The relationship between nurses' learning conceptions and their regulation of workplace learning

[learning conception; self-regulated learning; nursing]

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Abstract

Changing disease patterns and treatment methods cause a continuous need for the development of nurses. Nurses are expected to be responsible for their own professional development. To accomplish this self-responsibility, nurses need to be self-regulated in learning. Self-regulated learning is especially required in workplace learning since workplace learning enables nurses to select their own learning activities during work. According to the study of Aagten (2016), day-care nurses lack self-regulated behaviour in workplace learning. This lack could be caused by nurses' learning conceptions. Self-regulation of learning and learning conceptions are both parts of a learner's metacognition. If the learning conceptions, learner's ideas of what learning is about, do not demand self-regulation, the learner is more likely to not regulate their own learning. Therefore, the purpose of this study is to explore the relationship between nurses' learning conceptions and their regulation activities in workplace learning. To measure nurses' regulation activities at the workplace, a multiple-event measurement of Endedijk (2012), the Learning Moments-app, was used. The app enabled participants to report multiple learning experiences in two weeks which gave insights into their regulation activities. The learning conceptions were measured by the Likert-scale COLI-questionnaire (Purdie & Hattie, 2002). These were measured twice to investigate the changeability of nurses' learning conceptions, by the influence of learning and reflection on learning at the workplace. Nurses of various departments from the hospital *the Spaarne Gasthuis* in the Netherlands participated (*N* = 39). The results showed that a majority of the nurses featured a deep learning conception. No significant differences were found in the learning conceptions between the two measurements, which indicates that the learning conceptions are relatively stable. Nurses' extent of self-regulation was below average, especially on the forethought-phase of self-regulated learning. In contrast, nurses scored average on the self-regulation phases *performance* and *future planning.* A relationship between nurses' learning conceptions and their self-regulation behaviour was only found between the number of learning moments reported by the nurse and the learning conception *Learning as personal Change*. As a result of this research, the relationship between regulation activities and learning conceptions seems more complicated than theories claim.

[learning conception; self-regulated learning; nursing]

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1. Introduction

Caused by changing disease patterns and treatment methods, nursing is a dynamic profession wherein learning is a prerequisite to guarantee the best patient care (Berings, 2006). Nurses are held accountable for their own learning as was stated in guidelines for the Dutch professional code for nurses. One of the guidelines of the professional code emphasizes personal responsibility of medical professionals to be and remain competent in their profession: 'As a caretaker, I keep the knowledge and skills required for responsible professional practice up to standard' (De Witte, Berkers & Visser, 2007, p. 1). As this guideline suggests, nurses are expected to regulate their own learning. The ability to regulate one's own learning is called self-regulated learning (SRL) and is defined as a process in which learners construct their own cognition, motivation and behaviour through regulatory processes (Pintrich, 2004). Learner's regulation activities are concentrated on regulating the cognitive activities and therefore affect the learning outcomes (Vermunt, 1996).

Self-regulation is most important for workplace learning because this type of learning depends on the nurses' initiative and persistence. These abilities are needed because workplace learning is characterized as mostly informal and low degree of external regulation. Workplace learning is defined as: "implicit or explicit mental and/or overt activities and processes, embedded in working and work-related performance, leading to relatively permanent changes in knowledge, attitude or skill" (Berings, Doornbos, & Simons, 2006, p. 334). In a study of Aagten (2016) nurses' workplace learning activities and extent of self-regulation in learning were examined. This study revealed a positive attitude towards self-regulated learning of caretakers and nurses in daycare. However, participants showed a low degree of SRL-behaviour. It is unclear how the lack of nurses' SRL-behaviour could be explained.

The lack of nurses' self-regulation in learning could be caused by the lack of the right ideas of learning, the learning conceptions. In theory, learner's regulation activities are associated with their learning conceptions. According to Vermunt (1996), these concepts form two essential parts of the metacognition. The regulation activities are considered as the behavioural part and expression of the metacognition. This means that the regulation activities depend on contextual and internal factors and could differ per learning activity. The learning conceptions are seen as the relative stable part of the metacognition. The theory of Vermunt (1996) suggests that the ideas of what learning is affects the behaviour in learning and successively the regulation activities. These ideas, the learning conceptions, are defined as "the differing ways in which learners experience, understand and make sense of learning in general" (Boulton-Lewis, Marton, & Wills, 2001, p. 154).

Previous research revealed multiple learning conceptions, which could be divided into two overarching learning conceptions (Marton & Säljö, 1976; Purdie and Hattie, 2002). First, the *surface* learning conception wherein learning is seen as the reactive acquisition, storage and reproduction of information. Second, with the *deep* learning conception learning is seen as the active process of construction of knowledge wherein the meaning and reflection in learning is central. In previous studies, the deep learning approach is most often associated to self-regulation in learning, whereas the surface learning conception is related to external regulation (Lonka & Lindblom-Ylänne, 1996; Rozendaal, Minnaert, & Boekaerts, 2003). For example, if learning is seen as the reactive process of reproduction of information, the learner is less inclined to regulate their own learning.

In the study of Pool, Poell, and Ten Cate (2012) nurses perceived learning mostly as gaining competence, keep knowledge up to date and improve it. Another study revealed that first year's nursing students believed that learning was about solely remembering knowledge for a short amount of time (Eklund-Myrskog, 1997). These results could indicate that nurses feature on average a surface learning conception, yet a deep learning conception is desirable to reach self-regulation.

Even though empirical research suggests a correlation between learners' regulation activities

and their learning conceptions, it is still unclear how these concepts are related in the context of hospital nurses. As stated, the study of Aagten (2016) revealed a low extent of nurses' self-regulation in workplace learning. The current study should give insight if nurses' learning conceptions are truly correlated to their regulation activities. The results of this study give medical educators implications of nurses regulation of learning at the workplace and how learning conceptions are related to these regulation activities. This could provide medical educators with practical implications to use in the educational policy for nurses to improve nurses' self-regulation in learning at the workplace.

2. Theoretical framework

2.1 Nurses' Workplace Learning

Workplace learning (WPL) is beneficial for both organisations and employees. For organisations, WPL contributes to the development of new knowledge and saving training costs (Guglielmino & Murdick, 1997; Rowland & Volet, 1996). For employees, WPL plays a key role in their professional development and job satisfaction (Skår, 2010). Also, it enables nurses to integrate their own experiences of their work in learning, which makes learning more meaningful. In the study of Berings, Poell, Simons, and van Veldhoven (2007) six types of learning activities on the nurses' workplace could be distinguished: doing one's regular job, applying something new in the job, learning from theory, from supervision, from reflection by oneself, and by talking with others. Learning on the job in hospitals is characterized as learning from challenges in daily practice and with the involvement of other individuals (patients, colleagues, etc., Berings et al., 2007). Central arenas that challenge nurses the most to learn are the staff room, the meeting room and patient rooms (Bjørk, Tøien, & Sørensen, 2013).

WPL exists of both formal and informal learning experiences. Formal learning is planned, involves clear set learning goals and often a coach (Eraut, 2000). Informal learning is not always intentional, accumulates mainly implicit or tacit knowledge, does not involve a (formal) teacher, and takes place on daily basis (Manuti, Pastore, Scardigno, Giancaspro, & Morciano, 2015; Slotte, Tynjälä, & Hytönen, 2004). Even though employees learn mostly on the workplace from daily informal interaction (sixty to eighty per cent, Marsick & Watkins, 1990), studies that especially explore informal learning by nurses are scarce (Bjørk, Tøien, & Sørensen, 2013). Hospitals are a fruitful context for this informal learning because of the interaction between employees and the versatility of the context which encourage nurses to learn at the workplace (Ryan, Walshe, Gaffney, Shanks, Burgoyne, & Wiskin, 2010). This study focuses on workplace learning which entails both formal and informal learning activities, however informal learning activities will be more present.

According to Eraut (2004), informal learning exists from three types: implicit learning, reactive learning, and deliberative learning. First, implicit learning entails knowledge which is obtained without any conscious influence of the learner. Second, reactive learning, whereas spontaneous learning occurs in the middle of the action. Finally, deliberative learning is conscious learning with a clear learning goal. This theory suggests that only deliberative learning is self-conscious and therefore the only sort of informal learning which could be self-regulated. However, according to Endedijk (2012), reactive learning could also contain self-regulation as self-regulation is also possible during or after the learning activity.

2.2 Self-regulated Learning

Self-regulated learning (SRL) is defined as: "an active, constructive process whereby learners set goals for their learning and attempt to monitor, regulate and control their cognition, motivation, and behaviour, guided and constrained by their goals and contextual features in the environment" (Pintrich, 2000, p. 453). SRL is often used as a synonym for self-directed learning as both concepts describe the learner's active role in the learning process (Niemi, 2002). SRL originates from cognitive psychology and is inquired mostly in school environments concentrated on individuals' learning activities and learning behaviour, whereas self-directed learning (SDL) originates from adult education and involves mostly designing of the learning environment (Saks & Leijen, 2014). Although SDL is linked to adult education, the term SRL is often used in research on personal factors influencing the behaviour of regulation of learning. This study is focused on nurses learning activities and their learning behaviours, therefore the

term of SRL will be used.

The process of SRL is illustrated with several cyclical models. Based on the model of Zimmerman (2000) and Pintrich (2004) the SRL-process exists of three phases based on previous models of Zimmerman (1989) and Bandura (1989; 1977): *forethought*, *performance* and *self-reflection*. The second phase, *performance*, was divided into two separate phases by Pintrich. However, not much separation between these phases was found in research using self-report questionnaires (Pintrich, 2000). Because in this study self-report questionnaires will be used, only the three main phases will be explained.

The first phase, *forethought*, concerns the *planning* of learning. In informal learning, levels of planning and consciousness are distinguished as deliberative, reactive or implicit learning, as stated earlier (Eraut, 2004). In this phase, activation of the learner's perceptions and prior knowledge are important aspects. With prior knowledge in mind, the learner is able to build new information upon that knowledge and make potential adjustments to the new learning experience. In the study of Aagten (2016), it was found that most of the learning experiences were unintended and when they were planned, it was commissioned by a supervisor. Although a self-regulated learner is expected to actively plan his own learning on beforehand (called prospective regulation), self-regulation could also take place after the learning experience (Endedijk, 2012). With this so-called retrospective regulation, the learner's regulation is focused on the reflection part of the learning process after learning instead of planning before their learning activity. Retrospective regulation could appear on a higher degree in informal learning as formal learning, because of the spontaneous character. The forethought phase includes also the *learning goal orientation*, concerning the learners' motives for a specific learning goal (Pintrich, 2004). These motives for learning are based on intrinsic or extrinsic factors (Endedijk, 2012). Intrinsic motives for learning, such as curiosity or personal development, are representations of self-regulation in learning. External factors, such as a demand from the organization, represent more external regulation (Endedijk, 2012). From the master's study of Zoethout (2013), it was concluded that nurses' motives for learning arise from social interaction, such as receiving feedback or attend (in)formal meetings. Also, nursing proceedings (check-ups; distributing medicines) and function-related motives (extra roles as coach or manager) gave nurses the motivation to learn. This implies that in general nurses are more motivated by external factors than by internal factors.

The second phase, *performance*, involves the learner's (meta)cognitive awareness of several learning elements, such as *strategy choice* and *learning strategy control*. The strategy choice is about which strategy is chosen by the learner and if the strategy fits the learner's learning goal. A number of studies have shown that nurses mostly learn by social interaction (Berings, Gelissen, & Poell, 2008; Zoethout, 2013; Aagten, 2016). They learned for example from the feedback of others, analysing a situation with colleagues, or observing others. Furthermore, nurses learned also a lot during experiences at the workplace (Zoethout, 2013; Aagten, 2016). Information about the chosen learning strategy gives insights in nurses' learning process, however, it does not give any information about the extent of self-regulation. In contrast, learning strategy control reflects nurses' consciousness in choosing their learning strategy and gives information about the extent of self-regulation. If the learner thought consciously about which learning strategy to use on beforehand, he or she is characterized as self-regulated (Pintrich, 2000). From the study of Aagten (2016), it was found that nurses mostly did not deliberately choose their learning strategy (63.4 % out of 456 learning moments), which indicates a low level of self-regulation.

The third phase, *self-reflection*, involves the learner's reflection on the learning outcome and overall learning experience and planning for future learning (Pintrich, 2004). Herein, the learner thinks about what exactly was learned from the learning experience (*learning outcome*) and how the learner

want to proceed with these learning profits (*future planning*) (Endedijk, 2012; Raemdonck, 2006). Just as the learning strategy, information of the learning outcome reflects no extent of self-regulation. However, it gives insights into the learner's reflection skills and his learning process. From the qualitative study of Berings, Gelissen, and Poell (2008) various learning domains in nurses' workplace learning were discovered; *the technical practical domain* (e.g. technical nursing skills), *the organizational domain* (e.g. planning patient care), *the socio-emotional domain towards others* (patients or family of patients) and *towards oneself*, *the developmental domain*, and *a pro-active attitude at work* (e.g. taking initiatives at work). For *future planning*, learners are featured as self-regulated if the learner has planned to actively pursue in learning, for example by setting a new goal or by improving his/her skills even further (Pintrich, 2000). No new learning plans would reflect a low degree of self-regulation (Pintrich, 2000). The three-phase model represents a time-ordered sequence, however, could be intertwined in time depending on the learner, task and context. Also, not all phases are necessary for every learning experience (Pintrich, 2004).

In addition to the phases of SRL, self-regulated learning originates also from the employees' proactive identification and exploitation of learning moments (Raemdonck, 2006). A representation of these abilities is the number of learning moments that are acknowledged by the employee. The more learning moments are pursued, the more the learner took self-initiative and identified the moment as learning. It is plausible that employees who acknowledge a low number of learning moments have a low extent of self-regulation in learning.

2.3 The Measurement of Self-regulated Learning

Self-regulated learning is measured as *aptitude* or *event* and both have been defined as a contribution to the understanding of learners' SRL (Winne & Perry, 2000). If SRL is seen as an aptitude, it is assumed that the individual possesses self-regulation in learning as a personal characteristic. In an aptitude-instrument, SRL is measured by a single measurement to identify a relative enduring attribute of a person, such as the attribution of self-regulated learning (Winne & Perry, 2000) In this single measurement, often the learner has to rate their own enduring abilities by responding to a series of statements how much they agree or disagree with. Because these measurements depend on the learner's perspective, which is not always a true reflection of the reality, the risk of over-and underestimating one's own capabilities is significant (Endedijk, Brekelmans, Sleegers, & Vermunt, 2016).

With an event-measurement, it is assumed that self-regulated learning is an observable behaviour, which is affected by the (workplace) context. As stated earlier, every learning experience includes another set of SRL-phases and demands another degree of self-regulation by the learner (Pintrich, 2004). In assuming this, not every learning moment is a representation of the learner's extent of self-regulation in learning. Thus, the contextual influences and the diversity of SRL-phases are taken into account and the learner's regulation activities are measured during multiple learning experiences. Multiple learning experiences give a better reflection of the learner's average SRL-degree, than a single learning experience. In this study, therefore an event-measurement will be used.

Event-measurement could be administered during (*online*) or shortly after the learning experience (*offline*). With the first option, the *online* measurement, little information about what happens during the task is lost (Van Hout-Wolters, 2000). However, with the online-measurement, a chance of influencing the learning process by the measurement during the learning experience is bigger than with offline measurement, for example by using think-aloud instruments (Greene & Azevedo, 2009). Moreover, self-regulated learning activities also entail aspects after the learning experience which are not taken into account using an online-measurement (e.g. self-reflection, Endedijk, 2012).

Offline-measurement of self-regulated learning allows the learner to include tacit aspects of learning which need some time after the learning experience to realise (Howard-Rose & Winne, 1993). An online event measurement, during the learning performance, is difficult to realise since a lot of learning is unplanned and the hospital as workplace context could be dynamic and hectic (Tynjälä, 2008). Thus, in this study an offline multiple event-measurement will be used to take the aims of the study and the research context into account.

Such an offline multiple event-measurement is developed by Endedijk (2012) called the *Learning Moments-app* (LM-app). With this instrument, the self-regulated learning activities of participants could be measured, based on the SRL-phases (Pintrich, 2004; Zimmerman, 2000). For every phase, multiple questions were included. Previous studies using the first edition of the app, the *Structured Learning Report*, showed that SRL-activities could be measured in a valid and reliable way (Endedijk, Brekelmans, Sleegers, & Vermunt, 2016). This study will, therefore, use the LM-app, with some adaptations regarding previous research (Aagten, 2016; Endedijk, 2012; Endedijk et al., 2016; Petli, 2016).

2.4 Learning Conceptions

As earlier stated, regulation in learning and the knowledge about learning, as learning conceptions, form two essential aspects of a learner's metacognition (Vermunt, 1998). Learning conceptions are described as the stable part of the metacognition. Research on epistemological understanding, as learning conceptions, could help understand whereon individuals base their fundamental decisions in their learning process that effects themselves as a learner and their workplace (King & Kitchener, 1994).

