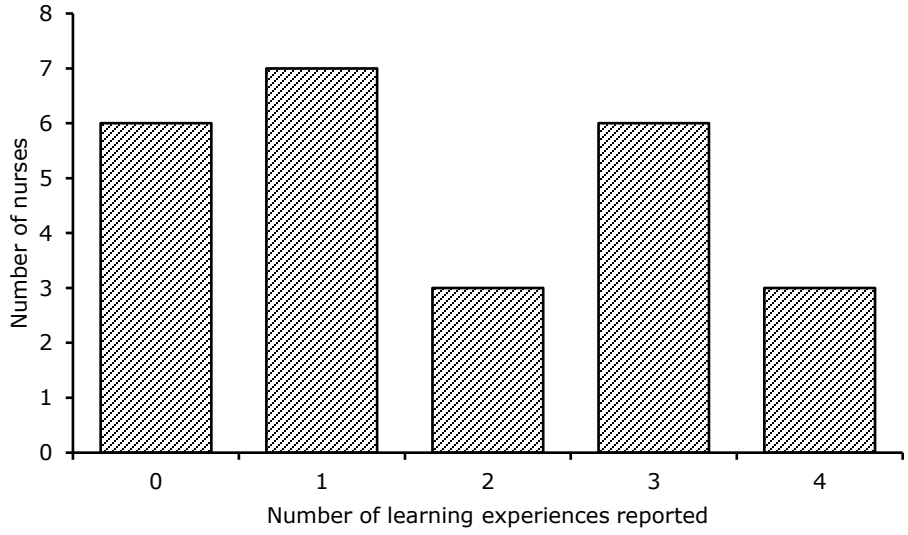

Figure 4. Frequencies of the amount of learning experiences as reported by n = 25 nurses.

Descriptive information on day level variables. For the subsample of n = 19, the following descriptive information was obtained: the mean score based on Aagten's method was 1.13 (SD = 0.82), with a range between 0 and 2. The mean score of daily SDL based on the MCA was -0.06 (SD = 0.66), ranging between -0.96 and 1.25. Daily work engagement had a mean of 4.91 (SD = 1.20), ranging between 2.00 and 6.67. The mean on daily co-worker support was 3.18 (SD = 0.99), with a maximum score of 5.00. The mean on daily emotional job demands was 2.36 (SD = 0.98), with a maximum score of 4.67. For both measures, the minimum score was 1.00.

Regression for self-directed learning on a general level. Kendall's tau-B indicated a strong correlation between age and years of work experience, $\tau = .881$, $p < .001$, two-tailed, N = 44. Also, a moderate negative correlation was found between average number of working hours per week and co-worker support, $\tau = -.263$, $p < .05$, two-tailed, N = 44. Furthermore, a moderate positive correlation was found between work engagement and self-directed learning score $\tau = .354$, $p < .01$, two-tailed, N = 44. The complete results of the analysis are in appendix 1. Based on the found correlations, *working hours per* week was used in the regression analyses as a control variable.

To test hypothesis 1a and 2a, a three-step regression analysis was performed to test the variability of self-directedness in learning, predicted by co-worker support and emotional job demands, and their interaction. In model 1, only the control variable was included. In model 2, the standardised scores of co-worker support and emotional job demands were added, and in model 3 the interaction between co-worker support and emotional job demands was added. All models showed a poor fit to the data. In model 2, the average number of working hours per week and co-worker support and emotional job demands demands account for a non-significant 3% of the variability in self-directed learning scores, $R^2 = .02$, adjusted $R^2 = -.05$, F (3, 40) = 0.38, $p = .766$. The model did not improve by adding the interaction of co-worker support and emotional job demands. Model 3 explained a non-significant 7% of variability in self-directed learning scores, $R^2 = .07$, adjusted $R^2 = -.03$, F (4, 39) = 0.69, $p = .605$.

To test hypothesis 3a, a three-step multiple regression analysis was conducted. Table X shows the results of the regression analysis. In model 1, only the control variable was included. In

model 2, the standardised scores of co-worker support and emotional job demands were added, and in model 3 the interaction between co-worker support and emotional job demands was added. A main effect of co-worker support was found, and the interaction between resources and demands showed a significant positive influence on work engagement in model 3, but the model as a whole does not explain a significant proportion of variance in work engagement, $R^2 = .19$, adjusted $R^2 = .11$, $F\ (4, 39) = 1.10$, $p = .076$.

