An experience sampling study of micro-interventions stimulating nurses' regulatory readiness and self-regulated learning behaviour

Master thesis

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Summary

Nurses are expected to be self-regulated in learning (SRL) to keep up with changes and innovations, and to remain competent as a professional. However, learning at the workplace is quite a challenge due to multiple and conflicting commitments of nurses, patient census and time-sensitivity, often resulting in a low extent of SRL-behaviour. Recent research in the clinical context revealed a new SRL model, with regulatory components to initiate, promote and assess the SRL process, and 'regulatory readiness' as a conditional component, described as the effort before an opportunity or activity can be recognized as a learning moment, to start the SRL process. Knowledge about how to support the awareness of learning opportunities and SRL-behaviour in the healthcare context is scarce but is necessary. Therefore, this study investigates to what extent micro-interventions can support and increase nurses' regulatory readiness and their SRL-behaviour. Micro-interventions are small messages, that are provided via an application on their mobile device, to assist learners to reshape their learning experiences and behaviours at the workplace. To maximize the effect of the micro-interventions, four empirically derived accepted change aspects from psychotherapy process-effect have been applied to achieve a behavioural change, combined with competences described in the Dutch professional nursing code. An experience sample of 9 nurses were studied to conduct the analysis. To capture the effect of micro-interventions on nurses' regulatory readiness and the development of their SRL-behaviour, a self-report questionnaire (pre- and posttest) and repeated and self-registered measurements by means of a daily diary were performed. The number of 267 self-registered measurements were analyzed descriptively and statistically; and two visual inspections were performed. Results indicate a middle size effect on nurses' regulatory readiness and their SRL-behaviour with Cohen's d = 0.64. This result indicates that there is a considerable chance that the effect size is caused by other factors and/or coincidence. Additionally, the result cannot be stated as statistically significant.

Thus, the results pinpoint the need for more research on the subject. However, current results contribute to the scarce knowledge of SRL in the clinical context, the supportive effects of micro-interventions on the regulatory readiness and regulation of nurses' SRL, and further development and application of the Learning Moments-app.

Keywords: workplace learning, self-regulated learning, nurses, micro-interventions, diary study.

Introduction

To remain competent as a professional, adequate lifelong learning is a necessity (Cuyvers, 2019). However, employees sometimes fail to firmly regulate their own learning (Littlejohn et al., 2016). It appears to be a challenge to be more aware of learning needs and opportunities (Cuyvers, & Endedijk, 2020; Siadaty et al., 2016b), and to regulate knowledge construction, motivation, and behaviour (Cuyvers & Endedijk, 2020).

A constantly changing clinical environment stresses nurses' need for continuous professional development (CPD), crucial for safe and proficient practice (Bloemendal, 2019; Pape, 2019; Jantzen, 2019). Additionally, as stated in guideline 1.4 in the Dutch professional code, nurses individually are kept responsible for staying competent (Beroepscode van Verpleegkundigen en Verzorgenden, 2020). They are expected to be self-regulated in learning (SRL) as an approach to achieve self-responsibility (Bloemendal, 2019). SRL proceeds through engagement in different activities during recursive phases that are measured in a learning process (Araka et al., 2020; Panadero, 2017) e.g., goal setting, strategy planning, and reflection, through which learners alter their psychological capacities to function-related academic competences (Zimmerman, 2008). Moreover, SRL at the workplace is firmly associated with a more successful performance (Cuyvers, 2019; Kyndt et al., 2016); and excellent patientcare (Jantzen, 2019). However, SRL is mainly studied in the field of educational psychology, but research is limited in the clinical context (Littlejohn et al., 2016; Panadero, 2017).

SRL in the clinical context is specified as a *"pro-active, re-active and/or implicit process orienting thoughts, motivation, and actions towards the achievement of goals"* (Cuyvers, 2019, p. 169). However, nurses are often not fully aware of their SRL and how to self-regulate their learning, experiencing professional learning as enforced instead of as an individual requirement (Kläser, 2018), and having difficulties with goal setting and planning their learning process (Kläser, 2018; Bloemendal, 2019). Therefore, they demonstrate a low extent of SRL-behaviour (Aagten, 2016). Thus, healthcare organizations need knowledge to design supporting tools to stimulate nurses' SRL trough interventions (Bloemendal, 2019; Cuyvers, & Endedijk, 2020; Pape, 2019). The application of a daily diary is an encouraging approach to merge awareness of learning opportunities and experiences, and to develop SRL-behaviour (Schmitz & Perels, 2011). However, previous research reveals a higher impact on SRL when a daily diary is supplemented with extra support (Dörrenbäcker & Perels, 2016). E.g., micro-interventions that are provided via a daily diary tool, to support SRL.

Micro-interventions are successfully used in previous research (Stieger et al, 2020). Due to a much shorter time frame, participant drop-out rate is lower compared to other types of interventions (Jeken, 2020). Micro-interventions are defined as small messages provided by specific technology and tools, such as a mobile phone, to support learners to reshape their know-how and performance in their everyday working place and assist them to start and manage the change process (Stieger et al., 2020).

The aim of current study is to investigate to what extent the micro-interventions support and increase nurses' regulatory readiness and their SRL-behaviour. Regulatory readiness is described as conditional to initiate the SRL-process (Cuyvers, 2019). The SRL- process is consisting of phases such as goal setting, planning and reflection (Zimmerman, 2008), demonstrating nurses' SRL behaviour.

The content of the daily diary-app, also referred to as the Learning Moments-app (LM-app) is originally based on the 'Structured Learning Report' (Endedijk, 2012), and the adapted versions of Aagten (2016), Bloemendal (2019) and Pape (2019). The LM-app is also used to provide micro-interventions. The micro-interventions are founded on the four empirically derived common change factors, which are adapted from psychotherapy process-outcome research (Stieger et al., 2020), and the Dutch professional nursing code (Beroepscode van Verpleegkundigen en Verzorgenden, 2020). Nurses will use the LM-app over a certain period of time during work, phased with and without the support of micro-interventions, to repeatedly measure and register their self-regulated learning activities (Cuyvers, & Endedijk, 2020). The outcome can be used for further development and adaptation of LM-apps. To achieve the research goals, collaboration takes place with the Ziekenhuis Groep Twente (ZGT), by designing a joint project.

The main research question that will be answered in this study is:
"To what extent do micro-interventions, provided via the ED-app, support nurses' regulatory readiness and their SRL-behaviour at the workplace?"

Given the lack of prior research investigating the effect of micro-interventions on nurses' regulatory readiness and their SLR, hypotheses were not defined. In general, it is predicted that nurses' regulatory readiness and their SRL is positively supported and influenced via micro-interventions.

Theoretical framework

In this chapter, the theoretical foundation of this study's core concepts will be discussed. First, the concept of workplace learning will be elaborated on, followed by the specification of the context of nurses' clinical workplace environment. Secondly, the concept of SRL will be discussed and the factors influencing SRL. In addition, SRL in the clinical context will be reviewed. The last key-concept that will be elaborated on, are the micro-interventions, used via the LM-app to support and increase nurses' SRL.

Workplace learning

Although there are several educational and training programs available (Yun, Kim & Park, 2019), referred to as formal learning (Eraut, 2004), most learning occurs primarily from experiences during performance at the workplace (Dornan, 2012), known as informal learning (Eraut, 2004). Examples of informal learning are trial and error (testing), discussions with peers, and searching for information offline and online (Siztman & Ely, 2011). In general, informal learning becomes more relevant than formal learning because employees can individually identify knowledge gaps, create or identify learning opportunities in different contexts, and determine where and with whom they can access knowledge and information (Cuyvers et al., 2016; Siztman & Ely, 2011). Informal learning appears both consciously and unconsciously, and is established by the learner himself (Eraut, 2004; Kyndt et al., 2017). Moreover, opportunities for collaboration, feedback, evaluations, knowledge acquisition, access to resources, mentoring, engagement in communities of practice (COP) (Butler et al., 2004), and scaffolding (Van Eekelen et al., 2005), forecast and increase learning outcome (Kyndt et al., 2016). Learning outcome is described as continuous adjustments in knowledge, competence or approaches that arises from involvement in learning proceedings and that influences learners' current and prospective professional performance (Kyndt et al., 2014).

However, performance at work, engagement in activities and interactions do not automatically contribute to informal learning at the workplace. Because of its tacit nature, informal workplace learning is usually not identified because employees are generally unaware of the fact that they have learned something (Eraut, 2004). It is reflection on learning experiences that is crucial for the professional to become aware of expectations, to look at problems from different perspectives, and to start learning, thereby reshaping daily professional practice (Tynjälä, 2013). Reflection is an active and intentional, emotional, and thoughtful

process of analysis and examination, to make meaningful explanation of learning experiences (Eraut, 2004), and thus crucial for learning. Organizations' leading characters and employees themselves can and should therefore generate opportunities for reflection via evaluation, time for reflection and emphasizing the relevance of reflecting on one's learning experiences at the workplace, so that employees are able to learn (Kyndt et al., 2016).

Although informal learning is mostly regarded as implicit and reactive, based on the level of intention, it can also be deliberative. Deliberative learning is more effective by setting both clear work-related goals and learning goals (Eraut, 2004; Endedijk, 2012), and can lead to more and new learning (Cuyvers, 2019). However, implicit, and reactive learning can become deliberative learning trough active regulation in a retrospective way, known as retrospective regulation. In other words, unexpected learning experiences without pre-set goals still can actively be monitored, evaluated, and reflected upon, after the learning opportunity was experienced (Endedijk, 2012), and become deliberative learning in a retrospective way. This is in contradiction with a planned learning activity in advance, referred to as prospective regulation. Due to the spontaneous aspect of informal learning, a higher degree of retrospective regulation can occur at the workplace (Endedijk, 2012).