Säljö (1979) discovered a hierarchical set of five characteristic learning conceptions of how students conceived learning; Learning as…*increase of knowledge, memorising knowledge, acquisition of facts/procedures, an abstraction of meaning* and *interpretative process to understand reality*. Marton, Dall'Alba and Beaty (1993) supplement these with the conception Learning as… *personal change*. Three learning conceptions reflect the *surface* learning conception, in which the quantity of learning is central (an increase of knowledge, memorising knowledge, acquisition of facts/procedures). The latter learning conceptions are defined as *deep* learning conceptions because they indicate a perception of learning wherein the analysis of new ideas and the linkage to existing concepts, are central (abstraction of meaning, interpretative process aimed at the understanding of reality, and personal change) (Purdie & Hattie, 2002).

Purdie and Hattie (2002) inquired the validation of these learning conceptions and subsequently developed a Likert-scale questionnaire to measure a learner's learning conceptions (*The Conceptions of Learning Inventory, COLI-questionnaire*). From several studies, the items of this COLI-questionnaire remain valid, also in the context of learning adults (Campos et al., 2018; Makoe, Richardson, & Price, 2008). The questionnaire takes into account that learners could feature more than one learning conception, as claimed by Fuller (1999). She stated that learners feature multiple learning conceptions because the learning conceptions are influenced by the differences in the learning context and learning domain. How these aspects of learning influence the learner's learning conceptions is not clear yet. For example, it could be the case that in learning about the nurses' future career the learning conception *learning as personal change* is activated.

Nurses' learning conceptions is not an often-inquired subject. The results of the studies that exist do not identify a unified learning conception for nurses. The phenomenographic study of Eklund-Myrskog (1997) revealed student nurses' learning conceptions: *remembering and keeping something in*

mind; understanding; *applying knowledge, based on understanding*; *getting a new perspective*; *forming a conception of one's own.* These learning conceptions show many parallels with previously found conceptions of Säljö (1979) and Marton, Dall'Alba and Beaty (1993). In the study of Eklund-Myrskog (1997) most students nurses perceived learning as *understanding information*. After joining the educational programme, the percentage of students who perceived learning as *applying information* and *getting a new perspective* had increased. Thus, the student nurses' learning conceptions shifted from a surface to a more deep learning conception. Students' learning conceptions could have been developed by following courses wherein new knowledge and skills were acquired. In the interview study of Pillay, Boulton-Lewis, Wilss, & Lankshear (2003), the medical service was one of the inquired contexts. Most of the medical service employees had a conception wherein learning on the workplace was perceived as *taking formal courses*. It implies that nurses' perception of learning is one where the learner is passive and dependent of formal learning courses, indicated as a surface learning conception. In an interview study of Skår (2010) nurses of different departments felt in learning the importance of improving knowledge to the expert-level instead of maintaining their previously acquired knowledge. According to the nurses, this should be done by actively searching for new knowledge and experience to develop their own practical knowledge.

From these studies, it appeared that nursing as a learning context does not identify a general learning conception. Acquirement of knowledge seems to be an important factor of learning as understanding information (Eklund-Myrskog, 1997), taking formal courses (Pillay, Boulton-Lewis, Wilss & Lankshear, 2003) or the active process to improve knowledge to the expert-level (Skår, 2010). The current study could give more insight into the actual learning conceptions of nurses.

The stability of learning conceptions seems relative as the study of Eklund-Myrskog (1997) implies. In this study, student nurses' learning conceptions were changed after a period of learning (Eklund-Myrskog, 1997). If the learning conceptions are more influenced by the time or by learning and how long this possible change of learning conceptions takes is still unknown. This study could give more clarity in the stability of nurses' learning conceptions and if this stability is correlated to nurses' regulation activities in learning.

2.5 The relationship between regulation activities and learning conceptions

From previous sections, it could be concluded that both learning conceptions and regulation activities are personal characteristics influencing the learning process. As previous stated, both concepts form aspects of the metacognition (Vermetten, 1998). The relative stable learning conceptions direct the learner (un)consciously in making decisions during learning. These decisions also have an impact on how learners regulate their learning. The learning conceptions direct the cognitive processing activities, which are used to process learning contents and attain their learning goals by doing so (Vermunt, 1998). With these cognitive processing activities, the learner also directs his/her regulation activities.

In previous studies, the deep learning conception is related to self-regulation in learning and the surface learning conception is related to external regulation (Lonka & Lindblom-Ylänne, 1996; Vermunt, 1998). In the study of Lonka and Lindblöm-Ylänne (1996), wherein 175 students (116 medical students) participated, participants rated a set of 71 statements concerning learning approach, regulation of learning and their conceptions of learning on a five-point scale. With a principal component analysis, two components were found reflecting the combinations *deep approach*, *self-regulation, construction of knowledge*, and the second combination reflecting *surface approach, external regulation,* and *the intake of knowledge.* This can be understood since a deep learning conception is one in which learners seek meaning in order to understand something. This meaning-

making process in learning entails controlling and reshaping one´s reasoning (Endedijk et al., 2016). To carry out the learning conception of reshaping one's reasoning, the learner is inclined to proactively regulate his own learning which results in self-regulation in learning. In contrast, if learning is perceived as acquiring and applying knowledge, information is only there to be used and no adjustments are made to the information (surface learning conception). These perceptions imply the belief that the learner is a passive actor in the learning process, and the learner is rather tended to leave regulation of learning to somebody else.

2.6 The Present Study

Research on the relation between learning conceptions and regulation activities in learning are scarce and the existing studies were on formal educational settings (Corno, 1993). Since regulation activities and learning conceptions are contextually dependent (Fuller, 1999; Pintrich, 2000), previous findings could only hypothesize the learning situation of the workplace learning of employees. This current study builds on these previous studies, to examine the relationships between nurses' learning conceptions and their regulation activities in the workplace learning environment.

Following Fuller (1999), nurses could have more than one learning conception especially in the learning context of the workplace. Previous research did not result in an explicit learning conception for the context of nurses. It is expected that the workplace as a pluriform learning context, including informal, formal, planned, unplanned, social and individual learning, causes versatility in nurses learning conceptions. Herein the high extent of social interaction and emphasis on medical-knowledge or training will be presented in nurses' learning conceptions, as from previous research is suggested.

For the regulation activities, from previous studies, it becomes evident that daily practice and social interaction are reflected in nurses regulation. From the study of Aagten (2016), it is expected that the degree of nurses' self-regulation in learning will be low. In the relation between learning conceptions and regulation activities, it is expected that nurses with deep learning conceptions will have a higher degree of self-regulation than nurses that feature a surface learning conception. Subsequently, learning conceptions are described as relatively stable, however, could be developed or changed by learning experiences (Pillemer, Picariello, Law, & Reichman, 1996). Since nurses will reflect upon their learning activities during this study, it could be that nurses with a surface learning conception will change their learning conception to a deeper one. If learners have more experience in different domains, their strategies, conceptions and motives become more differentiated (Buehl & Alexander, 2006). The aim of this study is to examine the regulation activities of nurses during workplace learning and their learning conceptions. For the measurement of the regulation activities, both the SRL-phases and the number of learning experiences are taken into account. Because those elements reflect the extent of self-regulation. The learning conceptions are measured twice to examine the influence of the reflection on regulation activities, on the nurses learning conceptions. More specifically, this research is aimed to answer the following research question and sub-questions:

a) *Which learning conceptions do hospital nurses have?*
b) *Do hospital nurses' learning conceptions change over time after reflecting on their daily regulation activities during workplace learning?*
c) *What is the nature of hospital nurses' regulation activities at the workplace?*
d) *How are hospital nurses' learning conceptions relate to their daily regulation activities during workplace learning?*

3. Method

3.1 Research Design

The correlation between nurses' regulation activities and their learning conceptions is examined in this study with a quantitative correlational research design. Both constructs are inquired by quantitative instruments, except for one question in the SRL-instrument. The first three research questions have a descriptive purpose to see how the concepts of learning conceptions and regulation activities are expressed by nurses in the workplace context. Data of the learning conceptions are gathered with a Likert-scale type questionnaire, which will be quantitatively analysed. Nurses' regulation activities at the workplace are examined with the multiple-event measurement instrument; *the Learning Moments-app.* This diary log is an appropriate method to examine nurses' learning attitudes of a large population (Babbie, 2010). The final learning question, concerning the relation between SRL and nurses' learning conception, is correlational of nature. Further argumentation for these instruments could be found in the section of the *Instrumentation.*

3.2 Context

The participants in this study are employed in the *Spaarne Gasthuis* hospital with three locations in the West of the Netherlands. In 2017 approximately 4000 employees were active in the hospitals from which 1180 were employed as a nurse. For the educational policy, a new project has started in 2018, called Leren@Work.

In this project, the self-responsibility of nurses and other medical professionals is promoted. With broad access to learning resources and the freedom to choose their own learning activities, nurses should explore their own professional identity to manage their development and maximize their abilities. Herein, learning is a means to perform in working as a nurse instead of learning as a goal in itself. On every department, a nurse is assigned as a learning coach to help and encourage other nurses for their continuous development. The collaboration to learn with and from other colleagues is considered as important too, for example to provide others of peer review and to be critical on each other's skills and knowledge. To put this vision into practice, every department has the freedom to complete the new learning policy within the norms and limits of the Spaarne Gasthuis. Therefore, it is likely that the progress of this policy will be different for every hospital department.

3.3 Participants

In this study, participants were nursing professionals of different department of the Dutch hospital *the Spaarne Gasthuis* (N = 39; see Table 1). In agreement with the educational advisor and department manager, hospital departments were approached to participate in the study. Using convenience sampling, nurses were asked to participate voluntarily. Only certificated nurses with at least one year of work experience at Spaarne Gasthuis were selected to participate in the study. If employees did not meet the study requirements, they were refused of participation by a personal email.

Nurses of eight departments participated, of which nurses of the First Aid Heart & Lung Care (EHLH), Children's Ward and Oncology were overrepresented. As expected, 88.9% of the participants were women compared to 11.1% men, which is similar to the 81.1% of the complete population of female employees in this hospital (Spaarne Gasthuis, 2017). The average age of 37.64 (SD = 11.98) is quite younger than the average age of all employees of the Spaarne Gasthuis hospital (μ = 45, Spaarne Gasthuis, 2017). The average years of experience of the participants (M = 14.94, SD = 11.50) is comparable to all hospital nurses' years of experience (13 years). Much more full-time employed nurses

participated than part-time nurses (M = 30.96, SD = 4.82; 13 missings). Nurses with varied educational backgrounds participated in the study, namely 12 nurses finished a vocational education, 13 nurses finished a higher educational level (HBO), and 14 nurses were specialized in their profession (Inservice, HBO-master or Speciality). Nurses' from two locations of the hospital participated (Hoofddorp, N = 20; Haarlem, N = 17; Haarlem Zuid and Hoofddorp, N = 2).

Table 1

Participant' Personal Background Variables

Variable	Categories	Frequency	Percentage	Mean	SD
Gender	Male	4	11.1		
	Female	35	88.9		
Education	MBO4	12	27.8		
	Inservice training	8	19.4		
	HBO-bachelor	13	36.1		
	HBO-master	1	2.8		
	University	0	0.0		
	Speciality	5	13.9		
Occupational category	Nurse	16	41.0		
	Specialized nurse	17	43.6		
	Senior nurse	2	5.1		
	Specialized senior nurse	3	7.7		
	Other	1	2.6		
Department	EHLH	9	23.1		
	Children's ward	7	17.9		
	Oncology	7	17.9		
	Surgery	5	12.8		
	urology	3	7.7		
	Internal medicines	4	10.3		
	ER	2	5.1		
	Geriatrics	1	2.6		
	Orthopaedics	1	2.6		
Location hospital	Hoofddorp	20	51.3		
	Haarlem Zuid	17	43.6		
	Haarlem Zuid and Hoofddorp	2	5.1		
Age				37.67	11.98
Work experience				14.94	11.50
Working hours				30.96	4.82

3.4 Instrumentation

3.4.1 General background questionnaire

To get a better picture of the participants, a general background questionnaire was included. Before participants start with the first COLI-questionnaire concerning the learning conceptions, they answered some general questions about age, gender, the highest achieved level of education, number of hours working, work experience, and their profession in the hospital. Questions were selected on relevance in context and theory, based on previous research in similar contexts (Aagten, 2016). In categorical questions about the department, occupational category, and education, the category *other,*

namely… was included. Answers of *other, namely…* could be coded for the existed codes. Only for the question concerning the nurses' occupation level a category was added.

3.4.2 Self-regulated learning on the workplace

To measure hospital nurses´ regulation activities at the workplace, the Learning Moments-app was used. This off-line multiple-event measurement, adapted from the 'Structured Learning Report' (Endedijk, 2012), which included one qualitative question (*What did you learn*) and twelve quantitative questions. The questions represent all phases of SRL (Pintrich, 2004). The quantitative questions, with all categorical answers, were: *planning, learning goal orientation, strategy choice, learning strategy control, reflection on the learning outcome, future planning,* and *learning evaluation.* All questions were adapted from Aagten (2016) and Endedijk (2012) (see Table 18, Appendix B). The app started every time with the question *Did you learn anything today?,* to encourage participants to think about something they learned that day. If they hesitated, they could fill in: *I don't know, give me a hint*, which released prompts of possible learning experiences. For the first time, in using this instrument, the app gave also prompts if participants filled in that they did not learn anything that day. These prompts showed nurses possible learning experiences participants maybe did not think of, for example, *maybe your learned something by… trying something new,* or *looking up information.* The routing and number of questions differed per participant, which was depended on the answers participants gave. Answers of the multiple-choice questions were based on previous studies (Aagten, 2016; Berings, Poell, Simons, & Veldhoven, 2007; Endedijk, 2012).

Some adaptations were made in the LM-app, based on the advice of the hospital's educational advisors and results of previous studies using this instrument. The evaluation question, concerning the learner's satisfaction with regard to their learning experience, was removed from the instrument, because of lack of validity resulted from previous studies (Aagten, 2016; Endedijk, 2012). Namely, in the study of Aagten (2016) 80% of the participants were satisfied with their learning experience, which could indicate a lack of validity. Also, a lack of differentiation was found in earlier self-report research between the variables *monitoring* and *learning strategy control*. The variable monitoring was therefore left out, which also benefited the length of the instrument (*How did you realise you learned something?*). The last adaptation was made in the instrumentation, by adding a question concerning other individuals that were involved in the learning experience. Previous studies revealed the high extent of social influence on nurses' workplace learning (Aagten, 2016; Berings, Gelissen, & Poell, 2008). The extent to which nurses include others in their learning implies something about the nature and strategy of learning, which could be interesting for this study.

The instrument enabled participants to answer daily questions about their learning activities in the workplace. The app could be installed on both Android and Apple smartphones, tablets or personal computers. It could be used two sequential weeks, and participants had the possibility to fill in the set of questions five times to ensure that contextual and personal factors were taken into account (Endedijk, 2012).

3.4.3 Learning conceptions

The COLI-questionnaire of Purdie and Hattie (2002), a quantitative Likert-scale instrument was used in this study. The learning conceptions of Säljö (1979) and Marton et al. (1993) were included and altered on the base of their research results. In Table 2, the original and altered learning conceptions are presented. The altered learning conceptions could be divided into a hierarchical set of two groups: the *surface* and *deep* learning approach (Purdie & Hattie, 2002). The first three conceptions, *Learning as…gaining information, remembering using and understanding information, and learning as a duty* are

surface learning conceptions, wherein learning is perceived as the acquisition, storage, reproduction, and use of knowledge (Purdie and Hattie, 2002). The learning conceptions classified as the *deep*-learning conceptions are *Learning as … a process not bound by time or place, developing social competence* and *personal change* (Purdie & Hattie, 2002).

Table 2
The original and altered set of learning conceptions

Overarching learning conception	Conceptions identified by Säljö (1979), and Marton et al. (1993)	Conceptions identified by Purdie and Hattie (2002)
Surface learning conception	Increasing knowledge	Gaining information
	Memorising what must be learned	Remembering, using, and understanding information
	Applying and using knowledge	A duty
Deep learning conception	Understanding what has been learned	Process not bound by place or time
	Seeing things in a different way	Developing social competence
	Changing as a person	Learning as personal change

Note. Original set retrieved from Säljö (1979), Marton et al. (1993) and altered by Purdie and Hattie (2002).

The 32-Likert-scale items were obtained from the original English version and were translated with the back-translation method by two independent translators (Brislin, 1970). In response to the back-translation, some adaptations were made in the Dutch-translated version to match the hospital context and approach the original items as close as possible and (see Table 19, Appendix D). For example, *Learning is not only studying at school...* is altered to *Learning is not only attending training…*, as training is a more commonly used term than the term school. The 32 items featured six learning conceptions (named subscales) with each three till nine statements. Participants indicated to what extent they (dis)agreed with the statements on a six-point scale (strongly disagree, disagree, slightly disagree, slightly agree, agree, strongly agree). For example for the learning conception *Learning as Personal change*, the item *When I learn, I think I change as a person* was included. The questionnaire was included twice, to inquire the changeability of nurses' learning conceptions and the possible reciprocal relationship between learning conceptions and regulation activities in workplace learning.