Table 2

Comparison between predictors of work engagement on a general level with and without multivariate cases

Variable	Model 1	Model 2	Model 3	95% CI
Constant	4.23**	3.84**	3.98**	[2.56, 5.25]
Working hours per week	0.00	0.01	0.01	[-0.03, 0.05]
Co-worker support		0.34	0.41*	[0.02, 0.81]
Emotional job demands		-0.01	0.02	[-0.38, 0.37]
Interaction co-worker support x emotional job demands			0.52*	[-0,09, 0.92]
R^2	.00	.09	.19	
F	0.00	1.25	1.10	
ΔR^2		.09	.11	
ΔF		1.88	5.04*	

Note. $N = 44$. CI = confidence interval. *$p < .05$. **$p < .01$.

Examination of the interaction plot showed that when co-worker support was high, work engagement was higher when emotional job demands were also high. When co-worker support was low, work engagement was higher with low emotional job demands.

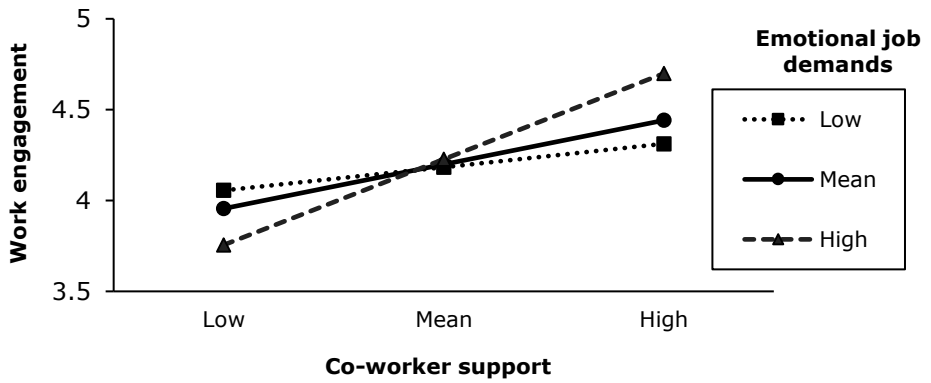

Figure 5. Interaction effect between co-worker support and emotional job demands on work engagement on a general level

Inspection of the normal probability plot of the standardised residuals and the scatterplot of standardised residuals against standardised predicted values indicated that the assumptions of normality, linearity and homoscedasticity were met.

To test hypothesis 5a, that work engagement is positively related to self-directed learning, a linear regression analysis was performed. The model showed a significant fit, with self-directedness as dependent variable and work engagement as predictor, $R^2 = .22$, adjusted $R^2 = .20$, $F\ (1, 42) = 11.59$, $p = .001$.

Table 3

Results of the regression analysis with general SDL as dependent variable

Variable	*B*	95% CI
Constant	2.92**	[2.23, 3.45]
Work engagement	0.25**	[0.14, 0.40]
F	11.59**	
ΔF		

Note. *N* = 44. CI = confidence interval. *$p < .05$. **$p < .01$.

Regression for daily SDL scores. Before performing the regression, correlations between the variables were studied in the subsample. Because the normality assumption was violated, Kendall's tau-B was used to calculate the correlation between variables. The complete results can be found in appendix 2. A positive correlation was found between daily co-worker support and daily emotional job demands, $\tau = .451$, $p < 0.05$, two-tailed, $n = 19$. The correlation between the Aagtenscore and the daily SDL-score derived from the MCA was confirmed here, as a strong positive correlation was found, $\tau = .718$, $p < 0.01$, two-tailed, $n = 19$.

To test hypothesis 1b and 2b, two two-step multiple regression analyses were performed. In the first analysis, the dependent variable is daily SDL, as derived from the MCA. In the second analysis, the dependent variable is self-directed learning as indicated by the Aagtenscore. The results are compared to study the influence of co-worker support and emotional job demands on self-directed learning on a specific day.