Workplace learning in the clinical context

There is a distinct importance for workplace learning in nursing because of the fast-changing healthcare environment, technological innovations, advanced treatment methods, growing disease variety and dynamic task distribution (Kyndt et al., 2016). Additionally, workplace learning is often mandatory, required by external organizations. Think of healthcare structures and managerial institutions, social and professional expectations and by nurses' internal incentive (Jantzen, 2019). Pool et al. (2015) revealed that important prompts for nurses' engagement in workplace learning activities are daily work on the ward, performing new or extra tasks and roles, and additionally, learning experiences in nurses' private lives. Nurses' development strategies could be aimed on those prompts.

According to Jantzen (2019), enhancing nurses' continuous professional development combines both formal and informal learning. However, substantial nursing skills are achieved by means of analyzing and exploring situations and asking questions of colleagues, medical specialists and area experts, described as a repetitive process of learning at the workplace, while nursing. This aspect is considered in the present study, shaping the daily questioning in the

diary with regards to the description of their learning moment and whom they learned with and/or from.

According to Joynes et al. (2017), informal workplace learning in primary care is triggered by patients demonstrating demanding or unexpected conditions, experiencing others' professional performance, and policy directed changes via revised instructions and protocols. These elements correspond with Jantzen's (2019) patient-specific concerns, the catalysts and workplace change. In addition, CPD is required since healthcare professionals mostly are part of an inter-professional team and being able to solve complex problems related to communication and medical treatment (Cleland et al., 2016). This is also corresponding with Jantzen's (2019) highly functional team as a catalyst and recognizing learning needs. Simultaneously, those factors are conditional for learning, because they demand active and conscious engagement and interactions in challenging circumstances, recognized as useful, important, relevant, and filled with practice (Cleland et al., 2014; Cuyvers et al., 2016; Eraut, 2007). Work experiences in the clinical context are, in other words, highly significant and continuously offer a lot of learning opportunities (Hadwin et al., 2018; Hardy III et al., 2018). Additionally, goal setting, strategy planning, reflection (Zimmerman, 2008), monitoring of actions and results, consideration and assessment of the learning process, and adjustments contribute to SRL, within science accepted as a relevant condition for lifelong learning (Cuyvers, 2019).

However, a lot of nurses' learning occurs in a hectic, shifting, chaotic or dysfunctional and dynamic environment (Jantzen, 2019; Tynjälä, 2008). Unexamined experiences may not enhance learning and improve performance; or even worse, may be miseducative and can lead to the development of less excellent nursing habits (Jantzen, 2019). Additionally, nurses' private live changes and lifetime career stages influences the engagement in professional development, time constraints and work environment can also be a barrier (Chakkaravarthy et al., 2018; Pool et al., 2015). In short, learning at the workplace is a challenge due to multiple and conflicting commitments of nurses, patient census and time-sensitivity (Hoffman & Donaldson, 2004).

Self-regulated learning

SRL is described as a controlled procedure wherein learners assemble individual understanding, incentive and performance through cyclical processes that unravel over time (Pintrich, 2004; Cuyvers, & Endedijk, 2020). SRL takes place before, during and after a

concrete learning experience, established by performance-related requirements and challenges, and the urgency to react to it (Cuyvers, 2019; Cuyvers & Endedijk, 2020). When learners organize their learning process themselves, they are highly active in their learning regarding metacognition, incentive, and behaviour (Jansen et al., 2019; Panadero, 2017).

Components of SRL are goal setting, selecting efficient strategies, and monitoring growth (Schulz & Stamov Rossnagel, 2010). According to Zimmerman's and Pintrich's three phased model, which is built on in the present study (Cuyvers, 2019), the SRL-process consists of the phases of forethought, performance, and self-reflection. During the first phase, *forethought,* learners set individual goals and plan for the learning task and work in advance. Learners align their thinking, incentives and decide on the approach of their goal achievement (Schunk & Zimmerman, 2013). During the second phase, *performance,* individual learners are highly cognitively active during their learning experiences at the workplace (Hadwin, Järvelä, & Miller, 2018), by altering, implementing, and developing the approach of their goal achievement (Zimmerman, 2008). In other words, learners apply cognitive activities to learn, monitor and regulate their learning. They arrange opportunities for learning and support in the best adequate way (Araka et al., 2020; Pintrich, 2000; Zimmerman, 2002). Finally, in the third phase, *self-reflection,* learners judge their accomplishment after finishing their work (Araka et al., 2020; Pintrich, 2000; Zimmerman, 2002). During the evaluation, learners rehearse, elaborate on their learning moment, which includes critical thinking and concluding which activities were efficient and what they could do otherwise when a learning opportunity occurs (Araka et al., 2020; Pintrich, 2000; Zimmerman, 2002).

Sitzman and Ely (2011) found that the decision on what goals and the level of goal setting, endeavor, and self-efficacy are the self-regulation components with the highest impact on learning. Thus, active engagement of learners is required (Butler et al., 2004) to shape situations and activities (Gijbels et al., 2012; Raemdonck et al., 2012a, 2014), and to demonstrate personal initiative and responsibility (Gijbels et al, 2012). Additionally, the social environment, social support, interplay, and interaction with significant other people are determining SRL at the workplace (Gijbels et al., 2012; Hadwin et al., 2018; Raemdonck et al., 2014). Therefore, entirely individual SRL is scarce (Cuyvers, 2019). In sum, self-regulatory processes develop from mutual relations between environment, outcome and learners (Hadwin et al., 2018; Pintrich, 2000, 2004), and proceeds through engagement in different activities during recursive phases, self-regulatory processes, and components that are measured in a learning process (Araka et al., 2020; Panadero, 2017).

According to Panadero et al. (2016), measurement of SRL described three waves. During the first wave, SRL was perceived as learners' characteristics or traits, and were therefore measured via self-report tools, e.g., a questionnaire. During the second wave, SRL was described as a process or event that occurred within a learner while being affected by extraneous surroundings, through which learning arises, e.g., the workplace, colleagues, and patients. The third wave, conceptualized as the 'current wave', is wherein SRL measurement procedures also performed as instruments to stimulate or support the self-managing competences in learners. In the current study, the three waves are considered with regards to the measurements of SRL.

SRL is considered a prerequisite to become aware of, to determine, and to address employees' learning needs (Siadaty et al., 2012, 2016a, 2016b), in other words, to determine differences between the present and needed levels of know-how, competences and capacity (Cuyvers, 2019). In turn, learning affordances are recognized and interpreted in the context of the workplace (Cuyvers, 2019). One of the most essential metacognitive SRL-strategies is reflection. Consideration and thinking during the complete procedure of SRL throughout a learning moment should therefore be facilitated (Cuyvers, 2019).

Additionally, research in motivation and engagement in the field of educational psychology revealed that learning leads to motivation (Garon-Carrier et al., 2016; Kirschner & Hendrick, 2020; McConney et al, 2014); moreover, there is a reciprocal relationship between motivation and learning (Liu & Hou, 2018). This implicates that successful learning experience increases motivation and engagement and vice versa. This can be achieved by building on what is already known, scaffolding and breaking tasks into small steps with clear instructions which are easy to follow. Regarding the micro-interventions applied in the present study, these aspects are considered.

SRL is mainly studied in the field of educational psychology. However, different fields can benefit from SRL research. Several areas can be researched, e.g., collaborative learning or regulation of learning, that matches best to the research questions, goals, and focus (Panadero, 2017). In present study, nurses' SRL is therefore explored in the clinical context.

Self-regulated learning in the clinical context

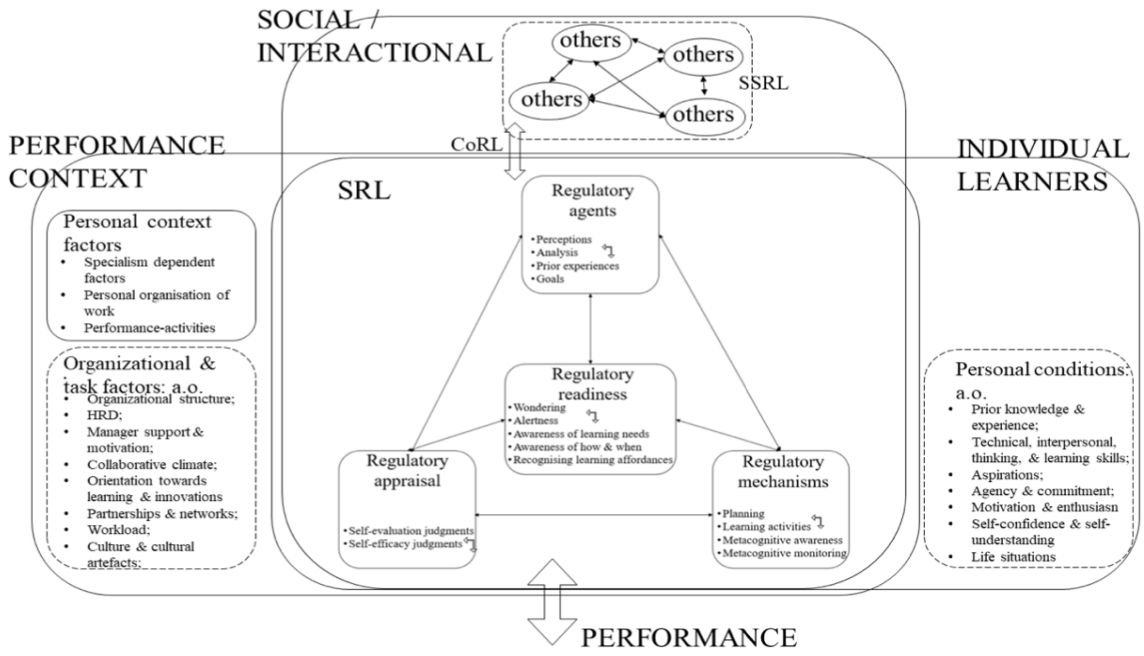
SRL in the clinical context is described as a "pro-active, re-active and/or implicit process orienting thoughts, motivation, and actions towards the achievement of goals" (Cuyvers, 2019, p. 169). SRL in the clinical context is affected by personal learner aspects,

performance context factors, and social interaction factors (Cuyvers, 2019). However, according to Bloemendal (2019) nurses' SRL activities mostly appear spontaneously, and reflection on learning experiences usually does not occur actively and structurally. In addition, Cuyvers (2020) found that nurses' learning is facultative and often focused on solving ad hoc problems. In short, improvement of nurses' SRL is required, and to develop nurses' SRL, interventions can be used (Cuyvers, 2020).