3.5 Procedure

The set-up of this study consisted of three phases (see Table 3). First, participants were recruited by convenience sampling. A meeting with the educational advisors was scheduled and the advisors received a mail on February 4th, 2019. This mail contained general information, a timeline and participation criteria of the study. The advisors were asked to come up with departments which were interested to participate in the study. Because advisors were consulted, the heads of department were not bothered by the study and the study felt familiar for nurses because it was introduced by their own educational advisors. Before distributing the questionnaires, ethical approval for the study was given by the University of Twente and the Spaarne Gasthuis hospital. In the following two weeks, nurses of the appointed departments were approached for participation by e-mail and face-to-face (see emails and content of LM-app in Appendix A).

Table 3
Chronological Overview of Data Collection Procedure

	Feb 4th – March 4th	March 8th – March 22nd	until March 30th
Researcher activities	Visited departments, spread information about the study, motivate nurses for participation.	Send personal notifications, remember participants of the study, visit departments to check up on participants.	Remind participants of the final questionnaire (COLI-2) by app and email.
Participants activities	Fill in screening questions (general background questionnaire, first COLI-questionnaire) (10 min)	Use the app (each 4 min): o 1 Introduction module o 5 Learning-Moment modules	Make the second COLI-questionnaire by app or email (10 min).

Till March 4th nurses could register by filling in the screening questions, which started with a question to (dis)agree with the terms of the study (see Informed Consent, Appendix C). Herein, it was made clear that results of the study were anonymized, participation was voluntary and participants could quite their participation anytime. The *informed consent*-form was spread by email and could be consulted again via the app, to guarantee participants were aware of these terms. Hereafter, the personal background questionnaire and the first learning questionnaire were inserted. Participants were given the ability to choose a preferred date they wanted to start using the app, which could be adapted in the personal notifications for the participant.

Subsequently, the Learning-Moments app was introduced to the participants and their supervisors by email. In the following two weeks, participants could use the Learning Moments-app five times and fill in questions concerning their learning experiences (8 March until 22 March). They could start on a preferred date and received notifications if they want to fill in the app, on a time they preferred. They could use the app at any convenient time after they experienced a learning moment. Weekends were included in the study to include data of nurses' learning at weekends.

After finishing five Learning Moment-modules, participants were able to finish their participation by filling in the second COLI-questionnaire. This questionnaire was also presented in the Learning Moments-app. Because not every participant finished their five Learning Moments by March 22nd, the second COLI-questionnaire was accessible for every participant by March 22nd. Due to a low response rate for the second COLI-questionnaire, the questionnaire was also spread for remaining participants by mail. All participants were mailed in BBC, to preserve participants' anonymity. After analysing the data, the results were sent by mail and presented for interested parties inside the Spaarne Gasthuis Hospital.

3.6 Data Analysis

The data analysis of this study is structured by the research questions. Both descriptive and inferential statistics were needed to present the data for this correlational study. All analysis was performed with *SPSS Statistics software* (Version 24). After the raw data was obtained from the Learning-Moments app the data was anonymized and transferred to an SPSS data file, by using a personal code for every subject. Table 4 shows the number of participants (*N*) per measurement. All results were taken into account for every analysis. For the paired-sample T-test, to investigate the stability of nurses' scores, only 23 participants finished the second COLI-questionnaire and could be included in the analysis.

Table 4
Number of Participants per Measurement

Research question	Statistics	Instruments	*N*	LM
1. Learning conceptions	● K-means clustering ● ANOVA-test ● Descriptive statistics	COLI-questionnaire	62	-
2. Changeability learning conceptions	● Cross-tabulation	COLI-questionnaire	62	-
	● Paired sample T-test	COLI-questionnaire	23	-
3. Regulation activities	● Descriptive statistics ● SRL-score	Learning-Moments app	30	82
4. Relation between learning conceptions and SRL	● Bivariate correlation analysis ● Paired sample T-test	COLI-1 + COLI-2 + SRL-score Learning-Moments app	39	82

Note. N = the number of participants finished the concerned measurement; LM = number of Learning Moments included.

3.6.1 Analysis of the learning conceptions

Internal consistency reliability. For nurses' learning conceptions, the COLI-questionnaire was used twice, before and after the use of the Learning Moment-app. A reliability analysis for COLI-subscales revealed a poor score (α ≤ .602) for subscales *Learning as… gaining information* (INFO), *as duty* (DUTY), and *a process not bound by time or place* (PROC) and were excluded from analysis (Bland & Altman, 1997, see Table 5). Subscales left, *Learning as remembering, using and understanding information* (RUU)*, as personal change* (PERS), and *as the development of social competence* (SOC), revealed sufficient scores on Cronbach's alpha (α ≥ .74). From the RUU-subscale the first item was deleted for a higher internal consistency (Total *α* = .76 instead of *α* = .73). These three subscales were sufficient internal consisted to use in further analysis.

Table 5
Cronbach's Alpha (α) Indexes for COLI-subscales

Subscale	Items	COLI-1	COLI-2	Total
Learning as gaining information (INFO)	5	.51	.69	.60
Learning as remembering, using and understanding information (RUU)	9	.74	.79	.76
Learning as duty (DUTY)	3	.51	.69	.60
Learning as personal change (PERS)	8	.84	.91	.88
Learning as process not bound by time or place (PROC)	3	.46	.33	.39
Learning as the development of social competence (SOC)	4	.84	.86	.85
Total	32	.88	.92	.90

Validation of K-means Clusters. For the identification of nurses' learning conceptions, nurses were classified in clusters (*surface* or *deep*). In doing so, a K-means clustering analysis was executed to identify homogeneous groups based on the data of COLI-1 (*N* = 39) and COLI-2 (*N* = 23) questionnaires. By clustering the nurses, possible differences in regulation of workplace learning between nurses featuring the deep-learning conception and the surface-learning conception could be discovered. Results of COLI-1 and COLI-2 were used in the same K-means clustering, to ensure identical classify criterium for both measuring moments (*N* = 63). Two overarching learning conceptions were envisioned from theory: the surface and deep learning conception. Therefore, the predetermined number of

clusters (k) for the K-means clustering was two. The subscales with sufficient internal reliability (RUU/PERS/SOC) were used to classify the participants to one of the clusters. Internal and external cluster validations were considered, by examining the internal cluster information (the Silhouette-index), and external cluster criterion based on previous studies (Brock, Pihur, Datta, & Datta, 2008, Charrad, Ghazzali, Boiteau, & Niknafs, 2014, Theodoridis & Koutroumbas, 2003).

Firstly, for the *internal cluster validation,* the Silhouette coefficient was extracted to indicate how well the *compactness* of the objects in a cluster was and how *separated* objects from different clusters were (Struyf, Hubert, & Rousseeuw, 1997). The number of clusters (*k*) was evaluated by varying different parameter values for *k* in SPSS. In Appendix F, Silhouette plots were included for two to four clusters. The width of the clusters and Silhouette coefficient showed most validation with two clusters. Due to outliers, K-means clustering with three and four clusters resulted in very small clusters (*N* = 2). Higher Silhouette-scores with three or four clusters could be attributed to the fact that outliers were no longer part of another cluster. So for this study, the ideal number of two clusters was chosen. All participants were successfully assigned to one of the clusters in five iterations (ten iterations is the maximum number of iterations) (Kodinariya & Makwana, 2013).

Secondly, for the *external cluster validation*, clusters were compared with previous results from COLI-questionnaire. In the study of Zhu, Valcke, and Schellens (2008) the same three subscales were removed (INFO/DUTY/PROC) because of low internal reliability. The classification of clusters is based on a high or low extent of subscales (RUU/PERS/SOC). Previous studies using the COLI-questionnaire revealed more than one learning conception by participants scoring high on several learning conceptions (Peterson, Brown, Irving, 2010; Zhu et al., 2008). The external cluster validation appeared to be sufficient because the class criterion for clusters is in line with previous research.

Differences in clusters. From the K-means clustering, a one-way ANOVA was extracted to have insight on which subscales the participant were classified to a certain cluster. A paired-sample T-test was examined to compare the scores COLI-1 and COLI-2 for the whole sample and test the scores on their stability. The variance of participants' cluster membership between COLI-1 and COLI-2 were presented in a cross-tabulation. For a Chi-square analysis, the sample size was too small, therefore no Chi-square analysis was executed.

3.6.2 Regulation of learning

Qualitative data. The Learning-Moments app was used five times by the participants to measure their regulation activities at the workplace. First, the results of the only open question, concerning the learning content of the learning experiences, were coded by an existing codebook from Berings et al. (2007) (see Appendix E). The categories of the *CanMEDS* competencies (Canadian Medical Education Directions for Specialists; V&VN, 2019) to categorize (workplace) learning experiences, were also considered as a codebook. However, during coding, the categories did not seem exclusive. Wherefore the codebook of Berings et al. (2007) was used for coding (see Appendix E). The codebook was developed to classify the content of nurses' on-the-job learning experiences. Categories existed of *the technical-practical domain, socio-emotional domain, organizational domain, developmental domain,* and *proactive attitude to work,* with each existing of several sub-codes. The category *insufficient answer* was added to the codebook, for answers wherein it was not clear what was learned (e.g. instead of the learning content, the learning activity was reported). Concerning the inter-rater reliability, a second researcher coded independently 20 % of the data to gain a reliable interpretation of the Cohen's κ. The inter-rater reliability was strong, with a score of κ = .885. Differences between the reviews of codes of both coders gave no reason to revise the codebook.

Quantitative data. Closed-ended questions of the Learning Moments-app were used to examine how and to what extent nurses' regulation activities were self-regulated. For every item of the Learning Moments-app, the descriptive statistics were extracted to explore the nature of nurses' workplace learning and regulation activities.

The data concerning the SRL-phases were scored to determine the extent of self-regulation in workplace learning, based on the approach of Aagten (2016) (see Table 6). For the scoring, every phase of SRL was considered: *the forethought, the performance, and the self-reflection*. For each of these questions, answers were marked as fully self-reflected (SRL-score of 1.0), a bit self-reflected (SRL-score of 0.5) and not self-reflected (SRL-score of 0.0). Participants could earn for every learning moment a maximum SRL-score of 3. The questions concerning *planning* and *learning goal orientation* reflected the forethought phase. Even though the regulation of the workplace learning process is less sequenced than in SRL-theories is described (Azevedo, 2009), a planned learning experience testifies of a high(er) SRL-extent (Zimmerman, 2000). If the reason to start the learning experience was internally initiated, the participant received a higher score than if the reason was externally initiated. The intrinsic motive for learning stands for self-regulation in learning (Ellinger, 2004).

The performance phase was presented by questions concerning *learning strategy control.* With this question, nurses' (un)consciousness of choosing the learning strategy was examined. From the theory, it is expected that learners consciously direct their learning activities towards their learning goals including their learning strategy (Pintrich, 2000; Winne, 1995). If the learning experience was chosen consciously, with a clear reason and without the interference of someone else, the maximum score of one was gained. If the strategy was chosen consciously, but with the help of others or the nurse was not able to point out a reason why this strategy was chosen, a half-point was gained. No consciously chosen strategy reflected no self-regulation in learning and therefore zero points were given.

Finally, the question about *future planning* represents the self-reflection phase. One point could be earned if the participant planned to actively continue with their learning and determine their future learning path. This proactive planning testifies of a high degree of self-regulation in learning (Guglielmino, 1971; Raemdonck, 2006). If the nurse had new plans, but less proactively, half a point could be earned. Zero points were assigned if no new plans were made because no new plans do not reflect the pro-activity of self-regulation. Questions left, concerning *reflection on the learning outcome, strategy choice*, and *seeking social assistance* were excluded from scoring because these questions were not theoretically founded for a hierarchical scoring system. For example, the learning strategies could not be classified on the scale of self-reflection whether nurses learn by *looking up information* or *discussing a topic.* However, the results of these questions gave descriptive details about the learning moments.

Subsequently, to calculate the total SRL-score, the SRL-scores of every learning moment were added and divided by the total number of finished learning moments. The number of learning moments was considered later, in examining the correlation between self-regulated learning and learning conceptions. The variation of SRL-scores was examined with the help of descriptive statistics for the whole sample and per learning moment. Lastly, box plots should be presented for all three SRL-numerical variables to have an idea of nurses' average self-regulation of all SRL-phases.

Table 6
SRL scoring table

Variable	Answer options	Extent SRL behaviour	Value

Learning intention	Unplanned	No	0.0
	Learning wish, stimulated by others	No	0.0
	Learning wish, necessary from supervisor	No	0.0
	Learning wish, it was needed for the roll in my team	A bit	0.5
	Learning wish, personal development	A bit	0.5
	Learning wish, curiosity	A bit	0.5
	Planned, stimulated by others	A bit	0.5
	Planned, necessary from supervisor	A bit	0.5
	Planned, it was needed for the roll in my team	Fully	1.0
	Planned, personal development	Fully	1.0
	Planned, curiosity	Fully	1.0
Learning strategy	No conscious choice	No	0.0
control	Conscious choice, but don't know why	A bit	0.5
	Conscious choice, commissioned by another	A bit	0.5
	Conscious choice, there is no other way	Fully	1.0
	Conscious choice, this is the quickest and easiest way	Fully	1.0
	Conscious choice, this manner of learning works for me	Fully	1.0
Future planning	No new plans	No	0.0
	Try another time	A bit	0.5
	Continue exactly in line with what I learned	A bit	0.5
	Apply the learning content in practice	A bit	0.5
	Have a concrete plan for a similar situation	Fully	1.0
	Improve what is learned	Fully	1.0
	New learning goal	Fully	1.0

3.6.3 The relation between nurses' learning conceptions and their regulation of learning

By the scoring table of Aagten (2016), the extent of self-regulation was scored. Variables of SRL, subscales of COLI-questionnaire and personal background variables were considered in a bivariate correlation analysis. With this correlational indexes, correlations between all personal background, SRL and learning conception variables could be explored. An independent sample T-test was included to test possible differences on SRL-scales, *planning, learning strategy control,* and *future planning*, between nurses with different learning conceptions. Finally, four participants that feature different learning conceptions were highlighted to explore differences and similarities between nurses with different learning conceptions.

4. Results

4.1 Exploration of Correlations

In Table 7, the correlations coefficients between all numerous variables of the study are presented. These correlational coefficients give an indication for further descriptive statistics. The bivariate correlation analysis was extracted from the data, including SRL-variables (*forethought, strategy choice,* and *future planning*) and COLI-variables of COLI-1 and COLI-2 (*RUU, PERS, SOC*). The subscales from the COLI-questionnaire were represented by the mean of the COLI-subscales. Also, the total SRL-score and the number of learning moments were included. The number of Learning Moments was considered because a higher quantity of learning experiences reflects a higher extent of learning initiative of the participant. Finally, the personal background variables were included in the bivariate correlation analysis to allow for the possibility of latent variables influencing the SRL-score or the learning conceptions.

Of all relations, twelve relations appeared to be significant. Three significant relations are evident. Work experience and age were highly positively correlated because on average older participants have been working for a longer time than younger participants (r = .895, p < .01). SRL-variables *strategy choice* and *future planning* were significantly positive correlated with the overall SRL-score because the results of these variables are part of the SRL-score (*strategy choice,* r = .650, p = < .01; *future planning,* r = .781, p < .01). This means for example, that how higher the score of future planning, the higher the total SRL-score is. The absence of the statistically significant correlation between the SRL-score and *learning intention* is striking.

Subsequently, there were two statistic significant relations found between the number of learning moments and another variable. Participants educational level was positive correlated with the number of learning moments (r = .330, p < .05). This implies that participants with a lower educational level included less learning moments than higher educated participants. Also, the number of learning moments and COLI-subscale *Learning as personal change* (COLI-2) were significantly positive correlated (r = .658, p < .01). This means that participants who have completed more learning moments in the Learning Moments-app, conceive that learning could ensure personal change. Finally, there was a significant negative correlation found between the COLI-subscale *Learning as remembering, using and understanding* (COLI-1) and participants' age (r = -.376, p < .05). Participants with a younger age scored on average higher on the RUU-scale than older participants.

The bivariate correlation analysis revealed correlations for subscales of COLI-questionnaire between COLI-1 and COLI-2 (Table 7). The variables *learning as personal change* of COLI-1 and COLI-2 proved to be significantly highly positive correlated (r =.773; p < .001). Likewise, the variables COLI-1 and COLI-2 of *learning as the development of social competence* were also positive significant (r = .587; p < .001). Results of the subscale left, *learning as remembering, using and understanding information,* revealed no significant correlation between the COLI-1 and COLI-2. It could be caused by participants that changed their way of thinking about the RUU-learning conception, however on average, the change is negligible (COLI-1 M = 4.72 SD = 0.50; COLI-2 M = 4.65, SD = 0.45).