In model 1, with daily SDL as dependent variable, the standardised scores for daily co-worker support and emotional job demand scores were added to the model by forced entry. In model 2, the interaction between daily co-worker support and emotional job demands was added. Table X shows the results of the regression analyses. Daily co-worker support and emotional job demands account for a non-significant 20% of the variability in daily SDL, $R^2 = .20$, adjusted $R^2 = .10$, F (2, 16) = 1.99, $p = .170$. The model did not improve significantly by adding the interaction of daily co-worker support and emotional job demands. Model 2 explained a non-significant 23% of variability in daily SDL, $R^2 = .23$, adjusted $R^2 = .08$, F (3, 15) = 1.51, $p = .253$.

Table 4

Results of the regression analysis with daily SDL as dependent variable.

Variable	Model 1		Model 2	
	B	[95% CI]	*B*	[95% CI]
Constant	-0.06	[-0.35, 0.30]	0.02	[-0.30, 0.29]
Daily co-worker support	0.37	[0.10, 0.73]	0.26	[-0.94, 1.37]
Daily emotional job demands	-0.17	[-0.55, 0.35]	-0.09	[-0.60, 0.35]
Interaction daily co-worker support x daily emotional job demands			-0.15	[-0.65, 0.67]

Note. $n = 19$. CI = confidence interval. *$p < .05$. **$p < .01$.

In the second multiple regression, the dependent variable was the Aagtenscore. Again, in model 1, the standardised scores for daily co-worker support and emotional job demands scores were added to the model by forced entry. In model 2, the interaction between daily co-worker support and emotional job demands was added. The daily co-worker support and emotional job demands account for a non-significant 24% of the variability in Aagtenscores, $R^2 = .24$, adjusted $R^2 = .15$, F (2, 16) = 2.57, $p = .108$. The model did not improve significantly by adding the interaction of daily co-worker support and emotional job demands. Model 2 explained a non-significant 31% of variability in Aagten scores, $R^2 = .31$, adjusted $R^2 = .17$, F (3, 15) = 2.24, p = .126.

Table 5

Results of the regression analysis with Aagtenscore as dependent variable.

Variable	Model 1		Model 2	
	B	[95% CI]	*B*	[95% CI]
Constant	1.13**	[0.81, 1.49]	1.24**	[0.92, 1.50]
Daily co-worker support	0.38*	[0.13, 0.71]	0.23	[-0.36, 1.02]
Daily emotional job demands	-0.28	[-0.65, 0.27]	-0.17	[-0.74, 0.43]
Interaction daily co-worker support x daily emotional job demands			-0.20	[-0.67, 0.78]

Note. n = 19. CI = confidence interval. *p < .05. **p < .01.

To test hypothesis 3b and 4b, a multiple regression was performed with daily work engagement as dependent variable and co-worker support and emotional job demands as predictors. In model 1, the standardised scores for daily co-worker support and emotional job demands scores were added to the model by forced entry. In model 2, the interaction between daily co-worker support and emotional job demands was added. The daily co-worker support and emotional job demands account for a non-significant 4% of the variability in daily work engagement, $R^2 = .03$, adjusted $R^2 = -.82$, F (2, 16) = 0.32, $p = .733$. The model did not improve by adding the interaction of co-worker support and emotional job demands. Model 2 explained a non-significant 4% of variability in daily work engagement, $R^2 = .04$, adjusted $R^2 = -.15$, F (3, 15) = 0.23, $p = .877$.

To test hypothesis 5b, two separate linear regressions were performed with daily work engagement as a predictor. In the first, daily SDL was used as dependent variable. In the second, the Aagtenscore was used as dependent variable. Neither of the models explained a significant variance. In the model with daily SDL as dependent variable, daily work engagement accounted for 11% of variability, R^2 = .11, adjusted R^2 = -.06, F (1, 17) = 2.14, p = .162. In the model with the Aagtenscore as dependent variable, daily work engagement accounted for only 1% variability in Aagtenscores, R^2 = .01, adjusted R^2 = -.05, F (1, 17) = 0.16, p = .696.

Conclusion and discussion

The research question of this study is: Are co-worker support and emotional job demands related to the level of self-directed learning of nurses? To answer this question, the relations between these variables were studied by use of linear regression analyses, on a general and on a daily level.