Based on her findings, Cuyvers (2019) developed a conceptual model for self-regulation of professional learning (SRpL) (see Figure 2), in which metacognitive regulatory components initiate, promote, and assess the SRL process.

Figure 2

Model of SRpL for the clinical context (Cuyvers, 2019, p 169).



Each component represents different SRL-strategies, activities, and behaviour (see Table 1). Regulatory readiness is placed in the center and is described as conditional for SRL. Without engagement in regulatory readiness activities, no progress within the learning process will occur (Cuyvers, 2019). Before a learning opportunity can be identified, learning goals are set and SRL is fostered and takes place, these metacognitive components are required. To start the SRL process, support for engagement in regulatory readiness activities, is therefore fundamental. Activities to support alertness, questioning and awareness of learning demands

are described as the use of resources, e.g. (medical) websites, question banks, and medical or specialized applications (Cuyvers, 2019). In this study, the focus is set on the support of regulatory components of nurses' SRL, specifically regulatory readiness, followed by increased SRL-behaviour.

Table 1

Overview of the SRL-components, SRL- strategies, and description of activities and/or behaviour.

SRL-components	SRL-strategies	Description
Regulatory agents	Perceptions of a case/task/situation	Expression regarding the cognitive and effective experience related to a case, task, or situation at hand potentially initiating SRL.
	Analysis of a case/task/situation	What is described to be known about the case, task, or situation at hand potentially initiating SRL.
	Prior experience activation	Expressions of actively searching memory for recall regarding knowledge, skills and metacognitive strategies used in a former, often very similar experience and a possible gap.
	Goals	Expressions of learning goals deliberate and tied to performance-goals, that initiate SRL at the workplace.
Regulatory mechanisms	Planning	Expressions regarding decision-making about a cognitive, or behavioural approach for learning. Expressions of thinking processes related to planning activities that could lead to deliberately or reactively undertaking learning strategies.
	Learning activities: interactions, doing, consulting literature and other written sources, observations	All activities described by the employee to be undertaken that serve the progression of SRL and reach the learning goals.
	Metacognitive awareness	Expressions related to the awareness of the expected efficacy of a way of learning. Descriptions of reasons why a chosen approach will help to reach the learning goals.
	Metacognitive monitoring	Expressions regarding the attention for progression towards the goals set. Descriptions of knowing if and how a chosen approach is serving the progression towards the learning goals.
Regulatory appraisals	Self-evaluation judgments	Expressions regarding the assessment of progress towards learning goals set, or assessment of learning that took place. For learning goals tied to performance, expressions of self-evaluation of performance leading to according self-evaluation of learning.
	Self-efficacy judgment	Expressions regarding the beliefs about one's own capabilities.
Regulatory readiness	Being alert	Not walking around thoughtless and keeping your eyes and brain open for challenges and the danger of routine.

	Wondering	Questioning oneself, one's competences, and what others claim.
	Awareness of how & when	Description of situations in which learning could take place.
	Awareness of learning needs	Realizing what one knows and can, and what not, which procedures and techniques one is able to perform, and which not, realizing that one is better in certain skills than others.
	Recognizing affordances	Expressions about changes and SRL invitations for learning seen in cases, tasks, or situations, and interactions.

Note. Retrieved and adjusted from Cuyvers, 2019, p 146, 150 and 163.

Micro-interventions to stimulate nurses' regulatory readiness and their SRL

SRL occurs at any time within different contexts, but learners often have problems in executing SRL processes, displaying the need for support. Supporting SRL has a decisive impact on motivation, it positively affects metacognition and increases reflection, necessary for SRL (Wesiak et al. 2014). To support SRL, interventions should therefore be focused on regulatory readiness and metacognitive control, referred to as SRL strategy-use (Cuyvers, 2019).

Previous research revealed that micro-interventions are used successfully (Stieger et al, 2020). Micro-interventions are small messages provided by specific technology and tools to support learners to reshape their experiences and behaviours in their everyday working situations and assist them to start and manage the change process (Stieger et al., 2020). Micro-interventions can be delivered via a smartphone or likewise devices. Therefore, the intensity is considerably higher compared with live interventions, e.g., consulting a trainer, which usually takes places once a week (Stieger et al., 2020).

Micro-interventions have a much shorter time frame of 2-4 weeks, than most other types of web-based interventions with a time frame of 8-12 weeks. Due to the compact time frame, there is a reduction of the high dropout rate (Jeken, 2019). Micro-interventions are self-guided and capable to monitor one's learning activities and to determine when to involve with exercises, interventions or resources provided in the application (Bunge et al., 2017; King et al., 2013). Moreover, micro-interventions provide opportunities to reinforce engagement, by generating behavioural micro-interventions to develop social connectedness and shape intrinsic rewards (McGonigal, 2011). In return, sustainable behavioural change is supported externally (McGonigal, 2011).

Another advantage is the easy access of micro-interventions for users via accessible technology. Over 3 billion smartphone users are registered worldwide (Statista, 2020), so they

can serve as a low-cost and engaging tool to support SRL at the workplace. Additionally, micro-interventions are designed to be used repeatedly without being limited, also referred to as 'non-consumable' (Muñoz, 2010), unlike trainers' time or available training opportunities area or region.

Micro-interventions are divided into two forms of modest interventions: *ecological momentary interventions* and *just-in-time adaptive interventions* (Fuller-Tyszkiewicz, 2019). When the appropriate amount and type of support is provided at the right time, just-in-time adaptive interventions are provided (Nahum-Shani et al., 2018). Think e.g., of a smart watch, which collects physical information (e.g., heartbeat rate during jogging) and in return, provides the support needed (e.g. slow down to decrease heartbeat rate). Ecological momentary interventions can be used by individuals in the context of their everyday lives and workplace. Users can apply the content of the micro-intervention at any time and place they prefer (Heron & Smyth, 2010). E.g., ecological momentary interventions enable nurses to reflect upon a learning opportunity at the workplace when and wherever they prefer. Therefore, the present study will apply ecological momentary micro-interventions.

The four common change factors

To maximise the effects on SRL regulatory behaviour, four empirically derived common change factors from psychotherapy process-outcomes are applied to further shape the micro-interventions (Allemand & Flückiger, 2017). These behavioural change interventions are applied in populations wherein personality disorders not specifically are involved (Allemand & Flückiger, 2017). First, *activation of discrepancy awareness*. A demanding factor of becoming aware of the gap between the current and desired levels of knowledge, skills, and ability, is to grant learners a choice in their change goals, to repetitively remind them of their craved behaviours, and to serve personally tailored comments on the perceived disparity in knowledge, skills and ability (Martin et al., 2014a). Second, *activating strengths and personal resources* is necessary to realize strengths orientations, to weight the learners' long-term goals and future ambitions, rather than to focus on difficulties and shortcomings (Allemand & Flückiger, 2017). This means that positive feedback must be given to reinforce motivation and confidence, and to inform the learner about the lifelong changeability of behaviour (Roberts & Mroczek, 2008). Third, to *increase self-reflection and to realize insight*, it is relevant to point feelings and thoughts (Allemand & Flückiger, 2017). This can be realized by teaching and supporting the learner to reflect on their experiences, pros and cons (Miller & Rollnick, 2012). *Practicing SRL*

behaviours is the fourth factor. This action-oriented factor ensures engagement and reinforcement in SRL behaviours (Allemand & Flückiger, 2017; Magidson et al., 2014; Roberts et al., 2017). Action orientation can be realized by helping the learner to determine the when and where of new SRL behaviour, e.g., by providing the learner with 'if-when' ideas. Additionally, the content of the micro-interventions is based on the Dutch professional nursing code (Beroepscode van Verpleegkundigen en Verzorgenden, 2020). See Appendix B.2 for the complete set of micro-interventions.

Present study

This study means to explore the effect of micro-interventions of nurses' regulatory readiness and their SRL-behaviour. Regulatory readiness is considered being conditional to initiate the SRL-process (Cuyvers, 2019). Without regulatory readiness the SRL process will not take place. The SRL-process itself is divided and measured in the phases of forethought (learning intentions), performance (strategy control) and self-reflection (future planning) (Zimmerman, 2008), demonstrating nurses' SRL-behaviour.