Then there are four correlations between COLI-subscales, which could be caused by coherence between the subscales. *Learning as remembering, using and understanding* and *Learning as personal change* revealed to be significant positive correlated in both COLI-measurements (RUU-PERS COLI-1 r = .340, p < .05; RUU-PERS COLI-2 r = .509; p < .05). This means that when participants score high on *Learning as remembering, using and understanding information* it is likely that they also score high on

Learning as personal change. This may also be the case for the significant correlation found between variables *Learning as remembering, using and understanding information* and *Learning as the development of social competence* (COLI-2, $r = .450$, $p < .05$). These variables revealed also a positive significant correlation between SOC (COLI-1) and RUU (COLI-2) ($r = .478$, $p < .05$). Lastly, a significant correlation was found between the subscale variable *Learning as personal change* and *Learning as the development of social competence* (COLI-1) ($r = .337$, $p < .05$).

Table 7

Correlations coefficients (Pearson) between personal background variables, SRL-variables and learning conception scales

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender															
2. Age	-.128														
3. Work experience	.053	.895**													
4. Education	-.179	-.153	-.066												
5. RUU1	.150	-.376*	-.320	.088											
6. PERS1	-.105	-.145	-.196	.140	.340*										
7. SOC1	-.033	-.008	-.010	.232	.305	.337*									
8. RUU2	.061	.243	.228	.277	.362	.307	.478*								
9. PERS2	-.095	.053	.041	.242	.209	.773**	.074	.509*							
10. SOC2	-.141	.091	.072	.125	.374	-.062	.587**	.450*	.225						
11. Forethought	.069	-.379	-.338	-.341	.004	-.055	-.132	.024	-.142	-.214					
12. Performance	.112	.009	-.097	-.129	.268	.286	-.197	.335	.651	.082	.174				
13. Future planning	-.249	-.104	-.080	.119	.209	.199	-.123	-.072	-.075	-.288	-.110	.106			
14. Number of LM	-.164	.124	.211	.330*	.058	.239	.025	.406	.658**	.047	-.032	.174	.015		
15. SRL-score	-.299	-.112	-.134	-.148	.215	.276	-.221	.135	.183	-.161	.476	.650**	.781**	.176	

Note. * indicates a correlation with a significance level of .05 (two-tailed), ** indicates a correlation with a significance level of ≤.01 (two-tailed).

4.2 Nurses' Learning Conceptions

For the measurement of nurses' learning conceptions, 39 nurses participated in COLI-1 of which 26 nurses participated also in COLI-2 (response rate of 66.6%). Results of three participants of the COLI-2 were removed because no learning moment was finished. As resulted from internal consistency analysis, only subscales *Learning as Remembering, Using and Understanding, Personal Change* and *the Development of social competence* were satisfactory reliable for further analysis. Results of the learning conceptions are presented in order of the research questions; the identification of nurses' learning conception and the changeability of the learning conceptions over time.

Identification of the learning conceptions. On average, participants in this study scored high on subscales *Learning as remembering, using, and understanding* and *Learning as personal change* (see Table 8, RUU *M* = 4.68, *SD* = 0.47; PERS *M* = 4.62, *SD* = 0.63). This means that on average the participants in this study recognized themselves in the statements concerning these learning conceptions. Nurses scored on average the lowest on the subscale *Learning as development of social competence* (SOC *M* = 4.26, *SD* = 0.76). This latter learning conception resulted in most differed scores.

Two homogeneous clusters were acknowledged from results of subscales COLI-1 and COLI-2. These clusters were made, to identify the nurses' learning conceptions and compare groups of different learning conceptions in their regulation of learning. All participants in both COLI-measurements were represented in the K-means clustering (Total *N* = 62; COLI-1, *N* = 39, COLI-2, *N* = 23,). Originally, the second COLI contained 26 participants, however three nurses were not taken into account in the clustering because zero learning moments were included by those nurses.

More participants were classified to the first cluster, named the deep-cluster (*N* = 33) than the second cluster, the surface-cluster (*N* = 29). An ANOVA-test gave insights into the class criterion for clustering participants. On average participants of the deep-cluster scored higher on all three COLI-subscales compared to the participants of the surface-cluster. The largest difference between the clusters could be found in average scores of subscale *Learning as the development of social competence*. The surface-cluster (RUU *M* = 3.69, *SD* = 0.58), differed on average *MD* = 1.08 on a 6-point Likert-scale from the deep-cluster (RUU *M* = 4.77, *SD* = 0.50). The subscale *Learning as personal change* resulted in the highest mean of all COLI-subscales for the deep-cluster (PERS *M* = 4.92, *SD* = 0.54). Contrastingly, the mean for the PERS-subscale was *MD* = 0.64 lower for participants of the surface-cluster (PERS M = 4.28, SD = 0.54). Between both clusters the COLI-subscale *Learning as Remembering, Using, and Understanding Information* resulted in most corresponding mean scores (RUU surface-cluster M = 4.47, SD = 0.48; RUU deep-cluster M = 4.86, SD = 0.37). All subscales resulted in statistical significant differences between the surface and deep-cluster (RUU, $F(1,60) = 16.57$, $p = < .001$; PERS, $F(1,60) = 16.57$, $p = < .001$; SOC, $F(1,60) = 16.57$, $p = < .001$). Thus, the class criterion for K-means clustering was based on all three subscales.

Table 8
ANOVA results of Nurses' Learning Conceptions Between Clusters

	Surface		Deep				Total	
Learning is…	*M*	*SD*	*M*	*SD*	F	*p*	*M*	*SD*
RUU	4.47	0.48	4.86	0.37	13.61	< .001	4.68	0.47
PERS	4.28	0.54	4.92	0.54	21.85	< .001	4.62	0.63
SOC	3.69	0.58	4.77	0.50	61.39	< .001	4.26	0.76

Note. Cluster size surface (*N* = 29), deep (*N* = 33), Total (*N* = 62).

Change over time. As stated, 66.6% of the participants finished the COLI-2-questionnaire (COLI-1, n=39; COLI-2, n=23). Data of the cluster membership of both COLI-measurements are presented in (cross) Table 9. In both measurements, most participants fit in the deep cluster (n=37; 58.7%; surface, n=26, 41.3%). 18 of 23 participants remain in the same cluster, finishing the COLI-2 (78.3%). The rest switched to another cluster (5 of 23, 21.7%), in particular from surface to deep (4 of 23, 17.4%). Only one of the 23 participants showed the second time a lower cluster than the first time (4.3%). From the 16 participants who dropped out of the second COLI-questionnaire, 10 participants featured a deep-learning conception and 6 participants featured a surface-learning conception (deep-cluster 45.5%; surface-cluster 35.3%). The number of dropouts includes also three participants who did not report any learning moment (*N* = 3).

Table 9

Cross-tabulation of Frequency of Participants per cluster per COLI-questionnaire

			COLI-2			
	Categories		Surface	Deep	Missing	Total
COLI-1	Surface	Count	7	4	6	17
		Percentage	17.9	10.3	15.4	43.6
	Deep	Count	1	11	10	22
		Percentage	2.6	28.2	25.6	56.4
	Total	Count	8	15	16	39

Note. *N* = 39.

Results of subscales in both COLI-measurements. In Table 10, the results of the COLI-1 and COLI-2 for the total sample was presented on a 6-point Likert-scale. From the descriptive statistics, it could be concluded that the average score of the COLI-subscale *Remembering Using and Understanding Information* was for both measurements the highest value of the three subscales (COLI-1 *M* = 4.72; COLI-2 *M* = 4.65). The variation in results on the RUU-subscale was also the smallest (COLI-1 *SD* = 0.50; COLI-2 *SD* = 0.45). Thus generally, nurses recognized themselves most in the statements about the RUU-subscale. On average nurses scored also high on the subscale *Learning as personal development* in both measurements (COLI-1 *M* = 4.68, *SD* = 0.60; COLI-2 *M = 4.60, SD* = 0.72). Participants' were mostly divided on the score of the subscale *Learning as the Development of social competence* as the standard deviation of this subscale was the highest of the three subscales in both measurements (COLI-1 *M* = 4.24, *SD* = 0.71; COLI-2 *M* = 4.27*, SD* = 0.76). The subscale average scores between subscales of COLI-1 and COLI-2 differed slightly from each other (RUU *MD* = -0.07; PERS *MD* = -0.08; SOC *MD* = 0.03). The paired-sample t-test revealed no significant differences on all subscales between COLI-1 and COLI-2 (RUU, $t(22) = 0.58$, $p = .57$; PERS, $t(22) = 0.85$, $p = .41$; SOC, $t(22) = -0.23$, $p = .82$). This means that nurses on average did not score differently the second time. This is in line with previous results in Table 9, wherein no significant differences were found on the level of cluster membership. Both analyses confirmed that there is no significant difference between participants' learning conceptions from COLI-1 to COLI-2. In this study, in a short period of two weeks, participants did not change their learning conceptions significantly.

Table 10

Descriptive Statistics and t-test Results for Subscales RUU, PERS, and SOC

	COLI-1		COLI-2		95% CI			Cohen's	
Subscale	*M*	*SD*	*M*	*SD*	*LL*	*UL*	*t* (22)	*d*	*p*
RUU	4.72	0.50	4.65	0.45	-0.17	0.30	0.58	0.15	.57
PERS	4.68	0.60	4.60	0.72	-0.12	0.28	0.85	0.12	.41
SOC	4.24	0.71	4.27	0.76	-0.32	0.26	-0.23	0.04	.82

Note. *N* = 23; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *p < .05.

4.3 Nurses' Regulation Activities

To measure nurses' regulation of workplace learning, nurses used the *Learning Moments-app* to reflect on their learning experiences. In the Learning Moments-app, a total of 82 learning moments (LM) of the possible 176 LM were finished by 30 participants (46.6%). This implies that 68 times nurses could not come up with a learning moment or simply not answered any questions (*N* = 30). On average participants who used the app, completed 2.73 LM (*SD* = 1.31) and 23 participants finished the required number of two learning moments for further analysis.

In 76 of the possible 176 Learning Modules, participants directly indicate that they learned something (43.18 %). All participants that answered with *I don't know, give me a hint* or *No, I did not learn anything*, were transferred to prompts with examples of various learning contents to let participants recognize their learning moments. Of the 18 times, 6 participants answered positive and recognized that they learned anyway. In the end, that resulted in the 82 completed learning moments (76 from the start of the learning moment, 6 after receiving prompts). In what follows, results regarding the second research question will be presented in the order questions were presented in the LM-app: learning content, learning intention, learning strategy choice, learning strategy control, social assistance and future planning of learning.

Learning content. After recognizing their Learning Moment, participants were asked what their learning content was during their learning moment. The question could help participants to concretize their regulation activities. With the learning content in mind, it would be easier for participants to reflect upon their Learning Moment. Results also give an impression if nurses nowadays have the same learning subjects compared to nurses' in previous research.

The results were coded with the help of the codebook (Appendix E, Berings et al., 2007), of which the results are presented in Table 11. Only 12 of the 17 codes of the codebook were used. 5 of the 17 learning content codes did not occur, including *socio-emotional contact with colleagues, appearance, co-ordinating tasks, learning and collecting information,* and *proactive attitude to work*. With the absence of these learning contents, the daily practical knowledge and skills are emphasized and less time is spent on abstract or tacit knowledge and skills. Mostly, learning moments featured the *technical-practical domain* (47 of 82, 57.3%). *Knowledge in technical nursing* was the most common sub-category of this latter domain (20 of 47). Little was learned about the category *information transfer to patients* (2 of the 47). Then, most learning moments were concerning the *socio-emotional* domain (13 of 82, 15.6%). In this domain, most was learned in the category (social-emotional learning) *with respect to others,* for example: "I have learned that I never should force a patient to take in medicines" (9 of 13). Only a few moments displayed a learning content of the *organizational domain* (5) or the *developmental* domain (1). In 12 of the 82 learning moments participants were not able to sufficiently describe their learning content (insufficient answer, 12 of 82, 14.6%). Participants answered for example how they learned (learning strategy) instead of what they learned, for example, "I had a lesson day".

Table 11

Frequency Table Learning Content

Learning Content	Frequency
Technical-practical domain	47
General skills	6
Nursing skills	14
Knowledge of technical nursing	20
Information transfer to patients	2
Information transfer to colleagues	5
Socio-emotional domain	13
With respect to others	9
With respect to oneself	4
Organizational domain	9
Task-management skills	4
Co-ordinating tasks	0
Role and environment skills	5
Developmental domain	1
Learning and collecting information	0
Self-knowledge	1
Proactive attitude to work	0
Insufficient answer	12
Total	82

Learning intention. In Table 12, frequencies of chosen categories for nurses' planning behaviour and reasons to plan the learning experience are shown. From the 82 learning moments 50 (61 %) learning moments were not planned. In 22 LM, participants planned the learning moment in advance. In 10 LM's, participants had the wish to learn it, however, did not plan the moment in advance. With regard to the SRL-scoring, from the 32 LM which were (to some extent) planned (29 %), 12 LM (37.5 %) fully self-regulated, 14 LM (43.8 %) were to some extent self-regulated and 5 LM (15.6%) were not a display of self-regulation. Participants who showed fully self-regulation in planning, planned it primarily because they wanted to develop themselves (7 out of 13 LM). From participants who showed a bit of self-regulation, they mostly learned it because it was needed for the roll in their team (8 out of 10 LM). The answers *stimulated by others* and *necessary from the organisation* were both chosen only once.

Table 12

Frequency Table Learning Intention

Learning intention	Extent of SRL	Frequency	Percentage
Planned learning strategy		22	26.8
Curiosity	Fully	4	4.9
Personal development	Fully	7	8.5
Preparing for their future	Fully	2	2.4
Stimulated by others	A bit	1	1.2
Necessary from the organization	A bit	0	0.0
Needed for the roll in my team	A bit	8	9.8
Learning wish		10	12.2

Curiosity	A bit	1	1.2
Personal development	A bit	2	2.4
Preparing for their future	A bit	2	2.4
Stimulated by others	No	0	0
Necessary from the organization	No	1	1.2
Needed for the roll in my team	No	4	4.9
Unplanned learning experience	No	50	61.0

Strategy choice. The strategy *to experience or do something* was mostly chosen (34.1 %, see Table 13). Subsequently, *to do a workshop, training or course* was the second most chosen learning strategy. Learning strategies with others involved were also frequently chosen (*to observe another,* 11%; *to discuss with others*, 12.2 %; *receive feedback*, 7.3%). In contrast to the strategy *to explain or teach someone else*, which was only mentioned ones (1.2%).

Table 13

Frequency Table of Strategy Choice

Learning strategy choice	Frequency	Percentage
To experience or do something	28	34.1
To experiment or try something new	3	3.7
To reflect on an experience	5	6.1
To search for information	7	8.5
To observe another	9	11.0
To discuss with others	10	12.2
To receive feedback	6	7.3
To do a workshop, training, or course	13	15.9
To explain or teach someone else	1	1.2
Total	82	100.0

Learning strategy control. For the strategy control, participants were first asked to determine if the consciously had chosen their learning strategy (see Table 14). If so, participants selected the reason why they had chosen the strategy. For 54.9 % (45 LM) of the learning moments, participants chose consciously their learning strategy. Of these consciously chosen strategies, 39 LM were fully self-regulated and 6 LM were a bit self-regulated. The fully self-regulated chosen learning strategies were chosen primarily because *this manner works for me* (22.0%) or *because this way is the fastest and easiest way* (20.7 %). Only once a participant indicated a conscious choice but did not know why this was the case (1.2%)

Table 14

Frequency Table of Strategy Control

Strategy control	Extent of SRL	Frequency	Percentage
Conscious choice		45	54.9
This manner works for me	Fully	18	22.0
Because there is no other way	Fully	4	4.9
Because this way is the fastest and easiest	Fully	17	20.7
Commissioned by another	A bit	5	6.1

Don't know	A bit	1	1.2
No conscious choice	No	37	45.1
Total		82	

Social assistance. The workplace of a nurse seems highly social and therefore social assistance during a learning experience was examined. For the *social assistance* question, participants could choose who was involved in their learning moment. Participants could assign multiple answers if applicable. From the data, it is shown that nurses social assistance is highly present (72 LM; 87.8%). From the 72 LM with social assistance, on average 1.40 different types of assistance were sought (*SD* = 0.62). Most often *a colleague of my own team* was involved in learning (53 times, 64.63%). Nurses sought less assistance from experts (10.98%) and supervisors (7.32%). In only 10 of the 82 learning moments, no social assistance was sought (12.2%).

Table 15

Frequency Table of Social Assistance

Social assistance	Frequency	Percentage
Assistance	72	87.80
A colleague of my own team	53	64.63
A colleague from another team	19	23.17
An expert from outside the organisation	9	10.98
My supervisor	6	7.32
A patient or drawee from patient	14	17.07
No assistance	10	12.20

Note. 82 LM = 100 % .

Future planning. For the last question participants were asked how they would proceed with their learning experience. Table 16 shows disunity in the answers of participants. In 34 learning moments, participants were fully self-regulated in choosing their future planning (41.5%). In another 30 learning moments, participants were only a bit self-regulated (36.59%). With the rest of the learning moments, participants had no new plans for future learning (18 times; 21.95%). With a narrow majority, nurses' planned to *apply the learning content in practice* (20 times; 24.4%). In contrast to *try another time*, which only was chosen once (1.2%).