On a general level, there is no evidence for a direct effect of co-worker support on self-directed learning, or a moderation of emotional job demands. Hypothesis 1a and 2a are rejected. On the daily level, there are indications that co-worker support may be positively related to self-directed learning, as it was found to be a significant predictor in one of the regression models, which also approached a significant fit to the data. As such, hypothesis 1b is not rejected. The interaction with emotional job demands was not found on the daily level, and hypothesis 2b is rejected. These results are partially in line with the JD-R theory, which predicts the effects of demands and resources to be mediated by work engagement (Bakker & Demerouti, 2014) and earlier empirical results showing a full mediation by work engagement between resources and demands and pro-active behaviour (Salanova & Schaufeli, 2008). Further explanation for this can also be based on findings of Orvis & Leffler (2011), who found that the positive influence of workplace support on self-development participation was stronger for employees with lower conscientiousness, while for employees with high levels of openness to experience or desire to develop themselves, the level of workplace support was rather inconsequential. It may be that comparable personality factors, which were not controlled for, strengthened or reduced the direct effect of the workplace factors on SDL for different employees, which would explain why no direct relation is found on a general level. Based on the triple match principle (de Jonge & Dormann, 2006), it is also possible that the predicting variables co-worker support and emotional job demands, which primarily consist of an emotional dimension, did not impact the outcome variable SDL because it consists primarily of a cognitive dimension (van den Tooren & de Jonge, 2008).

On a general level, evidence was found for a relation between co-worker support and emotional job demands, and work engagement. It was found that co-worker support had a significant positive relation with work engagement, and the interaction between co-worker support and emotional job demands also had a significant positive relation to work engagement, as such that the relation between high co-worker support and work engagement was stronger when emotional job demands were also high. Nevertheless, these variables did not explain a significant

proportion of differences in self-directed learning, which raised doubts about the generalisation of these conclusions. However, there is no cause to reject hypothesis 3a and 4a. The relation between co-worker support and engagement on a general level is consistent with the theory and previous research into the JD-R model, which advocates that job resources are the strongest predictors of work engagement (Bakker & Demerouti, 2014). In the same way, the interaction between co-worker support and emotional job demands follows the pattern of the motivational process, as described in the JD-R theory, where it is stated that job demands can reinforce the positive influence of job resources on engagement (Bakker & Demerouti, 2014). This also supports the theory that emotional demands are seen by nurses as a challenge demand instead of a hindrance (Bakker & Sanz-Vergel, 2013). In contrast, no evidence for these relations was found on a daily level, which leads to a rejection of hypothesis 3b and 4b. The lack of evidence for the influence of co-worker support and emotional job demands on daily work engagement contrasts with the mechanisms that are found on a general level. It can be theorized that these mechanisms have a lagged effect, but it has been shown before that for nurses, emotional resources can mitigate the influence of emotional demands in the morning on emotional exhaustion in the afternoon (Blanco-donoso et al., 2017). Similarly, emotional resources in the form of emotion regulation abilities could buffer the effect of emotional demands on outcomes the were measured the evening after a work shift (Blanco-Donoso et al., 2015). However, empirical results and theory from earlier studies (i.e. Sonnentag et al., 2010; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009) also suggest that personal resources function as mediator between job resources and demands, and daily work engagement. It may thus be that daily co-worker support and emotional job demands did not positively influence personal resources such as optimism or self-efficacy, and thus did not result in increased daily work engagement.

A significant positive relation was found between work engagement and self-directed learning on a general level, as work engagement explains roughly 22% of variability in self-directed learning. Hypothesis 5a is not rejected. The positive relation that was found between work engagement and SDL on a general level follows earlier findings by Bakker et al. (2012), who found that work engagement was positively related to active learning in the context of work, and by Salanova & Schaufeli (2008) who found that work engagement was positively related to proactive behaviour. This study expands this empirical evidence, as SDL was measured by self-report, whereas active learning was measured by supervisor indication. In addition, in the study of Bakker

et al. (2012), only individuals with high conscientiousness would show more active learning as a result of higher work engagement, while in this study, a positive relation was found for all participants. Again, the daily level does not mimic the general level, as the results indicate little support for the influence of daily work engagement on daily self-directed learning. Hypothesis 5b is rejected. Earlier studies did find evidence that work engagement predicts pro-active behaviour on a daily level, measured as personal initiative and pursuit of learning (Sonnentag, 2003). This evidence was not supported in this study.