Furthermore, the LM-app on itself operates as an intervention mechanism, because participants analyze and reflect on their learning moments via the daily questions. This might also affect participant's SRL (Panadero et al., 2016). In the LM-app the nurses are asked if, what, how and with/from whom they have learned, and what their future are with their learning experience. These questions correlate with the SRpL model of Cuyvers (2019), and its regulatory readiness – being attentive, curious, consciousness of how & when and learning demands. The regulatory agents (goals) in Cuyvers' SRpL model corresponds with the SRL-phase of forethought (learning intentions), and Cuyvers' regulatory mechanism – planning and learning activities corresponds with performance (strategy control). The regulatory appraisal (self-evaluation judgements) harmonizes with self-reflection (future planning), and the social/interactional aspect of Cuyvers' SRpL model (2019) corresponds with – and is embedded in the daily questionnaire.

Method

Research design

An experience sampling method (ESM), also referred to as a daily diary study, is used in a clinical context to explore the effect of micro-interventions, the independent variable, on nurses' regulatory readiness and their SRL behaviour, the dependent variables. The ESM involves questioning the participants on their learning experiences, behaviours, awareness, and reflection on multiple moments over time (Sather, 2014). The data is collected by a multi-method approach because relying on one instrument should be avoided (Schmitz & Perels, 2011; Panadero et al., 2016). To investigate the micro-interventions effect, Panadero, Klug, and Jarvelä (2016) recommended combining a pre- and post-questionnaire with the daily measurements.

First, SRL requires regulatory readiness to initiate the SRL-process (Cuyvers, 2019). To capture nurses' self-directed learning readiness and its development during participation, a self-report questionnaire is conducted before and after using the ED-app. Second, repeated and self-reported measurements are performed to capture the effect of the micro-interventions on nurses' regulatory readiness and their SRL-behaviour.

In current study a within single case design is applied, in which the achievement of each participant is measured in every phase of the study (Kartochwill & Levin, 2014). The effect of the interventions is assessed by analyzing the pattern of the measured outcomes; every participant operates as their individual control group (Smith, 2012). Generalizability is lower than for experimental group studies, but it allows for the deduction of causal inferences of treatment effects (Kratochwill & Levin, 2015; Manolov et al., 2016). Regular and repeated data collection via a quantitative instrument takes place over a period, between 14 and 35 days, as advised by Kazdin (2011).

The design is acknowledged as the treatment reversal design, also referred to as an ABAB design (Valentine et al., 2016). During the baseline phase (A), only learning moments are reported, micro-interventions are not provided. The baseline phase is followed by an intervention phase (B) wherein micro-interventions are provided, with further repetition of the baseline and intervention phase (Abrahamsson et al., 2018; Bouwmeester & Jongerling, 2020; Valentine et al., 2016).

According to Bouwmeester and Jongerling (2020), there are several factors which influence the power of interventions, measured in a single-case design. The number of participants has a main effect on both the power and the within participant effect size. The

number of 6 participants already result in an expected high power, with a Cohen's d = 1. Additionally, more possible (3 to 4) and non-overlapping start moments result into a higher power. Furthermore, a similar number of baseline and intervention measurements, between 15 and 30, results in a higher power, since more measurements result in more stable estimates of the mean, which is valuable for the power (Bouwmeester & Jongerling, 2020).

The forementioned factors are considered in the current design. The aim is to gain new insights on how to support nurses' SRL behaviour by systematically gathering data and to analyze it quantitatively, to answer the research question.

Organisational context

Research is performed in a medium size general hospital, with two locations situated in the east of the Netherlands, providing medical care for approximately 390.000 citizens in the region. Number of employees are over 3.200 (Jaardocument, 2018). Three participating nursing departments - the dialysis department, a children's ward, and a mother and child ward - are selected by the educational advisers of the hospital's academy, as a preparation towards a large-scale policy to reform and implement developmental-oriented assessments at the workplace. The support and increase of nurses' SRL behavior is required to prepare for the implementation of this policy.

Participants

Non-random sampling (purposeful sampling) is used to gain insight in nurses' SRL at the ZGT hospital. Participants are approached and enlisted by convenience sampling, because the admittance norms are applicable for nurses in the direct setting of the study, with access to use a smartphone or likewise device, and a reasonable average of working hours per week (> 16). The effect of the micro-interventions, which is the unit of analysis, on nurses' SRL is measured. Based on previous research, a sample size of at least 6 (n=6) is considered enough to discover average treatment effects in the design of this study (Abrahamsson et al., 2018; Bouwmeester & Jongerling, 2020; Kazdin, 2011). In this study however, at least 30 possible participants are addressed; the minimum sample size of 6 to end with, is a prerequisite. The ED-app must be used for 30 working days at a minimum, to cover at least 30 measurements per participant, to measure participants' SRL at the workplace (Bouwmeester & Jongerling, 2020; Kazdin, 2011).

Finally, 22 nurses were found willing to participate in this research, of which 15 nurses finished the pre- and posttest (N = 15). See table 2 for their general background characteristics.

Table 2

Participant's general background

Variable	Categories	Frequencies	Percentage
	Female	15	100%
Age in years	26-30	4	26.7%
	36-40	1	6.7%
	41-45	4	26.7%
	46-50	3	20.0%
	51-55	2	13.3%
	56-60	1	6.7%
Highest level of education	Mbo-4	1	6.7%
	In-service	5	33.3%
	Hbo bachelor	7	46.7%
	Hbo master/Hbo+	2	13.3%
Workexperience in years	0-5	2	13.3%
	6-10	1	6.7%
	11-15	1	6.7%
	16-20	3	20.0%
	21-25	3	20.0%
	> 26	5	33.3%
Working department	Children's ward	3	20.0%
	Mother-child ward	8	53.3%
	Dialysis department	4	26.7%
Working hours per week	17-24	9	60.0%
	25-32	4	26.7%
	33-40	2	13.3%

Instrumentation

Data is collected via two instruments. First, a self-report questionnaire is conducted at the start (pretest) and end of the study (posttest) to measure nurses' self-directed learning readiness. Second, daily measurements are taken during the study via ED-app, to measure the variables.

Self-report questionnaire

General background. A general background questionnaire was included into the SDL readiness questionnaire to profile the participants. The questionnaire, based on previous research in similar contexts (Bloemendal, 2019; Pape, 2019), included demographic questions about gender, age, highest achieved educational level, function at work, years of work experience, department, and the average working hours per week (see Appendix A.1).

Self-Directed Learning Readiness. To measure nurses' regulatory readiness, the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher & King, 2010), is used and adapted to the context of professional nurses. The scale consists of 29 items distributed over three subscales: 'Self-management' (10 items), 'Desire for learning' (9 items) and 'Self-control' (10 items), rated on a 5-point scale: (1) no, (2) to a small degree, (3) satisfactory, (4) to a great degree and (5) to a very great degree.

The SDLRSNE is previously reported as a reliable and valid scale in several studies in the clinical and nursing educational context (Fisher & King, 2010). E.g., a UK randomized experimental designed study reported the internal consistency of 0.86 for 'Self-management', 0.85 for 'Desire for learning', and 0.89 for 'Self-control; the total scale Cronbach's coefficient alpha was 0.95 (Fisher & King, 2010), see Appendix A.2.

The Ethica Data application (ED-app)

The ED-app used in the present study, is a diary log, using micro-interventions to enable nurses to reflect upon a learning opportunity at the workplace when and wherever they prefer, to gradually optimize their SRL behaviour. Ethica Data is an application that appeared from a research project at the University of Saskatchewan (https://ethicadata.com/about). The ED-app allows nurses to reflect on a learning experience in a retrospective way, since, according to Tynjälä (2008), a lot of learning is informal and unplanned in a hectic and dynamic environment. In addition, repeated self-monitoring of self-regulation will prompt an improvement of SRL (Schmitz & Perels, 2011).

Daily measurements. For daily SRL behaviour measurements, the ED-app will be delivered on the participant's smartphone. This offline measurement tool is an application that enables researchers to send questions and hints to participants with a particular timing and the application of announcements (Jeken, 2020). The ED-app content is adapted for use in the clinical context by Bloemendal (2019) and Pape (2019); and contains eleven closed-ended questions and one open question structures to discover the disposition of nurses' SRL on the

workplace, based on Aagten (2016). The questions illustrate the three SRL-phases forethought, performance, and self-reflection (Pintrich, 2000; Zimmerman, 2002), see Appendix B.1. Depending on the given answers, routing takes place, and not all questions are displayed. The participants are offered an opportunity to fill in a second learning moment.

Micro-interventions. During the intervention phase, the daily measurements were supplemented with micro-interventions based on the four common change factors (Allemand & Flückiger, 2017) and the Dutch professional code (Beroepscode van Verpleegkundigen en Verzorgenden, 2020). Founded on the fundamental concept of self-regulated intention towards requested behavioural adjustment, participants were obliged to choose whether to apply the intervention suggestions, without being biased by feedback (Stieger et al., 2020) (see Appendix B.2 for micro-interventions). The effect of the micro-interventions is explored through comparison of the measurements in the baseline phase and the intervention phase. A pilot study among 3-4 nurses and peers is conducted beforehand to test if the ED-app had to be adjusted, to perceive meaningful results.

Procedure

Preparation. Admission for this study was requested from the supervisor and the educational advisers of the ZGT Academy. Additionally, approval by the ethical committee of the University of Twente (UT) was requested for. By using the ED-app, private data of the participants were stored safely, therefore required privacy and General Data Protection Regulation (GDPR) standards are met. Nurses were recruited by the managers of the participating nursing departments. The sample is taken by using the snowball technique.

Participants are presented an informed consent form to inform them about the goal of current study, and conditions for participation, see Appendix C. Only after having agreed upon the informed consent, participation could proceed. Participants were informed that participation is voluntary, that they could withdraw from the study, and that their input is anonymized and exclusively applied for the current study. In addition, contact details were provided in case further questions or concerns should arise.