Table 16

Frequency Table of Future Planning

Future planning	Extent of SRL	Frequency	Percentage
Improve what is learned	Fully	18	22.0
Know now what to do in a similar situation	Fully	14	17.1
New learning goal	Fully	2	2.4
Apply the learning content in practice	A bit	20	24.4
Continue exactly in line with what I learned	A bit	9	11.0
Try another time	A bit	1	1.2
No new plans	No	18	22.0

SRL-score. Data of three variables (*learning intention, learning strategy, future planning*) were scored on the extent of self-regulated learning (see Table 6). For every learning moment (82), participants could earn one point for each of the three variables. The participants' scores of all learning

moments were added and divided by the number of learning moments completed by each of the participants. Of the 39 participants who completed the COLI-1 questionnaire, 30 participants used the app (76.9%). Participants scored on average 1.36 for SRL-index on a scale of 0-3, with a standard deviation of 0.63 (min = 0.00, max = 2.50).

In Figure 1, the boxplot presents the results of SRL-scores, categorized per SRL-variable. All variables variated from the possible zero to one point. On average, participants' SRL-score increased by the progress in phases of the learning moment (*planning M* = 0.29, *SD* = 0.29; *strategy M* = 0.48, *SD* = 0.35; *future planning M* = 0.58, *SD* = 0.28). As the boxplot for the SRL-variable *planning* shows, 25 % of the participants started the learning experience with no self-regulation. Overall participants did not score high on *planning* as the interquartile range shows (between 0 and 0.5). *Learning strategy* scores were equally distributed and had a high variability with scores between zero to one. The boxplot shows a median score of 0.5. In contrast to the planning-scores, the scores of *future planning* are on average high. The future planning scores variated between the possible scores of zero and one. The interquartile range is between approximately 0.33 and 0.83, which is higher than other SRL-variables (*Mdn* = 0.5).

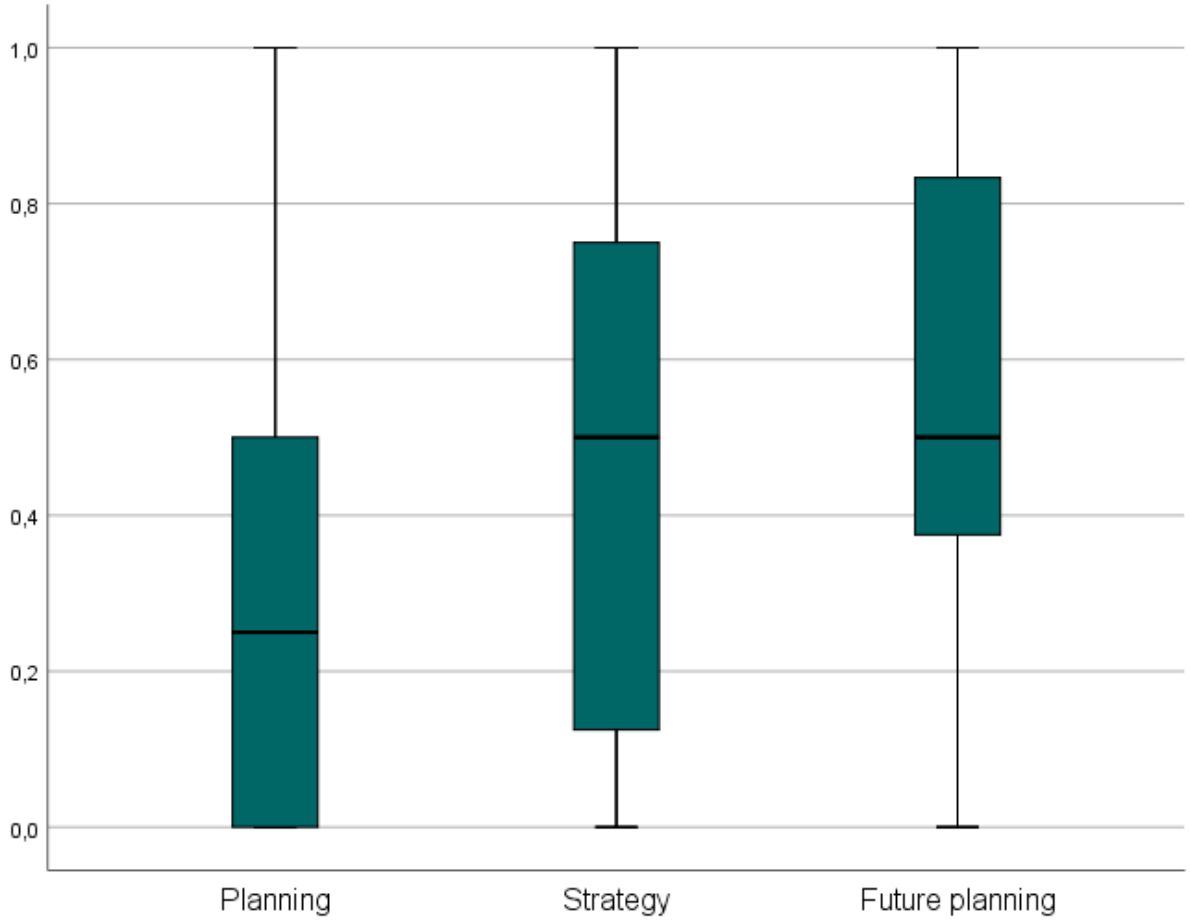

Figure 1. Boxplots for each SRL-variable, planning, learning strategy and future planning, *N* = 30.

5.4 Relationship nurses' learning conceptions and SRL-score

To answer the question concerning the relationship between the nurses' learning conceptions and their regulation activities at the workplace, the bivariate correlational analysis, a T-test and four individual cases are included. From the first paragraph of this chapter, it is concluded that the positive significant relationship between the number of learning moments and the second PERS-subscale was

the only correlation found between the two main concepts of this study (r = .658, p < .01). From the bivariate correlation analysis, no other correlation could be found between one of the COLI-subscales, the SRL-score or the SRL-variables.

Further determination of correlations between SRL-variables and COLI-1 clusters, an independent sample T-test was extracted (Table 17). Only the COLI-1 cluster membership was included because from results no significant difference in learning conceptions between COLI-1 and COLI-2 were observed. The independent sample T-test confirmed previous results of this study. No significant difference between participants of the surface- and deep-approach on separate SRL-variables was found (*planning* t (27) = -0.48, p = .638; *strategy* t (27) = 0.77, p = .447; *future planning* t (27) = 0.60, p = .557).

Table 17

The contrast of SRL-variables between participants from the surface and the deep cluster

	Surface		Deep				95% CI	
Variable	*M*	*SD*	*M*	*SD*	*t* (27)	*p*	*LL*	*UL*
Planning	0.17	0.25	0.22	0.24	-0.48	.638	-0.23	0.15
Strategy	0.55	0.38	0.45	0.31	0.77	.447	-0.17	0.37
Future planning	0.63	0.27	0.57	0.27	0.60	.557	-0.15	0.27

Note. N = 39, CI = confidence interval; *LL* = lower limit, *UL* = upper limit, *p < .05.

Individual cases. In this paragraph four individual cases will be presented, to examine the regulation processes from nurses with different learning conceptions. The two individual cases of the surface approach were clearly different from each other. The first nurse had shown a process of one learning goal, where her previous plans lived up as expected. Contradictory, the second nurse featuring the surface approach, did have a high variety in learning (variation in learning strategy, learning domain, social assistance) however lacked self-regulation in choosing her learning strategies consciously. These findings implied that the latter nurse missed the metacognitive overview in learning, wherein learning is monitored during the performance phase.

The nurses with a deep learning approach could both be described as retrospective or reactive learners as self-regulation was only present in the performance and self-reflection phase of the learning process. These nurses seemed eager in learning as a lot of different learning experiences passed, however the experiences were not planned in advance. Thereby, no cohesion could be found between learning experiences.

Surface Learning Approach

This nurse is 22 years old and has only one year of work experience. She became a nurse by finishing her vocational education degree. She completed three learning moments in the LM-app. Without prompts, she recognized her learning moments directly after starting with the questionnaire. The learning content was concerned the technical-practical domain, for example:

"I learned how I should clean ampoules before they enter the laminar flow cabinet."

She had the learning wish to learn this, however, did not plan it. She learned it by receiving feedback from her supervisor because according to her receiving feedback was the only way to learn this. She knew then what to do in similar future situations. Striking are the two consecutive learning moments concerning the skill of supporting colleagues. The nurse started her second learning moment with a training about how to support others at their workplace because she aimed to develop herself in this. She chooses the training because that was the way that suited her best. Three kinds of social assistance were involved in her learning: colleagues of her own and other teams, and an external expert. She planned to apply her learning profits in practice. Her last learning moment was regarding the active support of new colleagues. She applied her learning profits from training into practice as intended. This learning moment came unplanned for her, and she planned to improve even further what she learned from it. Although this nurse did not fully self-regulate her learning, she managed to actual continue working on her learning goal concerning the support of other colleagues.

Surface Learning Approach

With her 33 years of work experience and 53 years old, this nurse is one of the most experienced nurses who participated. She finished the abolished *in-service training* and works part-time in the geriatric department. She finished 4 of the 5 learning moments, in 3 learning domains and used 4 different learning strategies. Halve of her learning moments were planned (2 of 4), because it was *needed for her roll in the team*. She learned for example:

"I experienced how it would be to work as a director nurse."

With this spontaneous learning experience, the nurse received social assistance from a direct colleague and a patient. Although these data imply that the nurse had a high quantity and variety in learning, she lacked the high self-regulated score (M = 1.33). She missed out on choosing the learning strategy consciously, nor she choose it in other learning experiences. Also, some aspects of regulation were determined by others, as she learned because it was needed for the role in the team, or she had been instructed to use a kind of learning strategy. Yet, she was able to use several learning strategies and reflect on her learning content.

By the many learning moments and the lack of self-regulation, the quantity of learning seemed most important for this nurse.

A deep-approach on learning

This 34 years old nurse was graduated from Higher Vocational Education training for nurses. She already has 17 years of work experience and works part-time. She is a specialized nurse in cardiology. She reported four learning moments, where of one learning moment after receiving learning prompts. These four learning moments were concerning three learning domains, whereof two learning moments were about *general skills* in the *technical-practical domain*, for example:

"How to scan a document."

"How to admit an unknown patient."

In all cases, she used the learning strategy *to experience or do something.* None of her learning moments were planned, three LM were not planned at all, the fourth learning moment arose from a learning wish. Although she did not plan her learning, in three of the four LM the learning strategy was chosen consciously, because it was the quickest and easiest way or because the strategy suited her the best. Her learning was highly social, as social assistance was present in all her learning moments. In all of her four learning moments it concerned a colleague from her own team. For the future, she planned to apply her learning profits in practice or wanted to improve her learning profit even further.

Markedly, her self-regulation fell short planning in (M = 0.13) in comparison with her learning strategy and future learning (both M = 0.75). These results imply that she learns in a retrospective way, wherein she afterwards realises that she learned something.

A deep-approach on learning

One of the few male nurses is 56 years old and had 26 years of work experience in nursing. He finished a Higher Vocational Education for nurses and works in the urology department. Four learning moments were reported, whereof one time he received prompts. He learned something about the socio-emotional domain with respect to himself, and about knowledge of technical nursing, for example:

"In response to the explanation of the side effects of medication from a colleague to a new colleague, I looked up information concerning the medication."

Two of the four learning experiences were not planned, one was planned and the last experience arose from a learning wish. The latter two LM were planned because it was needed for the roll in his team, which reflects not a high degree of self-regulation. Four learning strategies were used, such as discussing with others, receiving feedback and experiencing or do something. Once, the nurse was assigned by another to use a particular learning strategy. Another time he chose a learning strategy because it suited him best. All four learning experiences were including someone else: A colleague of own team (2), a colleague of another team (2), and an external expert (1). He planned to improve his learning further, although no cohesion was found between the learning experiences.

His SRL-score was low on planning (M = 0.38) and learning strategy (M = 0.38), and high on future planning (M = 0.88). As the previous individual case, this nurse is probably positive and enthusiastic in learning however these plans did) not (always) live up to expectation.

5. Discussion

The aim of this study was to explore hospital nurses' learning conceptions and their regulation of workplace learning. To do so, four research questions were answered, concerning nurses' learning conceptions before and after reflecting on their workplace learning moments, their regulation during their moments of learning at the workplace and the relationship between their learning conception and regulation. In this section, results will be related to theories and results from previous studies. Consecutive, limitations and suggestions for further research will be stated and practical implications will be suggested.

5.1 Learning conceptions

The first research question was concerning nurses learning conceptions. Before and after a week of reflecting on the learning experiences nurses featured most often a deep learning conception. This means that nurses perceive learning as an active process of construction of knowledge wherein the meaning and reflection in learning is central. Previous research did not identify a unified learning conception of nurses (Pool, Poell, & Ten Cate, 2012; Eklund-Myrskog, 1997). However, in previous studies, the importance of keeping knowledge up to date was stressed, which was also reflected in the results of this current study.

On average nurses scored both high on the subscales Learning as… *remembering, using and understanding information (RUU)* and *personal change (PERS).* The score of the third subscale *Learning as the development of social competence* was on average much lower and scores were more variated between nurses. The high score on the RUU-subscale could be caused by various external influencers. First, the learning conception could be fostered by the high degree of knowledge which is needed to work as a nurse, as health care organizations are one of the most knowledge-intensive sectors in society (Lammintakanen, Kivinen, & Kinnunen, 2008). Both the base of medical knowledge (diseases, treatment methods, technical/procedural knowledge) and the continual change of this knowledge is causing the demand of acquiring new knowledge constantly (Harrison & Kessels, 2004). Secondly, the focus on remembering and understanding medical knowledge is further increased by the continual external requirement set for nurses to be *demonstrably competent* (Maurits, De Veer, Groenewegen, & Francke, 2017). If nurses are able to recall and understand prior medical knowledge, they are considered as competent. Both the knowledge intensity and demand to be demonstrably competent could cause a sense of urgency among nurses to remember and understand the medical and procedural knowledge.

The high average score of on the learning conception *Learning as the development of personal change* could be reflected by (1) seeing things differently, (2) continuity of a process, or (3) acquisition of a skill or capability that affects the self-perception (Marton et al., 1993). Learning as personal change is often referred by adult learning theorists as *transformational learning* which is sometimes perceived as central to all adult learning (Merriam & Cafferella, 1999). Transformative learning experiences could help learners become more autonomous and capable of determining their actions in future situations, which could improve indirect patient care (Hodge, 2014; Mezirow, 1997). In the study of Jantzen (2008), nurses mostly referred to a transformation if something was learned by an experience on the workplace, such as a complex situation, conflict or moral distress. This transformation or personal change could rather be an *aha-moment* or be spread over a long period of time. If the learner perceives learning as a possibility of personal change, learners could be more alert and aware of transformative experiences on the work floor. Little research has been devoted to nurses' transformational learning experiences. Future studies in this domain could give more insights in when nurses perceive learning as

transformative and why some nurses perceive learning as personal change and others do not.

The low and variated score of the SOC-subscale is striking, as nurses' learning is proved to be highly social (Aagten, 2016, Berings, 2006) and see social experiences often as antecedents for learning (Pool et al., 2012). It may be that nurses acknowledge their learning as highly social, however, they perceive it as a learning resource rather than they define learning by social competence.

The fact that a lot of nurses scored both high on the surface (e.g. on RUU-subscale) and the deep (e.g. PERS-subscale) learning conception implies the diversity of learning conceptions nurses could feature. This is in line with the theory of Fuller (1999), who suggested that learners could feature more than one learning conception. Nurses' learning conceptions could be affected by the influence of different learning contexts (Fuller, 1999; Halldén, 1999). Multiple learning conceptions per nurse could have been developed because hospital nurses are confronted with a large variety of learning situations (Slaats, Lodwijks, & Van der Sanden, 1999).

The second research question was concerning the changeability of nurses' learning conceptions. From this study, it is has been found that nurses' learning conceptions tended to be stable, as nearly 80% of the participants were classified to the same cluster at the COLI-2. The stability of learning conceptions was already suggested by previous research (Brown, 1987; Pintrich, 2004). The studies that showed a change in learning conception conducted a longer learning period (Eklund-Myrskog, 1997; Pool, Poell, & Ten Cate, 2012). The small number of participants that changed positively, could be due to nurses' reflection on learning experiences. By reflecting on their diversity of learning experiences, nurses might realise that learning is defined by more than their previous learning conceptions was comprised. They could widen their view on learning, by the awareness of new knowledge, skills and experiences in learning. The behaviour and learning conceptions of a learner could (unconsciously) affect each other, which could cause friction in a learner's learning style. If the learning conceptions and learning behaviour are not coherently linked to each other, there is a dissonance in a learner's learning style (Vosniadou & Kollias, 2003). Although the fact that dissonance between these concepts could mean a (temporary) friction, it may also be an important condition for change and development in learning (Vermunt & Minnaert, 2003). Differences in hospital's professional development policy for nurses could cause this change in nurses' learning conceptions and respectively the dissonance.