In conclusion, there does not appear to be a direct relation between nurses' co-worker support and emotional job demands and self-directed learning on either a general- or a day level. However, on a general level there is evidence for a relation between co-worker support and work engagement, and between work engagement and self-directed learning. This indicates an indirect relation between these nurses' co-worker support and emotional job demands, and their self-directed learning, through work engagement. On a daily level, this indirect relationship was not found.

Limitations. Several limitations are important for interpreting the conclusions of this study. The snowball sampling technique allowed for the recruitment of nurses from different departments, and data gathering in their authentic work situation, on a voluntary basis. As a downside, it is not unlikely that most participating nurses had an above average interest in learning, and extra time and energy to spend on this study, because they could afford to participate in something that did not contribute to their immediate job performance. Nurses who experience a higher level of work pressure and more exhaustion may have lacked energy and time to participate. The likelihood of this scenario is supported strongly by the high level and negative skewness of reported co-worker support. Thus, the sample may not be a legitimate representation of all nurses, but rather, of nurses with an average or above-average level of resources. The use of diary reports on mobile devices will have reduced memory bias and the demands on the participants to complete the measurements. On the one hand, this supports the reliability of the gathered data of the learning moments. On the other hand, the demand of these measurements on participants is still high, as only 63% of the participants completed at least one daily measurement. Part of this can also be explained by a malfunctioning notification system of the app, as at least five nurses indicated that they did not receive all the notifications to complete the measurements. Furthermore, it may be possible that nurses were not aware of all their learning experiences, and thus reported days without

learning, when in fact a learning experience may have occurred. Thus, the reported learning experiences may be representative only for conscious learning experiences. Methodologically, all measurements were performed at the same time, and as such no conclusions can be drawn about causal relationships between the variables.

Scientific implications. This study provides support for the interaction between co-worker support and emotional job demands to function as resources and demands to predict work engagement. However, since these effects were not found on a day level, more research is needed to study this process on a daily level to investigate how these general effects take shape on a daily basis. It may be interesting to study the factors on subsequent days to check for lagged effects and investigate causal relations between the variables. SDL seems to be among the outcomes that can be predicted by mechanisms of the JD-R model. This has two implications. First: the factors that have already been found and are strongly supported by empirical research in the context of the JD-R model can be expected to also influence SDL. This gives rises to new research in which these relations can be tested for other resources and demands. It is recommended, following the triple match principle, to study resources and demands that primarily consist of a cognitive dimension, as these are predicted to have the strongest relation to SDL, which is also at least partially a cognitive outcome. Second: the JD-R model seems to be a suitable starting point for further research to model predicting variables of SDL. Using a model has been recommended before (Poell et al., 2004). It is recommended to study a combination of known predictors of SDL in this model, to further validate whether this model can be used and expanded for the prediction of SDL in organisations. For example, work pressure can be modelled as a demand, and well-known job factors (i.e. task variation, task width, autonomy) can be modelled as resources. Then, the interaction between these factors on work engagement and SDL can be studied. This study also showed a relation between the manual scoring method of SDL by Aagten (2016) and the dimension derived from the multiple correspondence analysis (MCA), the method that was also used to create the structured learning report (Endedijk, 2010). Although only a very limited number of items and categories was used in the MCA, it gives rise to the assumption that both methods actually represent the quality of SDL and can be used in further research. It is suggested that to create a more reliable dimension and scores, more data is collected and imputed in an MCA. When a reliable dimension of SDL is found based on a fixed number of items and categories, new items

and categories can be created and tested on this dimension. In this way, the structured learning report can be expanded or adapted.