Thereafter, the general background and SDL readiness questionnaire is presented, followed by an instruction of how to install the ED-app, and how to create a personal account. Upon installation, a second informed consent and an introduction course is presented, to become familiar with the concept of the daily measurements, also called ‘learning moments (LM)’, the terminology, and to enable participants to practice with the ED-app.

Measurements and micro-interventions. Data collection started once the participants signed up after installation of the ED-app, according to the ABABAB phase design, to conduct a clinical and scientific authentic construction (Tanious & Onghena, 2019). A predefined timing is set, so that participants received notifications, activity hints and reminders at their working days and preferred time. The baseline measurements covered 1-5 minutes on a predefined everyday base for a duration of 30 working days, according to the participants' working schedule. The micro-interventions covered 1-2 minutes each with 15 measurements, divided into 5 measurements per phase per participant during the field research period. Started on the first day, chosen by participants within a period of 4 weeks, they received a push notification according to their personal working schedule to fill in the diary. When the diary was not filled in, e.g., in case of a working shift, an extra notification was sent after 90 minutes. The researcher intended to visit the participating departments regularly, to motivate the participants and to reduce the number of dropouts. Unfortunately, due to the pandemic, communication with the participants was only permitted online. The diary had to be filled in for at least 30 working days (at least 15 measurements per phase per participant) and ended with the SDL readiness questionnaire as a posttest.

Closure. After completion, the participants were acknowledged for their attendance. They were able contact the researcher in case of concerns or further questions.

Data analysis

Diary studies display a two-phase cluster sampling, with participants and daily responses sampled in three baseline phases and three micro-intervention phases, resulting into daily responses being assembled within participants (Ohly et al., 2010). The responses are measured and the results in the baseline phase and intervention phase are compared to explore the effect of micro-interventions (independent variable) on nurses' SRL-behaviour (dependent variable 2). ED-app is a diary log, which is an applicable approach to examine learning approaches of an extensive population (Babbie, 2016). Previous use of a similar 'learning moments'-app in research revealed that SRL can be measured in a valid and reliable way (Endedijk et al., 2016). Based on the research of Panadero et al. (2016), the difference between the pre- and posttest is also explored. Nurses' SDL readiness is measured during the pre- and posttest to explore the effect of participation, in particular the effect of micro-interventions, in current study.

Several analyses are performed to clarify the research question *"To what extent do micro-interventions, provided via the ED-app, support nurses' regulatory readiness and their SRL-behaviour at the workplace?"*

Nurses' SRL at the workplace. To explore nurses' SRL-behaviour during the baseline and intervention phases, a descriptive analysis with a distinction between the two phases in SPSS is executed. To determine whether a difference exists between learning intentions, strategy control and future plans in the baseline and in the intervention phase, a Pearson Chi-Square test with a 0.05 significance level was performed. Additionally, to establish the extent of nurses' SRL at the workplace, the categorical scores were transformed into a dimension score, using the daily SRL procedure of Aagten (2016) and Bloemendal (2019) (see Table 3). When participants did not experience a learning moment, the value was set on '0'. A high correlation between homogeneity analysis and the analysis of Aagten's daily SRL is demonstrated by the previous study of Pape, 2019.

Table 3

SRL-behaviour

Variable	Categories	SRL behaviour	Value
No learning moment		Not	0
Learning intentions	No answer because no learning moment experience	Not	0
	Unplannend learning strategy	Not	0
	Learning wish, stimulated by others	Not	0
	Learning wish, necessary from the organization	Not	0
	Learning wish, it was needed for the role in my team	A bit	0.5
	Learning wish, not satisfied with previous experience	A bit	0.5
	Learning wish, wanted to practice	A bit	0.5
	Learning wish, preparing for the future	A bit	0.5
	Learning wish, curiosity	A bit	0.5
	Planned, stimulated by others	A bit	0.5
	Planned, necessary from the organization	A bit	0.5
	Planned, it was needed for the role in my team	Fully	1
	Planned, not satisfied with previous experiences	Fully	1
	Planned, wanted to practice	Fully	1
	Planned, preparing for the future	Fully	1
	Planned, curiosity	Fully	1
Strategy control	No answer, because no learning moment experience	No	0
	No consious choice	No	0

	Conscious choice, but do not know why	A bit	0.5
	Conscious choice, suggestion from another	A bit	0.5
	Conscious choice, there was no other way	Fully	1
	Conscious choice, this was the fastest/easiest way	Fully	1
	Conscious choice, this manner works the best for me	Fully	1
Future planning	No answer, no learning moment experience	No	0
	No new plans	No	0
	Did not go the way I wanted it, so I will try again	A bit	0.5
	Know now what to do i a similar situation	A bit	0.5
	What I learned, I will keep doing	A bit	0.5
	What I learned, I will apply in practice	A bit	0.5
	What I learned, I try in another situation	A bit	0.5
	What I learned, I keep on developing	Fully	1
	I will set up new learning goals	Fully	1
	I will share this learning moment with others	Fully	1

Note. The value of '0' was also given in case of a 'no learning moment' experience.

Micro-interventions. To explore the effect of micro-interventions a frequency analysis is performed in SPSS. First, the responses to the micro-interventions are explored. Second, a visual inspection of the daily learning moments and the effect of micro-interventions on participant's daily learning moments was performed via the web application scdhlm (single-case design hierarchical linear model) of Pustejovky et al., (2020) to reveal if participants showed significant different SRL behaviour during the intervention phases compared to the baseline phases. The What Works Clearinghouse SCRD standards (Kratochwill et al., 2013) illustrated that an accurate treatment switch design should include four phases at a minimum - thus maintaining three moments to prove a functional relationship, which hold five or more outcome measurements each. However, an effect is recognized when shifts in the values of the dependent variables occur, whereby three demonstrations are reported within three different phase repetitions at three distinctive moments in time in a single case or across different cases within the same SCD study (Horner et al., 2005; Ledford et al., 2018). Therefore, participants with at least four phases and three or more measurements in the baseline phase and intervention phase are included in the analysis. Currently, it was expected that participant would demonstrate more SRL-behaviour during the intervention phases than during the baseline phases.

Additionally, the effect size of the micro-interventions was calculated. The effect size is specified as the between-case standardized mean difference (BC-SMD), the variation in the

mean of inspection between the baseline and intervention phases, divided by the within-case standard deviation of the baseline (Valentine et al, 2016). The effect size is also defined as *"the magnitude of the difference between groups"* (Sullivan & Feinn, 2012, p. 279). Magnitude does not only refer to the effect of an intervention, but how much the intervention affects participants, in contrast with the statistical significance (*P* value), which only reveals the existence of the effect of an intervention (Sullivan & Feinn, 2012). With a Cohen's d =1, and a sample size of 6 (Bouwmeester & Jongerling, 2020), present study would have enough power to support the estimated effect size of micro-interventions on nurses' SRL-behavior.

Third, the participants received a fact concerning the benefits of SRL on the workplace, followed by a suggestion for a learning goal which could be applied or not by choice. Additionally, a suggestion for an implementation intention for the coming working period was provided, which also could be applied or not by choice. After every suggestion, participants were asked to rethink their choice and to confirm, so that they were made fully aware of their choice.

Fourth, to determine if an effect of participation, in particular an effect of the micro-interventions, occurred during this study, a repeated measures ANOVA analysis was performed. Finally, to explore the relationship between the type of micro-intervention and nurses' SRL-behaviour during the working day, a one-way ANOVA was conducted.

Questionnaires. Descriptive analyses were conducted in SPSS, regarding participant's general background, revealing frequencies and percentages of gender, age, highest level of education, work experience in years, function, working department and working hours per week.

Furthermore, to compare participants self-directed learning readiness before and after using micro-interventions, a paired sampled T-test was performed, to explore participant's regulatory readiness towards their SRL. A visualization was made of the means scores between post- and pretest of different groups of participants, based on the selection criteria of a minimum of three learning moments per phase, with a minimum of four phases.

Results

In the subsequent section the outcome will be presented, starting with the description of how and with whom participants have learned. Additionally, the outcome regarding participants SRL-behaviour at the workplace will be elaborated on. Furthermore, the effect of participation in this study, in particular the effect of micro-interventions on nurses' SRL-behaviour, is explored and further explicated. Finally, the results regarding participants self-directed learning readiness before and after using micro-interventions are demonstrated and elaborated on.

At the start, 22 participants (N = 22) filled in the general background questionnaire and SDLRSNE. During the research 7 participants dropped out due to COVID-infections, personal and unknown circumstances. Finally, the results of 9 participants were considered and analyzed, based on the criteria of at least three learning moment registrations in four phases.

Descriptives

How and with whom is learned?

To explore how nurses have learned during current study, a descriptive analysis was conducted. Participants were asked to answer the question *'How did you learn?'*. There were ten answering options, see Table 4. During 228 learning moments the question was answered, 92 daily questionnaires did not report a learning moment, and 39 were missing. 'Getting information' was answered 63 times (23.6%), followed by 'Doing/experiencing something' 27 times (10.1%), and 'Discussing with others' 12 times (4.5%).

Table 4

Frequency table 'How did you learn?'

	Frequency	Percentage
No learning moment	**92**	**34.5**
I don't know	6	2.2
Doing/experiencing something	27	10.1
Experimenting/reflecting on a work experience	4	1.5
Getting information	63	23.6
Observing others	4	1.5
Discussing with others	12	4.5
Getting feedback from others	5	1.9
Through a workshop/course	5	1.9
Subtotal	**228**	**85.4**
Missing	**39**	**14.6**

Total	**267**	**100**

To explore the social aspect of nurses' learning, a descriptive analysis was performed. Participants were first asked if other people were involved in the learning moment. If 'yes', they were asked who were involved. Multiple answering was optional. The results are presented in Table 5. Of 267 daily questionnaires, 92 (34.5%) did not demonstrate a learning experience. The question *'Was someone involved in the learning moment?'* was answered 104 times (39%) with 'yes', and 32 times (12%) with 'no'. Most of the participants who answered the first question with 'yes', demonstrated that they mostly involve with 'colleagues from their own team' (86, 32.2%) during a learning moment, followed by 'experts from their own hospital' (23, 8.6%), 'colleagues from another team' (13, 4.9%), 'their manager' or 'a patient or someone involved with the patient' (8, 3.0%), and finally, 'with an expert from another hospital' (3, 1.1%).