5.2 Regulation of learning

The third research question was about nurses' regulation activities on the workplace. On average, nurses learning experiences were concerning the technical-practical domain and their experiences were not planned. Nurses chose their learning strategy consciously because that strategy worked for them. Most of the time, nurses learned something by experiencing or doing something. Nurses' learning experiences were also characterized by a high extent of social assistance predominantly by a colleague of their own team. In future learning, nurses had planned to apply the learning profit into practice. Most striking results are discussed in the following section.

Most learning moments were categorized in the technical-practical domain, which could be caused by compliance standards. These compliance standards, stated by internal and external governments, form structural motives for nurses' professional development. Most compliance standards are focused on medical knowledge and skills. As stated earlier, nursing is a profession with a high knowledge-intensity, which requires nurses to continue learning new knowledge (Lammintakanen et al., 2008). In contrast, the least was learned concerning the personal developmental domain (e.g. learning how to learn, self-knowledge). This lack could be caused by the general client focus of nurses,

which means that nurses tend to focus everything towards the patient's wellbeing (Crawford, Brown, & Majomi, 2008). The client focus could cause self-effacement, wherein self-development is not the first priority in learning.

Self-regulation in learning was inquired on the basis of the three SRL-phases: forethought, performance and self-reflection (Pintrich, 2000; Zimmerman, 2000). The results of the forethought phase revealed that a major part of the learning moments (60.9%) was not planned, 22 learning moments were planned and of with 10 learning moments participants had only a learning wish. This was in line with the results of the previous study of Aagten (2016) in a comparable context. It was not startling that there were more learning moments unplanned, as learning on the workplace features less intention (Tynjälä, 2008). The planned learning intention was mostly combined with the reason of learning as *personal development* and *the need for the role in the team,* which could be supplementary answers. Both personal development and the role in the team could testify of participants' insights of their own abilities and external/internal requirements for their profession. The motive of *personal development* is in corresponding to the high average score for the learning conception *learning as personal development,* and contrary to the few learning experiences concerning personal development as learning domain.

Although a lot of nurses' learning moments were not planned, their learning strategy was. This was also confirmed by the low SRL-score of *planning* and a mediocre SRL-score of *learning strategy control.* In more than half of the learning moments, nurses' consciously chose their learning strategy although only twenty per cent of the learning was planned. This finding suggests that *planning* and *learning strategy control,* phases of self-regulation in learning, could be separated in practice, what already is suggested by Pintrich (2004). A high degree of nurses' learning could be described as reactive (Eraut, 2004): the learner is aware of the learning experience but it was not planned. Although the learner could regulate the experience after he became aware of it, the learner is no longer able to include the forethought phase in the process of learning. In this current research, only the component *planning* and *learning goal orientation* were taken into account to reflect the forethought phase. If these components are skipped by the learner, no learning goal has consciously been chosen, the learner is not able to monitor the learning progress on the base of the learning goal and is not able to adapt his learning if necessary (Milligan & Littlejohn, 2014). In the study of Lung-Guang (2019), it was concluded that goal setting and strategic planning proved to be the minor SRL-strategies influencing the attainment of personal learning goals. Although the added value of reactive learning experiences remains important, a lack of planning and learning goal orientation appears to have a negative impact on a learner's learning outcomes (Lung-Guang, 2019; Milligan & Littlejohn, 2014). Further research should be undertaken to investigate the difference between profitable reactive learning and a lack of self-regulation.

Nurses learned mostly by *experiencing or doing something* or *to do a workshop, training or course.* In Aagten (2016), *doing or experiencing something* was the second most frequently chosen learning strategy, behind *social learning*. However, in this study *doing or experiencing something* could also include other individuals, as a result of which these data is difficult to compare. The strategy *learning by experiencing or doing something* could be arisen by the antecedent *daily practice*, what is most frequently the antecedent of nurses' learning (Zoethout, 2013). In the current study, the social aspect of learning was reflected in a high degree of social assistance sought by nurses during their learning moments (87.8%, M = 1.4 other individuals involved). Mostly, a colleague from their own team was involved, in contrast with the amount of social assistance from a supervisor. Knowledge sharing appears mostly in healthcare between actors within their occupational group rather than in

collaboration with external actors (Tasselli, 2015). Experts, formal learning experiences excluded, could therefore not be frequently sought actor in learning. The last SRL-phase, future planning resulted in a variation of answers. However, mostly it was planned to apply the learning content in practice. Nurses seem to be motivated to continue their learning process, though it was not measured if plans were put into practice. Future research could connect multiple learning conceptions to investigate the overall learning process instead of separate experiences.

5.3 Relationship between nurses' learning conceptions and their regulation of learning

The fourth research question in this study was regarding the relationship between nurses' learning conceptions and their regulation activities at the workplace. From the bivariate correlation analysis, one significant positive relationship was found between learning conceptions and regulation of learning. The number of learning moments was highly positively correlated to the subscale *Learning as personal change* (COLI-2). On average, participants who completed a high number of learning moments perceived that learning could cause a personal change. However, in the first place, the high number of learning moments should be declared to understand the correlation with the learning conception *Learning as personal change*. This could be caused by nurses' educational level. However, this assumption is unsure because no significant correlation was found between nurses' educational level and personal change.

The difference in the number of reported learning conceptions could also be declared by nurses' motivation and positive mood. In the research of Bindl, Parker, Totterdell, and Hagger-Johnson (2012) results were found that a learner's high-activated positive mood is positively associated with all elements of proactive regulation, envisioning, planning, enacting, and reflecting (Bindl et al., 2012). It was also found that, the *can-do* motivation, perceptions of capability to engage in proactive actions, *reason-to* motivation, the perception that it is worthwhile to engage in proactive actions, and *energized-to* motivation, which exists from an affective experience that fuels individuals into engaging in proactivity, could all enhance the proactivity in starting and regulating in learning (Bindl et al., 2012). Subsequently, a high-activated positive mood for learning and motivation for proactivity is important for forward-thinking and change-oriented behaviour. The correlation could, therefore, be caused by a nurse's positive motivation for proactivity which leads to a high number of learning experiences, and subsequently to a perception that learning could be defined by a change-oriented behaviour: *learning as personal change.* The actual correlation between a learner's high-activated positive mood, their proactivity, their undertaken learning experiences and their learning conceptions should be investigated in future research. If this is the case, it should be considered in which conditions nurses' feel more in a positive proactive mood.

Besides that, some latent variables appeared to correlate to COLI-subscales. Most striking findings were found between subscale *learning as remembering, using and understanding* and participants' age, which correlated negatively. From the study of Eklund-Myrskog (1998), it was already discovered that recently started nursing students perceived learning as solely remembering knowledge for a short amount of time. Tones, Pillay and Fraser (2010) found that age differs the engagement and development in learning. This relation could be caused by the fact that young nurses finished their study recently. During studies, students are used to recall information for tests. Still, at the workplace recalling, understanding and using information is important especially for compliances. The emphasis on knowledge could decrease in age, as older nurses feel more comfortable of possessing the right knowledge. Likewise, the variables *education* and the number of learning moments were positive significant correlated. According to Stockdale (2003), higher educated individuals are more self-directed

learners than individuals with a lower educational level. So these findings were only partly confirmed, as no other correlations between nurses' educational level and SRL-variables were found. In the study of Berings, Poell, & Van Veldhoven, (2010) it was already shown that nurses with a higher educational level were more likely to learn from work experience than nurses with a lower educational level. This current study stresses the need to do further research on the influence of educational level on nurses' workplace learning.

6. Limitations and practical implications

6.1 Limitations

The current study gave new insights into nurses' workplace learning. However, some limitations could be set which could be avoided in future studies. First, 2.73 learning moments per participant were conducted on average, what was below the average number of learning moments compared to the previous study of Aagten among healthcare professionals in residential care (2016; *M* = 4.7 logs). The more learning moments are reported, the more accurate the picture of nurses' self-regulation in learning is, as is assumed in using a multiple-event measurement measuring self-regulated learning. The difference in the number of reported learning moments could be caused by the instrumentation, as Aagten (2016) used emails to send the Learning Moments-questionnaires. In the current study, participants used an app on their mobile phone which was never used before in the use of the Learning Moments-app. From a study of V&VN (2015), it was found that 63% of the healthcare professionals did not felt confident enough in their digital skills. Even though nowadays the health care asks for a variety of digital skills (De Vries, 2014). Thus, although digital skills are demanded of nurses, using an app could still act as a threshold for continuous participation in research.

Secondly, like the study of Zhu, Schellens and Valcke (2008) the internal reliability of subscales *Learning as gaining information* (INFO), *as a duty* (DUTY), and *as a process not bound by time or place* (PROC) were too low to incorporate in the analysis. Apparently, items from these subscales are not consistent enough. An improvement could be made in the measurement of nurses' learning conception by altering the items of the non-reliable subscales. The internal reliability could be improved by finding more appropriate items for these subscales in the context of adult learning at the workplace, to increase the sample size or increase the number of items per subscale (Streiner, Norman, & Cairney, 2014).

Further, the small sample size of this study is a threat to the external validity and therefore to the generalization of the current results. Weeks were spent to convince nurses face to face of their contribution to this research, nevertheless, the response rate was not as high as hoped. Nowadays, according to several hospital employees, nurses experience an overload of requests to participate in multiple studies. In future research, trust and credibility could be gained by stressing the added value of participation, which could provide an increase of nurses' participation (Weierbach, Glick, Fletcher, Rowlands, & Lyder, 2010).

Lastly, the instrument underrepresented the regulation of learner's learning process of development spread over multiple experiences. The focus lied on the separate learning experiences instead of the entire learning process. Adjustments in connecting experiences and aspects of these experiences could improve the quality of the measurement of the learner's regulation in learning.

6.2 Practical implications.

In this study, self-regulated learning and nurses' learning conceptions were examined. The research on both learning aspects of nurses gave new insights that are useful to incorporate in

healthcare education. First, from the only open question of the Learning-Moments app concerning the learning content of nurses' learning experiences, it was revealed that the level of reflection on learning was to be improved. In a significant amount of learning experiences, nurses gave insufficient answers to what they had learned. The practice of reflection on learning could generate improvement in cognitive and metacognitive skills (Kuiper & Pesut, 2003). In the study of Kuiper and Pesut (2003), nurses received self-regulated learning prompts using a self-report instrument, which increased the development of metacognitive insights and reflective thinking in clinical reasoning context. Prompts existed of sentences that needed to be filled in thoroughly, to reflect on their learning (Kuiper & Pesut, 2003). The Learning Moments-app is suited well to incorporate self-regulated learning prompts, to support nurses' metacognitive skills.

From this study, it was again confirmed how social nurses' workplace learning is. It appeared that nurses often learned with (the help of) colleagues of their own team. Nurses' were less tended to learn with colleagues from other teams, a patient, a supervisor or an external expert. If nurses can successfully transfer knowledge among other professionals it could improve best practices, routines and innovations throughout the hospital (Tasselli, 2015). Hierarchical positions between healthcare professionals could act as a threshold for knowledge brokerage, for example between nurses and doctors. Nurse managers and clinical directors are important actors in gaining access to non-redundant, valuable knowledge and spread it between nurses and doctors and different departments (Tasselli, 2015). To maximize the benefit of knowledge of all healthcare professionals, the hospital could encourage nurse managers, clinical directors as well as other healthcare professionals to actively share knowledge. In addition to knowledge sharing, nurse managers have a central role in inspiring and engaging others in (informal) learning activities and provide structural support (Eraut, 2007, Nicolini, Powell, Conville, & Martinez-Solano, 2008; Nonaka, Toyama, & Konno, 2001). Although the importance of nurse managers in the workplace learning setting is highlighted in the literature (Nonaka et al., 2001; Williams, 2010), this impact is often underestimated by the managers themselves (Kane-Urrabazo, 2006). Further intervention research could explore how nurse managers could motivate and support others best in learning and especially in sharing knowledge and skills with others.

At the end of the study, nurses had the opportunity to give feedback on the Learning Moments-app. On average nurses were positive about the content and the use of the app. Some of the participants thought that the questions became a bit superficial after using the app a few times. Although keeping in mind that the app is made to measure the extent of self-regulated learning first, the app could include on-demand-reflection on learning to meet the demand of the nurses. In this way, the app still motivates learners to reflect on learning and could improve the reported number of learning moments. Another part of the nurses found the use of the app-friendly and helpful to get to know more about (their own) learning. Although the findings of the current study were not significant, some learning conceptions changed positively. From previous research, it appeared that reflection moments on individual learning in a continuous manner at the workplace could enhance further improvement in (meta)cognitive skills (Kuiper, 2002). These assumptions give cause for future studies to investigate the potential profits of nurses continuous self-reflection by using a self-report instrument.

7. Conclusions

The aim of this research was to explore nurses' learning conceptions, their regulation during workplace learning and the relation between these concepts. Nurses feature mostly a deep learning conception, although the proportion of nurses with a surface learning conception was large too. On average nurses related learning to remembering, understanding and using information, emphasizing the high intensity of knowledge in the nursing profession. Also, nurses perceived learning as a cause of personal change. This could be caused by the high frequency and diversity of learning nurses are confronted with. At a third learning conception, learning as the development of social competence, nurses scored on average low and results were spread. From this study, it is concluded that no significant difference in nurses' learning conceptions was performed and nurses' learning conceptions could be seen as quite stable.

Nurses' regulation activities were investigated by the Learning-Moments app, reporting multiple learning experiences. Their regulation activities were characterized as a spontaneous, consciously chosen learning strategy, highly social and included optimistic plans for future learning experiences. Nurses' extent of self-regulation was below average and lower than in a previous study. On the regulation aspects *learning strategy control* and *future planning* nurses scored mediocrely. On the aspect *planning* nurses scored on average low, which could indicate a lack of planning skills. From their feedback concerning the Learning-Moments app, it was found that nurses were not used to structurally reflect on their (spontaneous) learning experiences. More attention on reflecting on learning could improve their reflection skills and planning skills to improve nurses extent of self-regulation.

Lastly, in this study, no clear evidence was found for a relation between nurses' learning conceptions and their regulation activities. The correlation found between the number of reported learning experiences and the learning conception *learning as personal change* was striking. Future research could add more attention to the quantity of learning and its influence on a learner's learning conceptions.

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Appendix A
Learning Moments-app Content

Start screen – Informative pages

- Hallo werknemer van het Spaarne Gasthuis!

  Wat leuk dat je meedoet aan ons onderzoek. Met dit onderzoek komen we meer te weten over de manieren waarop jij leert tijdens het werken. Je zult eerst enkele vragen beantwoorden over jouw achtergrond en vragen over hoe jij denkt over het leren.
  Let op!
  1. Zorg ervoor dat je alle vragen beantwoordt en niet halverwege stopt, dan wordt het niet opgeslagen.
  2. Zorg ervoor dat je het wachtwoord onthoudt die jij op de volgende pagina invult. Deze gebruik je om in te loggen in de app.

  Veel succes en plezier bij het gebruiken van de app!

  Anne Bloemendal
  masterstudent Educational Science and Technology

Screening questions

- Hallo medewerker,
  - Voordat je kunt starten met het gebruiken van de app, willen we graag meer over jou te weten komen.

- Rechten van deelname
  Om te kunnen deelnemen, moet je akkoord gaan met de informatie over het onderzoek. Deze informatie is als bijlage meegestuurd in de eerste mail (*informatiebrief verpleegkundig onderwijsonderzoek*). Hierin staat informatie over de rechten van jou als deelnemer en wat je kunt verwachten van het onderzoek. Deze kun je ten alle tijde tijden teruglezen. Alleen als je akkoord gaat, kun je deelnemen aan dit onderzoek.
  - Niet akkoord
  - Akkoord

- Wat is je geslacht?
  - Man
  - Vrouw
  - Overig

- Wat is je leeftijd?
  - *Antwoord in hele Jaren*

- Wat is je hoogst afgeronde opleiding?
  - Mbo4
  - Inservice opleiding
  - Hbo bachelor
  - Hbo master

  - Universitaire bachelor
  - Universitaire master

- Hoeveel jaren werkervaring heb je in de zorg?
  - *Afgerond op hele jaren.*

- Welke functie heb je binnen het Spaarne Gasthuis?
  - *Open antwoord.*

- Hoeveel uur ben je werkzaam (op papier)?
  - *Open antwoord.*

- Op welke locatie van het Spaarne Gasthuis ben je werkzaam?
  Wanneer je bij meerdere locaties werkzaam bent, kun je meerdere antwoorden selecteren.
  - Hoofddorp
  - Haarlem Zuid
  - Haarlem Noord

- Vanaf welke dag zou je de app willen gebruiken?
  Je kunt de app op vijf verschillende dagen gebruiken. De dagen dat je de app gebruikt, moeten daarom binnen de onderstaande dagen vallen. De app zal je aan het einde van je shift een bericht sturen met de vraag of je de app wilt gebruiken. Het gebruik van de app zal niet meer dan zeven minuten kosten.
  - vrijdag 8 maart
  - zaterdag 9 maart
  - zondag 10 maart
  - maandag 11 maart
  - dinsdag 12 maart
  - woensdag 13 maart
  - donderdag 14 maart
  - vrijdag 15 maart
  - zaterdag 16 maart
  - zondag 17 maart
  - maandag 18 maart
  - dinsdag 19 maart
  - woensdag 20 maart
  - donderdag 21 maart
  - vrijdag 22 maart
  - zaterdag 23 maart
  - zondag 24 maart

- Op welk tijdstip van de dag wil je vragen beantwoorden?
  Het beantwoorden van de vragen zal ongeveer 7 minuten innemen van je tijd. Je krijgt vanaf je startdag elke dag een korte melding op het tijdstip dat jij selecteert.
  - 16.00 - Na de dagdienst
  - 23.30 - Na de avonddienst
  - 07.45 - Na de nachtdienst

- Jouw ideeën over het leren
  Bedankt [user-firstname], voor het beantwoorden van de eerste vragen! Nu volgen er 32 zinnen die iets zeggen over wat leren betekent. Voor elke zin geef jij aan in hoeverre jij het ermee (on)eens bent. Het is belangrijk dat je het antwoord geeft wat jij denkt dat goed is.