Practical implications. This study provides evidence to suspect that in general, co-worker support and emotional job demands predict self-directed learning through a process of work engagement. As such, it is recommended that organisational actors that want to stimulate SDL, such as HRM or HRD professionals do not only consider the individual factors that have been found to be direct predictors, but also to consider the indirect influence that job factors have on the level of work engagement of their employees, and then on SDL. This may mean that employees who show little SDL behaviour also have low work engagement, which mitigates the effect of other job factors on SDL. Co-worker support and emotional job demands seem to be resources and demands that influence work engagement. Interventions exist to increase these resources or to decrease demands, on organisation and individual levels (Bakker & Demerouti, 2014).

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Appendix 1

Means, standard deviations and Kendall's tau-B bivariate correlations between variables on a general level.

	M	*SD*	1	2	3	4	5	6	7	8
1. Age	39.16	10.52	-							
2. Years of work experience	17.5	10.883	.881**	-						
3. Education	-	-	-.178	-.176	-					
4. Average number of working hours per week	-	-	-.128	-.151	.141	-				
5. Emotional resources	4.30	0.66	-.032	-.037	.198	-.259*	-			
6. Emotional job demands	3.08	0.58	.140	.125	.061	-.067	.134	-		
7. Work engagement	4.22	0.73	-.029	-.070	.062	.024	.206	.044	-	
8. Self-directed learning score	3.99	0.40	.136	.113	.067	.024	.117	.035	.354**	-

Note. $N = 44$. *$p < .05$. **$p < .01$.

Appendix 2

Means, standard deviations and Kendall's Tau-B bivariate correlations between variables on a general and daily level for the subsample of learning experiences (n = 19).

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. General Emotional resources	4.30	0.66											
2. General Emotional job demands	3.08	0.58	.375*										
3. Interaction emotional resources x emotional job demands			-.185	.320									
4. General Work engagement	4.22	0.73	.243	.176	.316								
5. Self-directedness in learning	3.99	0.40	.313	.232	.175	.354*							
6. Daily emotional resources			.070	.314	.007	-.065	.006						
7. Daily emotional job demands			.253	.568**	.101	.057	.125	.451*					
8. Interaction daily emotional resources x daily emotional job demands			-.046	.032	-.090	.144	-.042	-.103	.094				
9. Daily work engagement			-.054	-.227	.100	.124	.099	-.080	-.058	.012			
10. Aagtenscore			.495*	.199	-.013	.112	.366*	.226	.055	-.222	-0.81		
11. Self-direction in learning experience			.338	.295	.012	.018	.399*	.111	.063	-.254	-.206	.718**	
12. Education level			.369	.414*	-.068	-.030	.060	.138	.526**	.150	-.054	.288	.183

Note. $n = 19$. *$p < .05$. **$p < .01$.

Appendix 3

Categories in the learning report with frequencies and corresponding scores based on Aagten's method.

Item	Categories in the learning report	Score	Frequency for all learning experiences (*n* = 43)	Frequency in subsample (*n* = 19)
Did you plan to learn this?	No, it happened to me	0.0	38	17
	Yes, but not for this specific moment	0.0	3	1
	Yes	0.5	2	1
Why did you learn this?	Yes, others stimulated me to learn this	0.0	0	0
	My supervisor thought it was necessary*	0.0*	1	1
	Yes, I wanted to develop myself	0.5	1	0
	Yes, I was curious	0.5	0	0
	It was necessary for my role in the team*	0.5*	0	0
	Yes, I wanted to improve something*	0.5*	3	1
Did you plan to learn it this way?	No	0.0	28	10
	Yes	0.5	15	9
Why did you plan to learn it this way?	Someone told me to learn it this way	0.0	1	1
	I don't know why	0.0	2	0
	Yes, this is the easiest and fastest way	0.5	3	3
	Yes, this way suits me best	0.5	6	3
	This is the only way to learn this	0.5	3	2
What is the next step?	No new plans yet	0.0	6	3
	What I've learned, I will continue to do so	0.5	4	3
	I will apply my knowledge/skills in practice	0.5	18	7
	I am going to try again	0.5	0	0

I now know exactly what I'm going to do in a similar situation	1.0	5	0
What I've learned, I want to improve further	1.0	4	4
I will share my knowledge/skills with others*	1.0*	6	2
I have set a new learning goal	1.0	0	0

*Answers and scores that were not derived directly from the method of Aagten (2016).