Table 5

Frequency table of the social aspect of learning

	Frequency	**Percentage**
No learning moment	**92**	**34.5**
Was someone involved in the LM?	**228**	**85,4**
- Yes	104	39,0
- No	32	12.0
Missing	**39**	**14.6**
Total	**267**	**100**
A colleague from my own team	86	32.2
- Missing	89	33.3
A colleague from another team	13	4.9
- Missing	162	60.7
An expert from my own hospital	23	8.6
- Missing	152	56.9
An expert from another hospital	3	1.1
- Missing	172	64.4
My manager	8	3.0
- Missing	167	62.5
A patient or someone involved with the patient	8	3.0
- Missing	167	62.5

SRL-behaviour at the workplace

The data presented an overall of 267 daily questionnaires (134 in the baseline phase and 133 in the intervention phase) collected by 9 selected participants *(N* = 9), on average 29.7 daily questionnaires per participant. The number of 119 learning moments were reported, 51 in the baseline phase and 68 in the intervention phase, 33 responses were missing. The number of 80 reported 'no learning moment', 44 in the baseline phase and 36 in the intervention phase. In 35 cases hints were given, of which 23 confirmed a learning moment after the hint, 15 in the baseline phase and 8 in the intervention phase. In 12 cases after the hint, 5 during the baseline phase and 7 during the intervention phase, there was no learning moment experienced. This means that the question *'Have you learned something today*' was answered 142 times in total with 'yes' and that 92 times in total participants did not experience a learning moment that day. The number of 234 daily questionnaires reported 'working', 19 did reported 'did not work today', and 14 responses were missing. See table 6 for the results.

Table 6

Frequency table daily questionnaire

Daily questionnaire	**Baseline phase**		**Intervention phase**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Completed	**134**	**50.2**	**133**	**49.8**	**267**	**100**
Experienced a learning moment	66 (51+15)	24.7	76 (68+8)	28.5	142	53.2
Did not experience a learning moment	49 (44+5)	18.4	43 (36+7)	16,1	92	34.5
Missing	**19**	**7.1**	**14**	**5.2**	**33**	**12.3**
Did not work that day	13	4.9	6	2.3	19	7.2
Other	6	2.3	8	3.0	14	5.3
Total	**134**	**50.2**	**133**	**49.8**	**267**	**100**

On the total set of 267 daily questionnaires, 142 confirmed learning moments were recorded. In table 7, the phases of the SRL-process and variables of participant's SRL-behavioural choices are presented. A distinction is made in levels of SRL-behaviour and the total SRL. The levels are 'no','a bit', and 'fully'.

Learning intentions. The number of 87 reported learning moments with regards to the learning intentions displayed no SRL-behaviour (61.3%). The number of 33 learning intentions represented a bit of SRL-behaviour (23.2%), and 16 of the learning intentional choices revealed

fully SRL-behaviour (11.3%). This means that most of the participants (61.3%) did not plan the learning activity and/or did not use a learning goal. In short, learning appears ad-hoc mostly.

Strategy control. Regarding participant's strategy control, the number of 73 strategy choices revealed no SRL-behaviour (51.4%), followed by 7 measures (4.9%) representing a bit of SRL-behaviour, and 56 measures displaying fully SRL-behaviour (39.4%). It can be declared that the plurality of the participants (51.4%) did not determine their learning strategy, in other words the way on which they learn, in advance. Additionally, the number of 28 (19.7%) fully determine the way on which they learn.

Future planning. The SRL-behaviour regarding participant's future planning revealed that 30 times (21.1%) participants did not reflect on their learning moment and how to benefit from it in the future. The number of 78 choices (54.9%) displayed a bit of SRL-behaviour towards future planning, and 28 measures (19.7%) revealed fully SRL-behaviour.

Total SRL-behaviour. Table 7 presents the total SRL-behaviour regarding learning intentions, strategy control and future planning. The number of 17 participant's choices (12.0%) displayed no SRL-behaviour. The vast majority, the number of 115 choices represented a variety of some level of SRL-behaviour (85,2%), and 4 choices reported fully SRL-behaviour (2.8%).

Table 7

Frequency Table SRL-behaviour (learning moments)

Phase	Variable	SRL-behaviour	Frequencies	Percentage
Forethought	Learning intentions	No (0.00)	87	61.3%
		A bit (0.50)	33	23.2%
		Fully (1.00)	16	11.3%
Performance	Strategy control	No (0.00)	73	51.4%
		A bit (0.50)	7	4.9%
		Fully (1.00)	56	39.4%
Self-reflection	Future planning	No (0.00)	30	21.1%
		A bit (0.50)	78	54.9%
		Fully (1.00)	28	19.7%
	Total SRL	No (0.00)	17	12.0%
		(0.17)	38	26.8%
		(0.33)	23	16.2%
		A bit (0.50)	21	14.8%

(0.67)	18	12.7%
(0.83)	15	10.6%
Fully (1.00)	4	2.8%
Missing	6	4.2%

Learning intentions behaviour. The analysis results of choices for nurses' planning behaviour and argumentation to scheme a learning moment are presented in table 8. Of the 267 daily questionnaires, 228 (85.4%) responded to the question '*Did you plan to learn this?*', 39 responses were missing. No learning experience was demonstrated by the number of 49 (21.5%) daily questionnaires in the baseline phase and 43 (18.9%) in the intervention phase. An unplanned learning experience was revealed by the number of 45 (19.7%) of daily questionnaires in the baseline phase, and 41 (18.8%) in the intervention phase. The number of 21 learning moments (9.2%) revealed a learning wish, of which 8 (3.5%) in the baseline phase and 13 (5.7%) in the intervention phase. Planned learning strategy was revealed by the number of 9 (3.9%) in the baseline phase and 20 (8.8%) in the intervention phase. The Pearson Chi-Square tests reveals the following results: $\chi^2(3) = 5.79$, $p = 0.122$. A *p*-value > 0.05 means that there is insufficient evidence to conclude that a difference exists between learning intentions in the baseline and in the intervention phase. Conclusively, learning intentions behaviour is not significantly supported by micro-interventions. However, the Pearson Chi-square test on planned learning strategy demonstrates $\chi^2(1) = 4.143$, $p = 0.042$. A *p*-value < 0.05 means that there is significant evidence to state that there is a difference between the planned learning strategy in the baseline phase and in the intervention phase. Altogether, there is evidence that the planned learning strategy is significantly supported by micro interventions.

Table 8

Learning intentions

Learning intentions	**Baseline phase**		**Intervention phase**		**Chi-Square**	**df**	**Sign. (2-sided)**
	N	**%**	**N**	**%**			
No learning experience	49	21.5	43	18.9			
Unplanned learning experience	45	19.7	41	18.8	0.733	1	0.392
Learning wish	8	3.5	13	5.7	1.038	1	0.308
Planned learning strategy	9	3.9	20	8.8	4.143	1	0.042

Total	**111**	**48.7**	**117**	**51.3**	**5.786**	**3**	**0.122**

Strategy control behaviour. Participants were asked to conclude if their learning strategy was chosen consciously or not consciously. The analysis results of the strategy control behaviour are presented in table 9. In the baseline phase 35 (15.4%) of the learning moments demonstrates a conscious learning strategy, in the intervention phase 38 (16.7%) of the learning moments revealed a learning strategy. No conscious choice was demonstrated by 27 (11.8%) learning moments in the baseline phase, and 36 (15.8%) in the intervention phase.

The Pearson Chi-Square tests reveals the following results: $\chi^2(2) = 1.64$, $p = 0.440$. A *p*-value > 0.05 means that there is insufficient evidence to conclude that a difference exists between strategy control in the baseline and in the intervention phase. Thus, that nurses' strategy control behaviour is not significantly supported by micro-interventions.

Table 9

Strategy control

Strategy control	**Baseline phase**		**Intervention phase**		**Chi-Square**	**df**	**Sign. (2-sided)**
	N	**%**	**N**	**%**			
No learning moment experienced	49	21.5	43	18.9			
Conscious choice	35	15.4	38	16.7	0.03	1	0.878
No conscious choice	27	11.8	36	15.8	1.18	1	0.277
Total	**134**	**48.7**	**133**	**51.3**	**1.64**	**2**	**0.440**

Future planning behaviour. Table 10 presents the analysis results on future planning, revealing how nurses would continue with their learning moment. First, in the baseline phase 16 (41.4%) of the learning moments revealed 'no new plans', in the intervention phase 14 (45.4%) of the learning moments revealed 'no new plans'. Second, the number of 34 (14.9%) learning moments in the baseline phase demonstrated 'applying and trying in practice', and 44 (19.3%) in the intervention phase. Finally, 'formulating new learning goals' was registered 12 times (5.3%) in the baseline phase, and 16 times (7.1%) in the intervention phase.

The Pearson Chi-Square tests reveals the following results: $\chi^2(9) = 11.23$, $p = 0.260$. With a *p*-value > 0.05 it can be concluded that there is insufficient evidence to state that there

is a difference between future planning in the baseline and in the intervention phase. In other words, nurses' future planning is not significantly supported by micro-interventions.