- *Hereafter the COLI-questionnaire will follow, see Appendix B, Table 18.*

Thank you pages

- Bedankt dat jij deze vragen hebt beantwoord! Binnen 24 uur krijg jij een bevestigingse-mail. Daarna kun je gebruik maken van de App door in te loggen met je emailadres en wat jij hebt aangemaakt. Deze app zal je kunnen gebruiken vanaf de voorkeursdatum die jij zonet hebt aangegeven.
  Download nu de app om mee te doen:

  Apple telefoon: Download hier
  Android telefoon: Download hier

  Mocht je toch vragen hebben, dan kun je ons bereiken via de contactgegevens in de mail. Een fijne dag toegewenst!

Information mail study starts

- Hallo medewerker van het Spaarne Gasthuis,

  Je hebt de eerste vragen beantwoord en bent klaar om de app te gebruiken!
  Mocht je de app nog niet hebben gedownload dan kun je dat doen via:

  Apple telefoon: Download hier
  Android telefoon: Download hier

  Het onderstaande filmpje legt uit hoe je de app kunt downloaden:
  - Filmpje downloaden app: Bekijk het filmpje hier

  Na het downloaden kun je inloggen met je eigen emailadres en eerder ingevulde wachtwoord.
  Zorg ervoor dat je ingelogd blijft,
  zodat je een melding krijgt op het moment dat je de app kunt gebruiken.
  Kom je er niet uit? Mail of bel naar 0629414764.

  Succes!

  Met vriendelijke groet,

  Anne Bloemendal

Information mail participant rejected

Hallo medewerker van het Spaarne Gasthuis,

Afgelopen week heb je de vragen ingevuld voor deelname aan het onderzoek omtrent het werkplekleren van verpleegkundigen.
Helaas moeten wij afzien van jouw deelname door een maximum capaciteit aan participanten of omdat je niet voldoet aan de onderzoek eisen.
Toch willen we je van harte uitnodigen voor de presentatie van de resultaten van dit onderzoek. Hiervoor ontvang je een mail rond eind april.

Met vriendelijke groet,

Anne Bloemendal

Introduction module

- Na deze module weet je hoe de Learning Moments-app werkt.
- Welkom en bedankt voor het gebruiken van deze app!
  Op de volgende pagina's zal je meer te weten komen over de studie en je maakt kennis met de functies van de app (5 min).
- Bij de meeste vragen krijg je de mogelijkheid om te kiezen uit meerdere antwoorden, zoals hieronder wordt weergegeven.
  Kies één van de volgende antwoorden die je denkt dat correct is. Leren is…. *Select an option:*
  - Nieuwe kennis opdoen
  - Vaardigheden ontwikkelen
  - Uit boeken studeren
  - Een cursus volgen
- Fantastisch, je begrijpt het!
  Alle antwoordmogelijkheden van de vorige vraag bevatten leren, er zijn zelfs nog meer mogelijkheden.. Eén van de definities van leren is:

  Het proces van het verkrijgen van nieuwe vaardigheden, kennis en inzichten, wat vaak geuit wordt in nieuw gedrag.

  Vaak wordt leren gezien als iets wat enkel op een training gebeurt. Maar leren gebeurt overal om ons heen, ook op de werkvloer en op veel verschillende manieren.
- Over Leermomenten…
  Omdat leren vaak voorkomt, zouden we graag willen weten wat jij leert op de werkvloer. In deze app worden drie definities van leren gebruikt: leermomenten en leeractiviteiten. Leermomenten zijn de momenten wanneer je je realiseert dat je iets nieuws geleerd hebt. Deze willen wij graag in kaart brengen, door jou één keer per dag vragen te stellen over jouw leermoment. Leeractiviteiten zijn de concrete acties die je onderneemt tijdens de leren.
- Bijvoorbeeld:
  Vorige week heb je een erg interessant boek gelezen over lichaamstaal. Gisteren heb je dit onderwerp besproken met een collega en daarna heb je het zelf op Google opgezocht.

Hierdoor realiseerde je dat je eigenlijk wat geleerd hebt van het boek wat je vorige week hebt gelezen.

- Wij willen graag meer te weten komen over hoe jij leert!
  Dit wordt gedaan doormiddel van modules, een serie vragen over jouw leeractivitieiten op de werkvloer gedurende de dag.
  Aan het einde van elke werk/schooldag ontvang je de vraag om een nieuwe module in te vullen. Je krijgt dan vragen met betrekking tot wat, hoe en met wie je geleerd hebt.
  Geen inspiratie of tijd om de vragen te beantwoorden? Geen probleem. Je kunt de vragen beantwoorden op een moment die jou uitkomt.
- Over de app…
  Als je de app afsluit tijdens het invullen van een module, zullen de antwoorden niet opgeslagen worden en de module zal weer opnieuw starten wanneer je terugkeert naar de module. Wanneer je de laatste vraag van een module hebt beantwoord, denk er aan om op de knop 'Finish module' te klikken. Je zult daarna weer terugkomen op het hoofdmenu en de module die je net hebt afgerond, kun je terugvinden op 'afgeronde modules'.
- Klaar?
  Je weet nu hoe je de app moet gebruiken. De app zal je een notificatie sturen op de dag dat jij wilt starten. Deze dag heb je eerder ingevuld bij de vragenlijst. Mocht je toch vragen hebben, mail gerust!

Appendix B

Questionnaire Learning Moments-app

Table 18

Questionnaire Learning Moments-app in Dutch

Phase	Variable	Item	Categories	Next Item
Introductory question	Introductory question	1. Heb je iets geleerd vandaag?	- Ja - Nee - Ik weet het niet	3 2 2
Introductory question	Introductory question	2. Misschien heb je iets geleerd van: - Iets opzoeken - Iets nieuws proberen - Iemand die jou helpt - Iemand die jou iets vertelt wat jij nog niet wist	- Ja, nu weet ik het - Nee	3 12
Self-reflection	Reflection on learning outcome	3. Wat heb jij geleerd gedurende deze ervaring?	- (Open question)	4
Forethought	Planning	4. Je hebt aangegeven dat je [antwoord vraag 3] hebt geleerd. Had je gepland om dit te gaan leren?	- Ja, ik had gepland om dit te leren - Ik wilde dit al langer leren, maar had dit niet gepland voor dit moment - Nee, het is mij overkomen	5 5 6
	Learning goal orientation	5. Wat was de belangrijkste reden om dit te leren?	- Nieuwsgierigheid - Ontwikkeling van mijzelf - Voorbereiding voor toekomstige situaties - Ik werd door anderen aangemoedigd mijzelf hierin te ontwikkelen - Dit vond mijn leidinggevende noodzakelijk	6 6 6 6 6
Performance	Strategy choice	6. Kies de activiteit waardoor je hebt geleerd. Ik heb geleerd door…	- Iets te doen of te ervaren - Te experimenteren of iets nieuws te testen - Op een ervaring te reflecteren - Informatie op te zoeken (internet, boek, etc.) - Anderen te observeren - Met anderen te discussiëren - Het krijgen van feedback	7 7 7 7 7 7 7

				-	Een workshop, (online)training of cursus te volgen	7
				-	Het geven van uitleg, instructie of een klinische les	7
	Strategy choice	7.	Had je van tevoren bedacht om het op deze manier te leren?	-	Ja	8
				-	Nee	9
	Learning strategy control	8.	Waarom leerde jij dit op deze manier?	-	Er was geen andere manier om dit te leren	9
				-	Dit was de snelste en makkelijkste manier	9
				-	Deze manier werkt van leren voor mij	9
				-	Door een suggestie of instructie van iemand anders	9
				-	Weet ik niet	9
Performance	Seeking social assistance	9.	Waren andere mensen bij betrokken bij jouw leermoment?	-	Ja	10
				-	Nee	11
	Seeking social assistance	10.	Welke mensen waren betrokken bij deze activiteit?	-	Een collega van mijn eigen team	11
				-	Een collega uit een ander team	11
				-	Een expert buiten mijn organisatie	11
				-	Mijn leidinggevende	11
				-	Een patiënt, of betrokkene van de patiënt	11
Self -reflection	Future planning	11.	Hoe ga je nu verder met deze leerervaring?	-	Op basis van mijn leerervaring, stel ik een nieuw leerdoel	
				-	Ik heb precies bedacht wat ik ga doen als ik in een soortgelijke situatie terecht kom	
				-	Wat ik heb geleerd, wil ik nog verder verbeteren	
				-	Het was niet gegaan zoals ik wilde, dus ik ga het nog een keer proberen	
				-	Wat ik heb geleerd, blijf ik zo doen	
				-	Wat ik heb geleerd, ga ik toepassen in de praktijk	
				-	Ik heb (nog) geen nieuwe plannen	

Note. Items are shown in chronological order as presented in application. Questions are based on Aagten (2016), Endedijk(2012), Pintrich (2000), & Zimmerman (2000).

Appendix C
Informed Consent Letter

Informatiebrief verpleegkundig onderwijsonderzoek

Titel van het onderzoek
"Het werkplekleren van ziekenhuis verpleegkundigen."

Onderstaande punten geven diepgaande uitleg over het onderzoek en wat er van je verwacht wordt. Daarom willen we je vragen deze punten goed door te lezen. In de eerste vragenlijst van het onderzoek wordt je gevraagd of je akkoord gaat met onderstaande informatie.

1. Wat is het doel van het onderzoek?
De Spaarne Gasthuis Academie is op zoek naar de passende ondersteuning voor de professionele ontwikkeling van verpleegkundigen, in het bijzonder voor Leren@Work. Het doel van dit onderzoek is meer te weten te komen over het werkplekleren van verpleegkundigen. Dit wordt gedaan door verpleegkundigen te vragen hun leermomenten gedurende vijf dagen bij te houden door het gebruiken van de Learning Moments-app. Aan de hand van deze ervaringen kan er een algemeen beeld worden geschetst. De resultaten van deze studie worden gedeeld met de Spaarne Gasthuis Academie om de ondersteuning voor Leren@Work (nog) beter af te stemmen voor de verpleegkundigen.

2. Wat wordt onderzocht?
Er wordt onderzocht hoe verpleegkundigen op de werkvloer leren en welke factoren invloed hebben op het werkplekleren. Door de data te analyseren kan hier duidelijkheid in geschapen worden.

3. Hoe wordt het onderzoek uitgevoerd?
Eerst zal de verpleegkundige twee vragenlijsten beantwoorden: een vragenlijst over zijn/haar persoonlijke achtergrond (m.b.t. het werken en leren) en een vragenlijst over zijn/haar ideeën bij het leren (15 min). Daarna maakt de verpleegkundige binnen 14 dagen, 5 dagen gebruik van de Learning Moments-app waarbij hij/zij vragen beantwoordt over het werkplekleren (5 x 7 min). Deze kan hij/zij invullen aan het einde van hun werkdag. Ten slotte wordt de verpleegkundige nog één keer gevraagd vragen te beantwoorden over hun ideeën bij het leren (10 min).

4. Wat wordt er van je verwacht?
We verwachten dat je de vragen zo eerlijk mogelijk probeert in te vullen. Er zijn geen goede of foute antwoorden. Het gaat erom hoe jij iets beleefd hebt. Als je vragen hebt of als er onduidelijkheden zijn, hopen we dat je contact met ons opneemt, zodat we je verder kunnen helpen. We willen je vragen om de vragen in de app individueel te beantwoorden, zonder met je collega's te overleggen.

5. Welke risico's zijn er mogelijk?
Er is geen risico bij deelname aan dit onderzoek.

6. Wat zijn mogelijke voor- en nadelen van deelname aan dit onderzoek?

- *Voordelen:* deelname aan dit onderzoek geeft je als verpleegkundige een moment van reflectie van je eigen werkplekleren. Daarnaast levert je deelname informatie op waarmee de Spaarne Gasthuis Academie vooruit kan in het faciliteren van het Leren@Work.
- *Nadelen:* Het kan spannend zijn en niet meteen vertrouwd voelen om je persoonlijke leerervaringen te delen voor wetenschappelijke doeleinden. Ook kost het onderzoek wat tijd (zie *3. Hoe wordt het onderzoek uitgevoerd?*). Mocht je vragen hebben over jouw deelname dan kun je ten alle tijden contact opnemen met de onderzoeker van deze studie *Anne Bloemendal*. Mocht je liever iemand spreken van de Academie dan kun je contact opnemen met Marianne Voskamp (zie contactgegevens onderaan dit document).

7. Wat gebeurt er als je niet wenst deel te nemen aan dit onderzoek?

Je beslist zelf of je meedoet aan dit onderzoek, jouw deelname is vrijwillig. Ook nu jouw afdelingshoofd je heeft gevraagd deel te nemen, ben je vrij in jouw keuze. Als je besluit niet mee te doen, hoef je verder niets te doen. Je hoeft géén reden te verschaffen om niet deel te nemen en je hoeft dan ook geen vragenlijst te maken. Als je wel meedoet, mag je alsnog ten alle tijden bedenken om toch te stoppen. Ook hiervoor hoef je géén reden te geven. Er wordt niemand ingelicht over jouw besluit. Als jij je tijdens of na het onderzoek terugtrekt, dan worden de antwoorden van de vragenlijsten en app verwijderd.

8. Wat gebeurt er met je gegevens?

- *Standaard inzage (geanonimiseerd):* de hoofdonderzoekster (Anne Bloemendal), de PHD-student die verder gaat werken met de app binnen het Spaarne Gasthuis (Judith Frissen) en begeleidster van het onderzoek (dr. Maaike Endedijk, Universiteit Twente).
- *Bewaartermijn:* wij zijn verplicht je onderzoeksgegevens 10 jaar te bewaren (in een afgeschermde map op de server van de Universiteit Twente). Daarvoor geef je toestemming als je meedoet aan dit onderzoek. Als je dat niet wilt, kun je niet meedoen aan dit onderzoek.
- Jouw gegevens zullen gecodeerd opgeslagen en bewaard worden. Dit betekent dat niet direct te herleiden is van wie de gegevens afkomstig zijn. Alleen de hoofdonderzoekster (Anne Bloemendal) en haar supervisor (Marianne Voskamp) hebben toegang tot de sleutel van de codes, en daarmee tot de direct herleidbare gegevens van de interviews. De andere onderzoekers hebben alleen toegang tot de indirect herleidbare gegevens. Tevens worden gegevens in rapportages/publicaties niet herleidbaar (geanonimiseerd) verwerkt.

9. Zijn er extra kosten/is er een vergoeding wanneer je besluit aan dit onderzoek mee te doen?

De deelnemer krijgt geen vergoeding voor zijn/haar medewerking aan dit onderzoek en er zijn geen extra kosten aan verbonden.

10. Heeft de ethische toetsingscommissie van medisch onderwijsonderzoek dit onderzoek goedgekeurd?

Om te toetsen of het onderzoek niet schadelijk is voor deelnemers wordt voorafgaand aan ieder onderzoek goedkeuring gevraagd bij de Commissie Ethiek (CE) van de faculteit Behavioural, Management and Social Sciences (BMS) van de Universiteit Twente. Ook is goedkeuring gevraagd voor de uitvoering van dit onderzoek via de ethische commissie voor onderzoek binnen het Spaarne Gasthuis, Research Manager.

11. Wil je verder nog iets weten?

Voor het stellen van vragen en het inwinnen van meer informatie voor, tijdens, en na het onderzoek kun je terecht bij Anne Bloemendal.