Appendix 4

Structured learning report in Dutch, as used in this study.

Phase	Item	Categories	Next item
	1. Heb je iets geleerd vandaag?	Ja	3
		Ik weet het niet zeker, geef me een hint	2
		Ik heb geen tijd op dit moment	"Come back later"
		Nee	2
	2. Misschien heb je iets geleerd op deze manier…	Ja, nu weet ik het!	3
	Ging iets anders dan verwacht?	Nee	End
	Heb je hulp gevraagd of iets opgezocht?		
	Had je een aha-moment?		
	Heb je iets voor het eerst gedaan of toegepast?		
	Ben je iets nieuws te weten gekomen?		
	3. Wat heb je geleerd gedurende deze ervaring?	[Input Respondent]	4
	4. Had je gepland om dit te gaan leren?	Ja, ik had gepland dit te gaan leren	5
		Ik wilde dit al langer leren, maar had dit niet gepland voor dit moment	5
		Nee, het is me overkomen	6
	5. Wat was de belangrijkste aanleiding om dit te leren?	Het was nodig voor mijn rol in het team	6
		Ik wilde iets verbeteren	6
		Uit nieuwsgierigheid	6
		Ik werd door anderen aangemoedigd mezelf hierin te ontwikkelen	6
		Ik wilde mezelf verder ontwikkelen op dit gebied	6
		Mijn leidinggevende vond dit noodzakelijk	6
		Ik liep tegen een probleem aan	6

Phase	Item	Categories	Next item
	6. Kies de activiteit waardoor je hebt geleerd Ik heb geleerd door…	Iets te doen of ervaren	7
		Te experimenteren of iets te testen	7
		Iets wat ik al goed kan eens op een andere manier te proberen	7
		Op een ervaring te reflecteren	7
		Informatie op te zoeken met een boek, internet, etc.	7
		Te observeren hoe anderen iets aanpakken	7
		Met anderen over iets te discussiëren	7
		Feedback van anderen te krijgen	7
		Hulp of informatie van anderen te zoeken	7
		Een workshop, training of cursus te volgen	7
		Uitleg, klinische les, of instructie te geven	7
	7. Had je van tevoren bedacht om het op deze manier te leren?	Ja	8
		Nee	9
	8. Waarom leerde je het op deze manier? Omdat	Dit de enige manier is om dit te leren	9
		Dit de snelste en makkelijkste manier is om dit te leren	9
		Deze manier het beste bij mij past	9
		Ik de opdracht van een ander kreeg het op deze manier te leren	9
		Weet ik niet	9
	9. Waren andere mensen betrokken bij je leerervaring? Denk aan collega's, patiënten etc.	Ja	10
		Nee	11
	10. Welke mensen waren betrokken bij deze activiteit?	Een collega uit mijn eigen team	11
		Een collega uit een ander team	11
		Een expert buiten het Deventer Ziekenhuis	11
		Mijn leidinggevende	11
		Een patiënt of betrokkene van een patiënt	11

Phase	Item	Categories	Next item
	11. Hoe ga je nu verder met deze leerervaring?	Ik heb (nog) geen nieuwe plannen	End
		Het was niet gegaan zoals ik wilde dus probeer ik het nog een keer	End
		Ik weet nu precies wat ik ga doen in een soortgelijke situatie	End
		Wat ik heb geleerd, blijf ik zo doen	End
		Wat ik heb geleerd, wil ik nog verder verbeteren	End
		Wat ik heb geleerd, ga ik toepassen in de praktijk	End
		Ik stel een nieuw leerdoel op basis van mijn leerervaring	End
		Ik ga mijn kennis/vaardigheden delen met anderen	End

Appendix 5

Differences between structured learning report in this study and in supplementary data for MCA.

In this study, the scoring logistics are performed differently, because the scoring method is based on two steps. At first, points are given for the chosen category on item 4. These are then added to the points the apply to the answer category on item 5. Whereas in the study of Aagten, the answer categories on items 4 and 5 are first combined, and then the points are given. In the end, these methods yield identical scores.

Item 4: Did you plan to learn this?

Formulation and scoring

No differences

Item 5: Why did you learn this?