Table 10

Future planning

Future planning	Baseline phase		Intervention phase		Chi-Square	df	Sign. (2-sided)
	N	%	N	%			
No learning moment experience	49	21.5	43	18.9			
No new plans	16	41.4	14	45.4	0.33	1	0.566
Applying and trying in practice	34	14.9	44	19.3	1.23	1	0.267
Formulate new learning goals	12	5.3	16	7.1	0.37	1	0.543
Total	**134**	**100**	**133**	**100**	**11.23**	**9**	**0.260**

Micro-interventions

Responses to micro-interventions. With regards to the application of micro-interventions, a descriptive analysis is performed to explore the responses to the type of micro-intervention. A number of 267 daily questionnaires were explored *(N* = 9), of which 114 responded with 'yes' (99, 37.1%) and 'no' (15, 5.6%) to the question *'Does this learning goal suit you?'* - followed by a suggestion*,* 153 (57.3%) responses were missing. Additionally, during 69 daily questionnaires (25.8%) the suggestion for an implementation intention, which differed with each suggestion was accepted. 35 times (13.1%) the suggestion was refused, and 163 (61%) responses were missing, meaning that there was no response to the suggestion for a goal and/or implementation intention. The results are presented in Table 11.

Table 11

Preference of micro-interventions

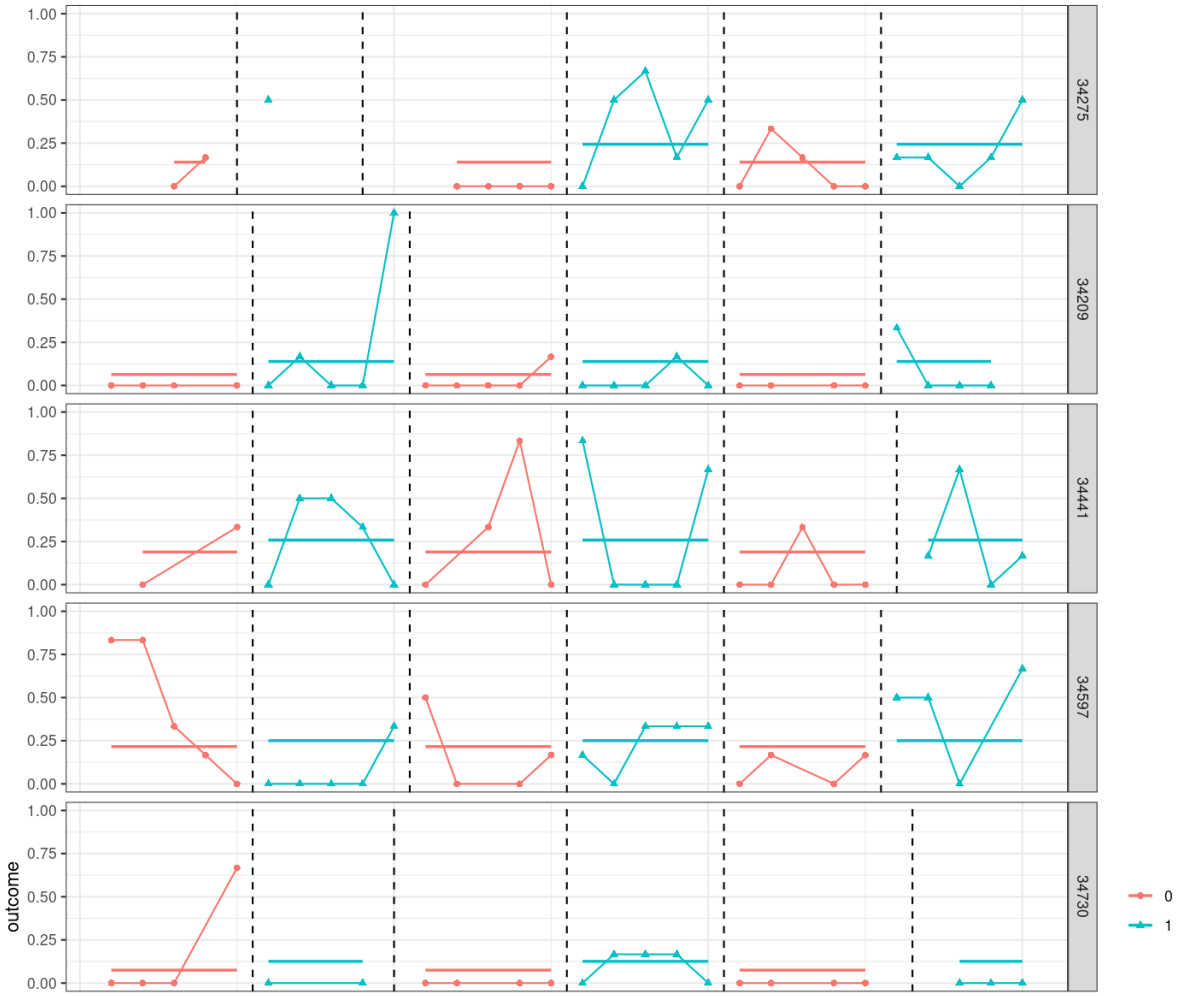
Micro-intervention	Yes		No		Missing	
	Freq.	Perc.	Freq.	Perc.	Freq.	Perc.
Learning goal	99	37.1	15	5.6	153	57.3
Implementation intention	69	25.8	35	13.1	163	61.0

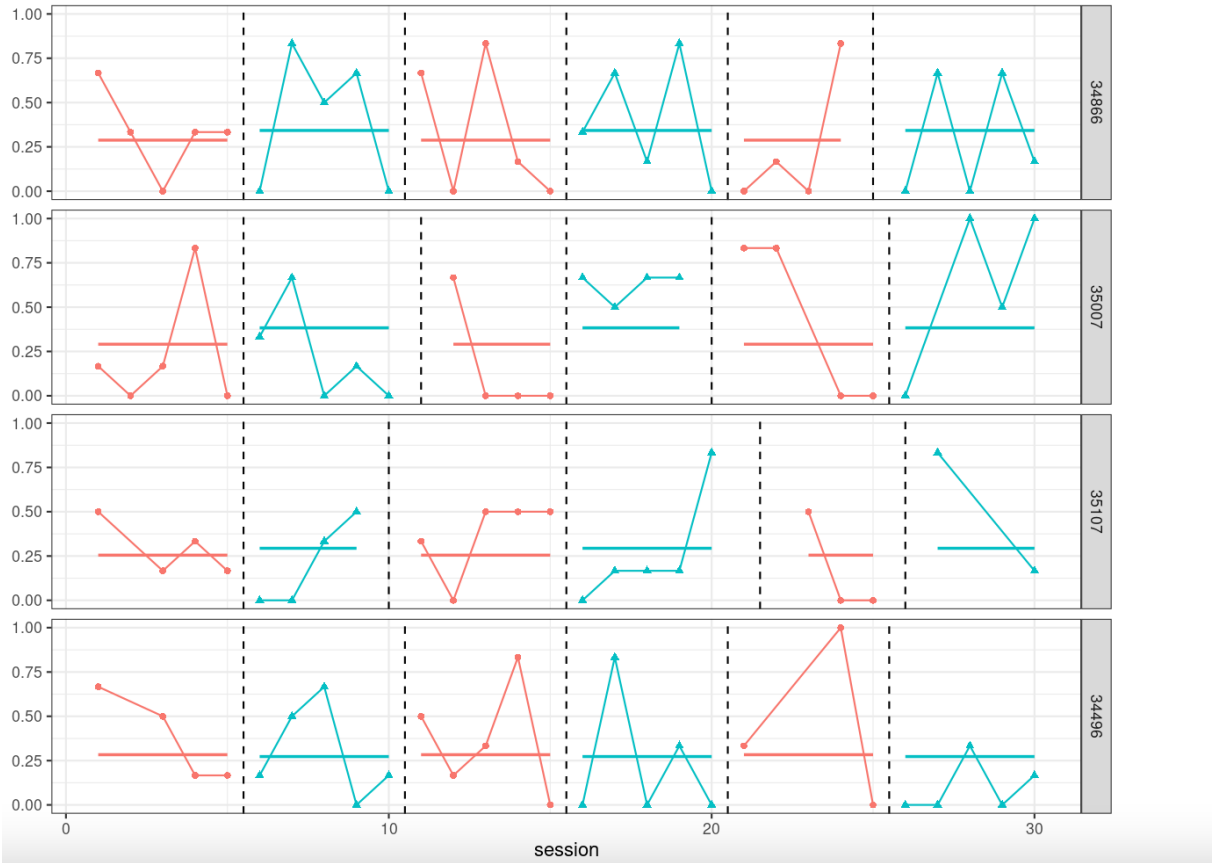
The effect of micro-interventions on nurses' SRL-behaviour

Visual analysis. A visual analysis and an effect size analysis was performed via the web application scdhlm (single-case design hierarchical linear model), to reveal if participants showed significant different SRL behaviour during the intervention phases compared to the baseline phases. See Graph 1 for visual inspection of the development of SRL-behaviour *(N* = 9). The horizontal lines present the mean score for each phase, red for baseline and blue for intervention phase. The level of the data refers to change in the SRL-behaviour across certain points in time. Trend or slope assigns to difference in the results in time within each phase. If SRL-behaviour developed during launch and during removal of the intervention, it is considered as proof that the intervention is effective, in other words, that there is a functional relationship between the intervention and the results. A large variation in SRL-behaviour is demonstrated in the graph, thus there is no pattern to be discovered. Additionally, 660 learning moments could have been registered, but only 329 daily questionnaires were completed, of which 267 were included for analyses. During the 267 daily questionnaires, quite a substantial numbers of learning moments are not experienced (see Graph 1, the 0.00 scores). The difference between the baseline (59 unexperienced learning moments) compared to the intervention phase (49 unexperienced learning moments) suggests a medium size effect of the micro-interventions on nurses' SRL-behaviour.