Appendix D
COLI-questionnaire

Table 19

Questionnaire Learning Conceptions

Learning as…		Original English items	Dutch translation
Gaining information	1	Learning is when I'm taught something that I didn't know about before.	Leren betekent: wanneer mij iets verteld wordt dat ik eerder nog niet wist.
(INFO)	2	Learning is taking in as many facts as possible.	Leren betekent: het opnemen van zoveel mogelijk feiten.
	3	When someone gives me new information, I feel that I am learning.	Wanneer iemand mij nieuwe informatie geeft, heb ik het gevoel dat ik leer.
	4	Learning helps me to become clever.	Leren helpt me om slimmer te worden.
	5	Learning means I can talk about something in different ways.	Leren betekent: dat ik op meerdere manieren over een onderwerp kan praten.
Remembering, using, and understanding information	6	When something stays in my head, I know I have really learned it.	Als er iets in mijn hoofd blijft hangen, weet ik zeker dat ik iets geleerd heb.
(RUU)	7	If I have learned something it means that I can remember that information whenever I want to.	Als ik iets heb geleerd, betekent dit dat ik me de informatie kan herinneren wanneer ik dat wil.
	8	I should be able to remember what I have learned at a later date.	Als ik iets heb geleerd, moet ik me dat op een later moment kunnen herinneren.
	9	I have really learned something when I can remember it later.	Ik heb echt iets geleerd als ik het me later kan herinneren.
	10	When I have learned something, I know how to use it in other situations.	Wanneer ik iets heb geleerd, weet ik hoe ik het moet gebruiken in andere situaties.
	11	If I know something well, I can use the information if the need arises.	Als ik iets goed weet, dan kan ik de informatie gebruiken als dat nodig is.
	12	Learning is making sense out of new information and ways of doing things.	Leren betekent: het betekenis geven aan nieuwe informatie en manieren om dingen te doen.
	13	I know I have learned something when I can explain it to someone else.	Ik weet dat ik iets geleerd heb, als ik het aan een ander kan uitleggen.
	14	Learning is finding out what things really mean.	Leren betekent: uitzoeken wat iets echt betekent.
A duty	15	Learning is difficult but important.	Leren is moeilijk, maar belangrijk.
(DUTY)	16	Even when a learning task is difficult, I must concentrate and keep trying.	Zelfs als leren moeilijk is, moet ik me concentreren en het blijven proberen.

	17	Learning and studying must be done whether I like it or not.	Leren moet gebeuren, of ik het leuk vind of niet.
Personal change	18	Learning has helped me to widen my views about life.	Leren heeft mij geholpen om mijn blik op het leven te verruimen.
(PERS)	19	Learning changes my way of thinking.	Leren verandert mijn manier van denken.
	20	By learning, I look at life in new ways.	Door te leren, kijk ik op nieuwe manieren naar het leven.
	21	Learning means I have found new ways to look at things.	Leren betekent dat ik nieuwe manieren heb gevonden om naar dingen te kijken.
	22	Increased knowledge helps me become a better person.	Leren helpt me om een beter persoon te worden.
	23	I use learning to develop myself as a person.	Ik gebruik leerervaringen om mijzelf als persoon te ontwikkelen.
	24	When I learn, I think I change as a person.	Als ik leer, dan heb ik het gevoel dat ik als persoon verander.
	25	Learning is necessary to help me improve as a person.	Leren is nodig om mijzelf als persoon te ontwikkelen.
Process not bound by time or place	26	I don't think that I will ever stop learning.	Ik denk niet dat ik ooit zal stoppen met leren.
(PROC)	27	I learn a lot from talking to other people.	Ik leer veel door te praten met anderen.
	28	Learning is gaining knowledge through daily experiences.	Leren is het verkrijgen van kennis en inzichten door dagelijkse ervaringen.
The development of social competence	29	Learning is knowing how to get on with different kinds of people.	Leren betekent: weten hoe je met verschillende soorten mensen kunt omgaan.
(SOC)	30	Learning is not only studying at school but knowing how to be considerate to others.	Leren betekent niet alleen trainingen volgen, maar weten hoe je rekening kunt houden met anderen.
	31	Learning is the development of common sense in order to become a member of society.	Leren betekent: de ontwikkeling van gezond verstand om een onderdeel te kunnen zijn van de samenleving.
	32	Learning is developing good relationships.	Leren betekent: het ontwikkelen van goede relaties.

Note. Original version retrieved from Purdie & Hattie (2002).

Appendix E
Codebook Learning Content

Table 20

Codebook of Nurses' Learning Content

Nurses learning contents	Sub-code	Code	Examples theory	Examples sample	*f*
1. Technical-practical domain	a. General skills	1	Computer skills, administrative skills	Inscannen document, hoe je een onbekende patiënt opneemt.	6
	b. Nursing skills	2	Technical nursing skills, methodological acting, following protocols	Behandeling bij geïnfecteerde pacemaker, hoe een reanimatie gaat in het zuiderpoort gebouw.	14
	c. Knowledge of technical nursing	3	Knowledge of pathology, knowledge of medication	Wat een bepaald ziektebeeld inhoudt, wat medicijnen doen.	20
	d. Information transfer to patients	4	Information transfer, answering questions, forwarding, writing brochures	Hoe over je een introductiegesprek	2
	e. Information transfer to colleagues	5	Answering questions, teaching clinical classes, reporting, elaborating protocols	Ik heb tips en trucks ontvangen over hoe ik werkbegeleiding moet geven.	5
2. Socio-emotional domain 1. With respect	a. Socio-emotional contact with patients and family	6	Empathy, empathic treatment, patience, dealing with aggressive people, emotional support	Ik heb geleerd nooit een patiënt te dwingen medicatie in te nemen.	5

		to others	b.	Socio-emotional contact with colleagues	7	Emotional support, collaboration, diplomacy, giving feedback	-	-
			c.	Daring to communicate	8	Assertiveness, honesty, prioritizing, drawing the line	Ik heb geleerd dat ik om hulp moet vragen.	4
			d.	Appearance	9	Tranquil, enthusiastic	-	-
	2.	With respect to oneself	a.	Personal coping	10	Putting things in perspective, work-family balance, self-confidence, physical position	Je aan het begin van je dienst niet laten beïnvloeden door gestreste collega's.	4
3.	Organizational domain		a.	Task-management skills	11	Planning, elaborating nursing schemes, structured working	Voorwerken loont.	4
			b.	Co-ordinating tasks	12	Offering guidance, leadership, structuring meetings, performance assessment of team members	-	-
			c.	Role and environment skills	13	Transcending one's own tasks, understanding different roles in the organization, critical reflection on the organization	Hoe de communicatie met betrekking tot opnames verloopt in Hoofddorp als je coördinerend verpleegkundige bent.	5
4.	Developmental domain		a.	Learning and collecting information	14	Collecting information, asking questions, formulating learning objectives, studying learning opportunities	-	-
			b.	Self-knowledge	15	Knowing your own weaknesses and strengths, knowing your own boundaries	Bevestiging dat ik goed zelfinzicht heb en dat dat gewaardeerd wordt.	1

5. Proactive attitude to work	16	Work ethic, decision-making, practical support to colleagues, independent work attitude, flexibility	-	-
6. Insufficient answer	17	No specific learning content was described.	Les over kanker en seksualiteit, Ik ben gisteren naar een voorstelling geweest over dementie, dit was indrukwekkend en leerzaam.	12

Note. f = frequency of learning moments, codebook adapted from "On-the-job learning in the nursing profession, Developing and validating a classification of learning activities and learning themes", by Berings, M. G. M. C., Gelissen, J. P. T. M., & Poell, R. F., *Personnel Review, 37*(4), 442-459.

Appendix F

Silhouette Plots per Number of Clusters (*k*)

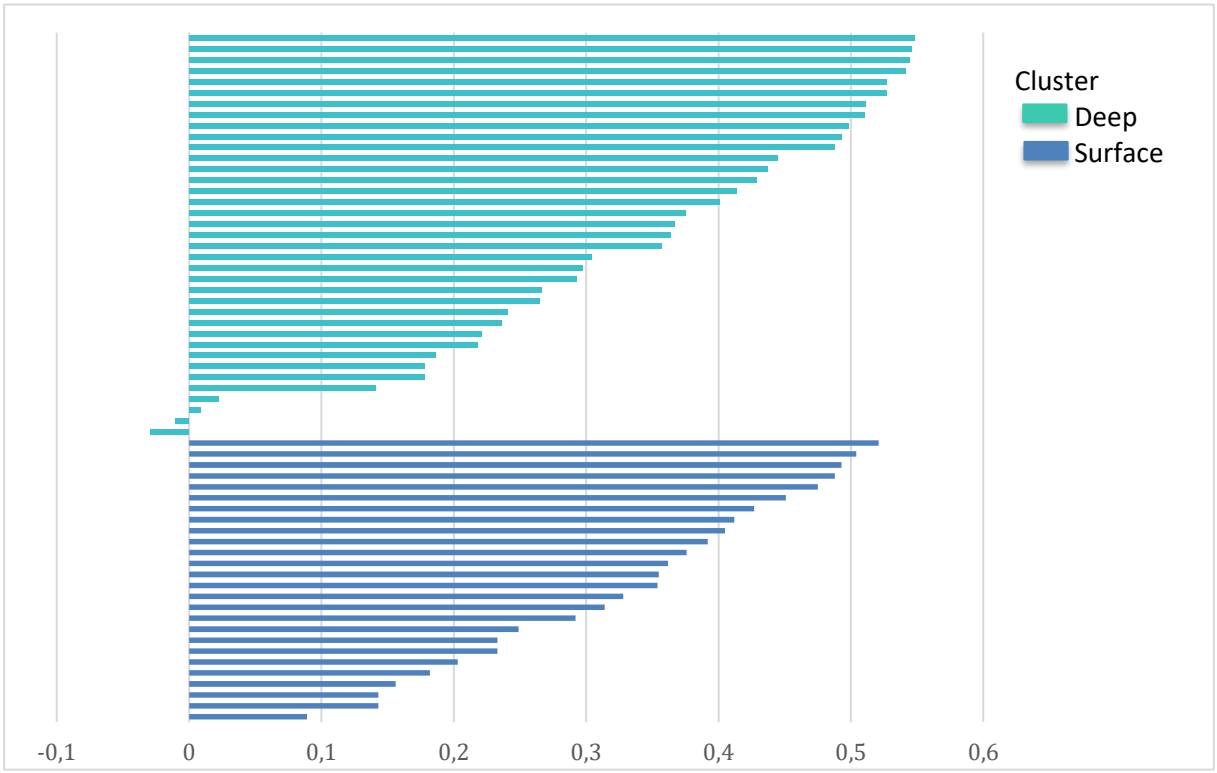

Figure 2. Silhouette Plot of K-means Clustering, *N* = 63, k = 2, *M* = .33, *SD* = 0.15.

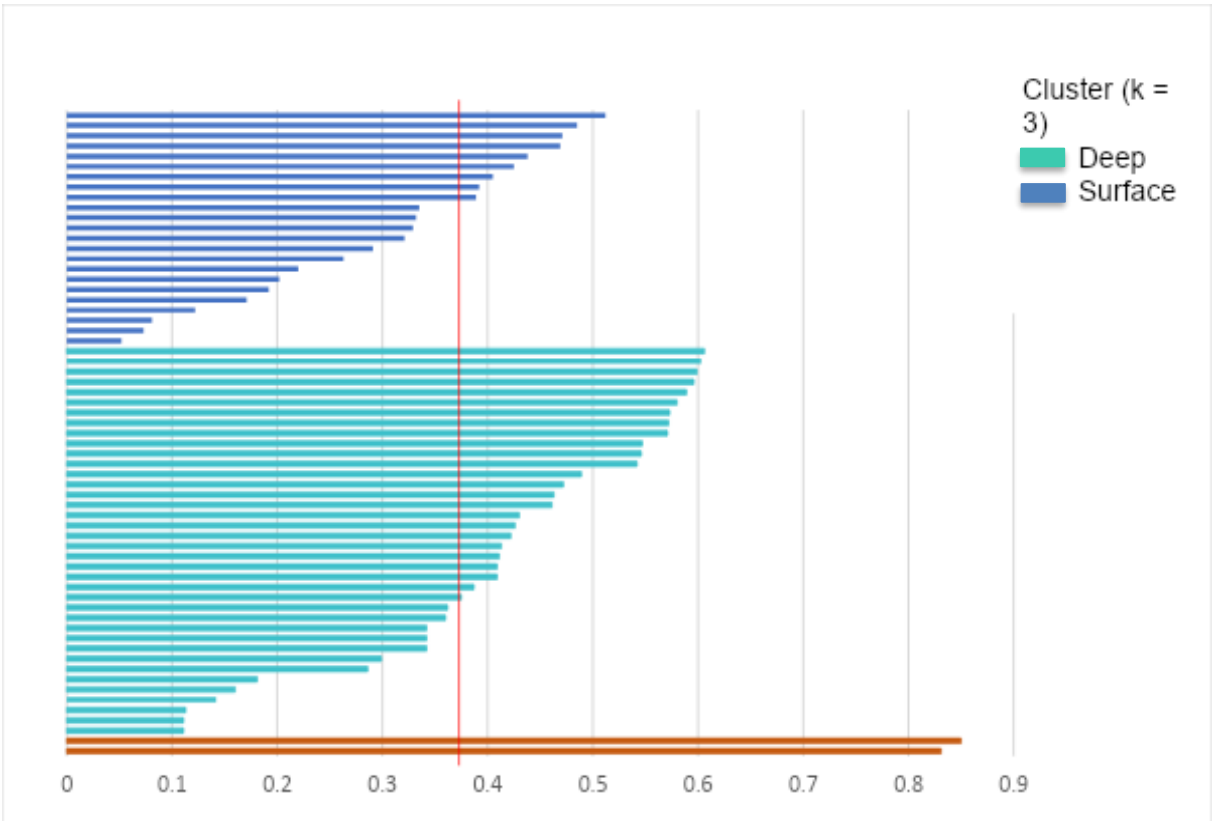

Figure 3. Silhouette Plot of K-means Clustering, *N* = 63, k = 3, *M* = 0.39, *SD* = 1.75.

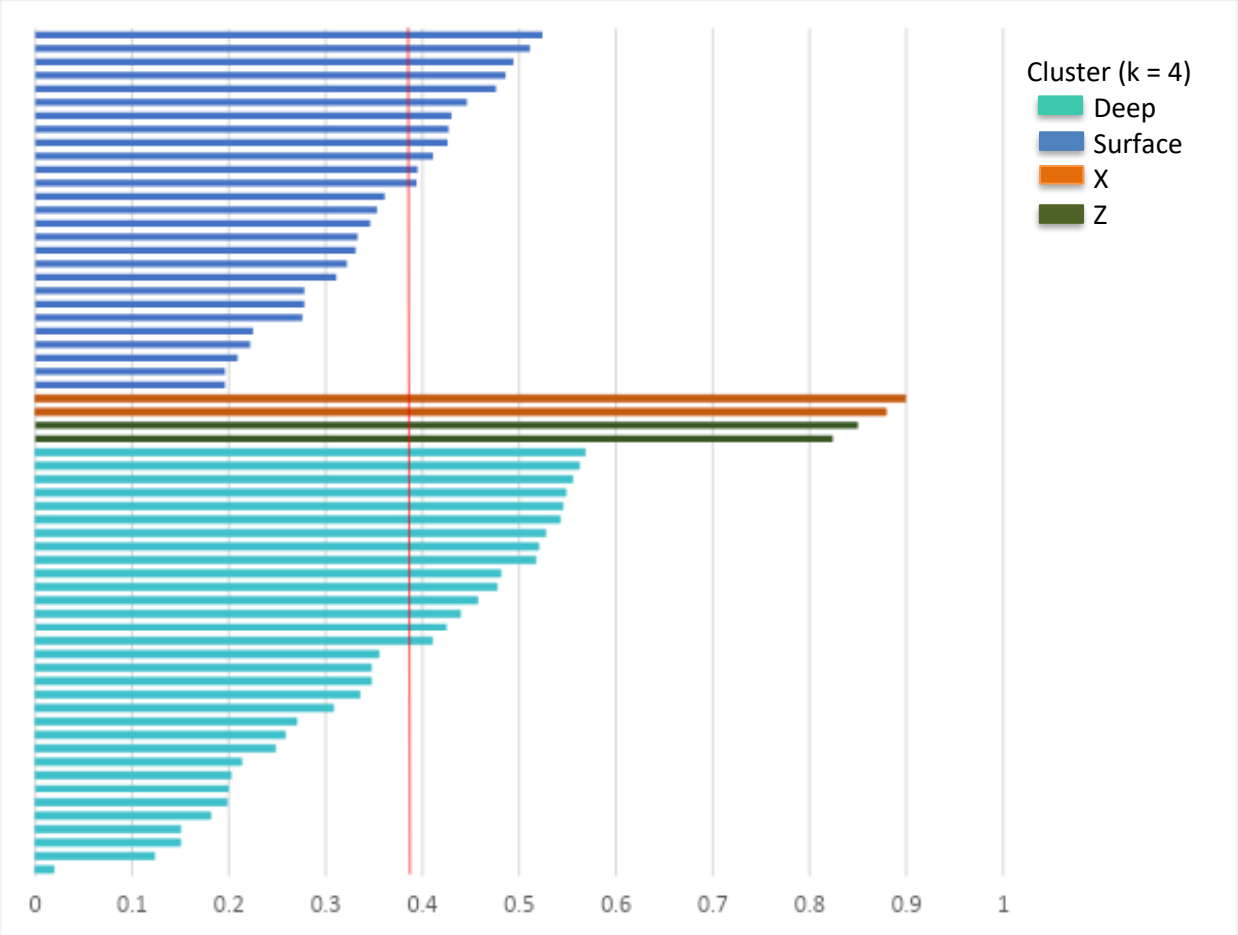

Figure 4. Silhouette Plot of K-means Clustering, *N* = 63, k = 4, *M* = 0.39, *SD* = 1.80.