Formulation

In this study, the answer category 'I encountered a problem' was added. However, this option was not chosen. In the supplementary data, the option was added: 'My supervisor thought it was necessary', this option was not included in this study. In this study, the item was formulated: 'What was the most important cause to learn this?', whereas in the version of the supplementary data, this item was formulated: 'What was the most important reason to learn this?'.

Item 7: Did you plan to learn it this way?

One minor grammatical chance in the question formulation.

Item 8: Why did you learn it in this manner?

Formulation

No differences.

Item 11: What is the next step?

Formulation

In the answer category 'I now know exactly what I'm going to do in a similar situation', the version of the supplementary data is phrased as: 'I now know exactly what I do in a similar situation'. Also, the answer option 'I will share my knowledge/skills with others' was added in this study.

Appendix 6

Frequencies of participants who reported a number of learning experiences in relation to the reported worked days by that participant (n = 25) are shown in figure 6. Larger circles indicate that a combination occurred more often, with the exact number being shown inside of the circle. Note that it was not possible to report multiple learning moments for one workday.

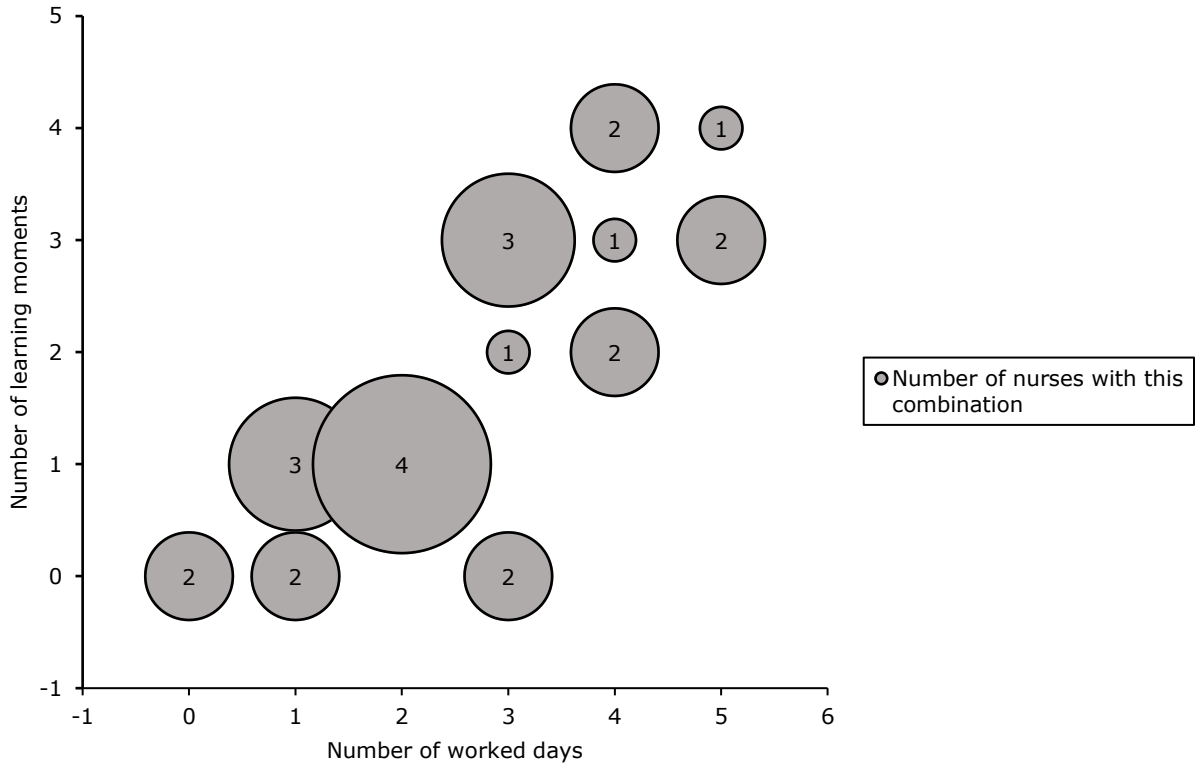

Figure 6. Frequencies of participants who reported a number of learning experiences in relation to the reported worked days by that participant (n = 25).