Graph 1

Development of SRL-behaviour





Effect size. The effect size is specified as the between-case standardized mean difference (BC-SMD) of the dependent variable, of which in each phase parts are collected at certain moments in time. Analysis demonstrated an effect size estimate (BC-SMD estimate = 0.21), 95% CI [-0.10, 0.51], with $N = 9$). In other words, it can be stated that the effect of micro-interventions on nurses' SRL is not significant for two reasons. First, the BS-SMD is estimated around 0. Second, the confidence interval is situated around 0. However, the effect size is estimated 0.21, so it appears that the micro-interventions do influence nurses' SRL, but it cannot be stated as significant.

The effect of participation in this study on SRL-behaviour

Reception of and Response to MI and nurses' SRL. To explore if there is a relationship between the reception and response to MI and nurses' SRL-behaviour, a repeated measure ANOVA (analysis of variance) is performed. Of the 117 daily questionnaires in the intervention phase, 21 did not demonstrate the reception or response to a MI ($M = 0.29$, $SD = 0.27$), 96 daily questionnaires did respond to the received MI ($M = 0.26$, $SD = 0.30$). The results are presented in Table 12. The latter did not affect their SRL-behaviour, because the Levene's test based on

the mean was found not to be significant, ($t(1, 115) = 1.68$, $p > 0.05$). Additionally, there was no significant effect of the received micro-interventions on nurses' SRL-behaviour at the $p < 0.05$ level for the conditions, ($F(1,115) = 0.182$, $p = 0.669$), demonstrated by the repeated measure ANOVA. With a $p > 0.05$, there is no significant difference in participant's SRL-behavior whether they received and responded to the MI or not. In other words, there is no relationship between the received and response of MI and nurses' SRL-behaviour.

Table 12

Descriptives Reception of and Response to MI

					95% CI for Mean	
	N	**Mean**	**Std. Dev.**	**Std. Error**	**Lower bound**	**Upper bound**
Did not receive or respond to a MI	21	0.29	0.27	0.59	0.16	0.41
Received and respond to a MI	96	0.26	0.30	0.31	0.19	0.32
Total	**117**	**0.26**	**0.30**	**0.03**	**0.21**	**0.32**

Note. Dependent variable: SRL-behavior

Type of MI and nurses' SRL. A one-way ANOVA (analysis of variance) is performed to explore if there is a relationship between the type of micro-intervention and participant's SRL-behaviour. Besides receiving a fact regarding the benefits of nurses' SRL, participants received a suggestion for a learning goal, and an implementation intention. Both suggestions could be accepted or could be rejected separately. The results are presented in Table 13. For the goal accepted and the implementation suggestion accepted ($M = 0.28$, $SD = 0.30$) with N = 61. The goal accepted and the implementation intention not accepted ($M = 0.19$, $SD = 0.29$) with N = 30. The goal not accepted, and the implementation not excepted ($M = 0.37$, $SD = 0.34$), with N = 5. Further analysis revealed that the reaction of participants on the type of micro-intervention has no significant effect on their SRL-behaviour, because the Levene's test based on the mean was found not to be significant ($t(2, 93) = 0.800$, $p > 0.453$). Finally, the one way ANOVA also demonstrated no significant effect of the goal ($f(1) = 0.900$, $p > 0.345$) and/or implementation intention ($f(1) = 2.036$, $p > 0.157$) on nurses' SRL.

Table 13

Descriptives of type of MI and nurses' SRL

Goal	Implementation Intention	Mean	Std. Dev.	N	Std. Error	95% Confidence interval	
						Lower Bound	Upper Bound
Yes	Yes, try	0.28	0.30	61	0.039	0.200	0.352
	No	0.19	0.29	30	0.055	0.085	0.303
	average	**0.25**	**0.30**	**91**			
No	Yes, try	0.37	0.34	5	0.134	0.100	0.634
	Average	**0.37**	**0.34**	**5**			
Total	Yes, try	0.28	0.31	66			
	No	0.19	0.29	30			

Note. Dependent variable: SRL-behaviour

SDL readiness before and after using micro-intervention

To measure nurses' regulatory readiness, the Self-Directed Learning (SDL) Readiness Scale for Nursing Education (SDLRSNE) is used as a pre- and posttest. To explore if there was a significant difference between participant's regulatory readiness before and after using the ED-app, a paired sample t-test was performed (see Table 14, $N = 9$, and Table 15, $N = 15$).

Results demonstrated that the mean SDLRNE-score $(N = 9)$ before the treatment was 3.96 ($SD = 0.40$). Thus, on average, participants answered that they approximately agree to a great degree on the 29 items about their regulatory readiness. The means of the subscales before treatment were on 'self-management' (M = 3.88, $SD = 0.45$), 'desire for learning' (M = 3.91, $SD = 0.50$), and 'self-control' (M = 4.10, $SD = 0.40$). The mean SDLRNE-score $(N = 9)$ after the treatment was 4.23 ($SD = 0.44$). Thus, on average, participants answered that they approximately agree 'to a great degree' on the 29 items about their regulatory readiness. The means of the subscales after treatment were on 'self-management' (M = 4.12, $SD = 0.49$), 'desire for learning' (M = 4.22, $SD = 0.51$), and 'self-control' (M = 4.36, $SD = 0.41$).

The results showed that there was a small difference in the regulatory readiness between the pre- and posttest (M = 0.27, $SD = 0.41$), conditions: t (9) = 2.006, p = 0.08. The effect size, Cohen's d, is calculated ((Mpost – Mpre)/MStd.Dev.), Cohen's d = 0.64. This can be considered a medium effect size. But is also indicates that there is a considerable chance that the effect size is caused by other factors and/or coincidence. Additionally, a p-value > .05 demonstrates that the difference between the means is not statistically significant. In other words: participant's regulatory readiness towards SRL did increase with a medium effect size, but cannot be stated as significant after use of the micro-interventions via the ED-app.

Table 14

Paired sample t-test SDLRNE pre- and posttest (N = 9)

	Mean	Std.Dev.	*t* value	df	Sig. (two-tailed)
Total SRL-readiness (pre-test)	3.96	0.40	2.006	8	.080
Total SRL-readiness (post-test)	4.23	0.44			
SRL self-management (pre-test)	3.88	0.45	1.861	8	.100
SRL self-management (post-test)	4.12	0.50			
SRL desire for learning (pre-test)	3.91	0.50	2.120	8	.067
SRL desire for learning (post-test)	4.22	0.51			
SRL self-control (pre-test)	4.10	0.40	1.680	8	.131
SRL self-control (post-test)	4.36	0.41			

The paired sample t-test was also performed for $N = 15$, since this is the number of participants who completed the pre- and posttest, but not all participants did not meet the selection criteria, of a minimum of three learning moments per phase, with a minimum of four phases. The results are presented in Table 15.

Results demonstrated that the mean SDLRNE-score *(N* = 15) before the treatment was 4.05 (*SD* = 0.35). Thus, on average, participants answered that they approximately agree to a great degree on the 29 items about their regulatory readiness. The means of the subscales before treatment were on 'self-management' (M = 3.93, *SD* = 0.36), 'desire for learning' (M = 4.06, *SD* = 0.48), and 'self-control' (M = 4.17, *SD* = 0.34). The results of the posttest showed that the mean score for SDL-readiness after the treatment was 4.14 (*SD* = 0.39). The means of the subscales were: for 'self-management' (M = 4.05, *SD* = 0.40), 'desire for learning' (M = 4.17, *SD* = 0.48), and 'self-control' (M = 4.19, *SD* = 0.43).

The results revealed that there was a small difference in the regulatory readiness between the pre- and posttest (M = 0.11, *SD* = 0.50), conditions: t (14) = 0.857, p = 0.406. The effect size Cohen's d = 0,30. This can be considered a small effect size, in other words, there is a large change that the effect size is caused by other factors and/or coincidence. Additionally, a p-value > .05 demonstrates that the difference between the means is not statistically significant, in other words: participant's regulatory readiness towards SRL *(N* = 15) did increase slightly, but not significant after use of the micro-interventions via the ED-app.

Table 15

Paired sample t-test SDLRNE pre- and posttest (N = 15)

	Mean	Std.Dev.	*t* value	df	Sig. (two-tailed)
Total SRL-readiness (pre-test)	4.05	0.35	0.800	14	.439
Total SRL-readiness (post-test)	4.14	0.39			
SRL self-management (pre-test)	3.93	0.36	1.156	14	.267
SRL self-management (post-test)	4.05	0.40			
SRL desire for learning (pre-test)	4.06	0.48	0.857	14	.406
SRL desire for learning (post-test)	4.17	0.48			
SRL self-control (pre-test)	4.17	0.34	1.680	14	.872
SRL self-control (post-test)	4.19	0.43			

Additionally, a paired sample t-test was also performed for $N = 6$ ($N = 15 - N = 9$), since this is the number of participants who completed the pre- and posttest, but did not meet the selection criteria, of a minimum of three learning moments per phase, with a minimum of four phases. Only the total SRL-readiness mean scores in the pre- and posttest were needed to compare de differences in mean scores for the N-groups and were calculated. The results are presented in Table 16. The results revealed that there is a decrease in the regulatory readiness between the pre- and posttest (M = - 1,98, *SD* = 0.22), conditions: t (6) = -2,189, p = 0.80.

Table 16

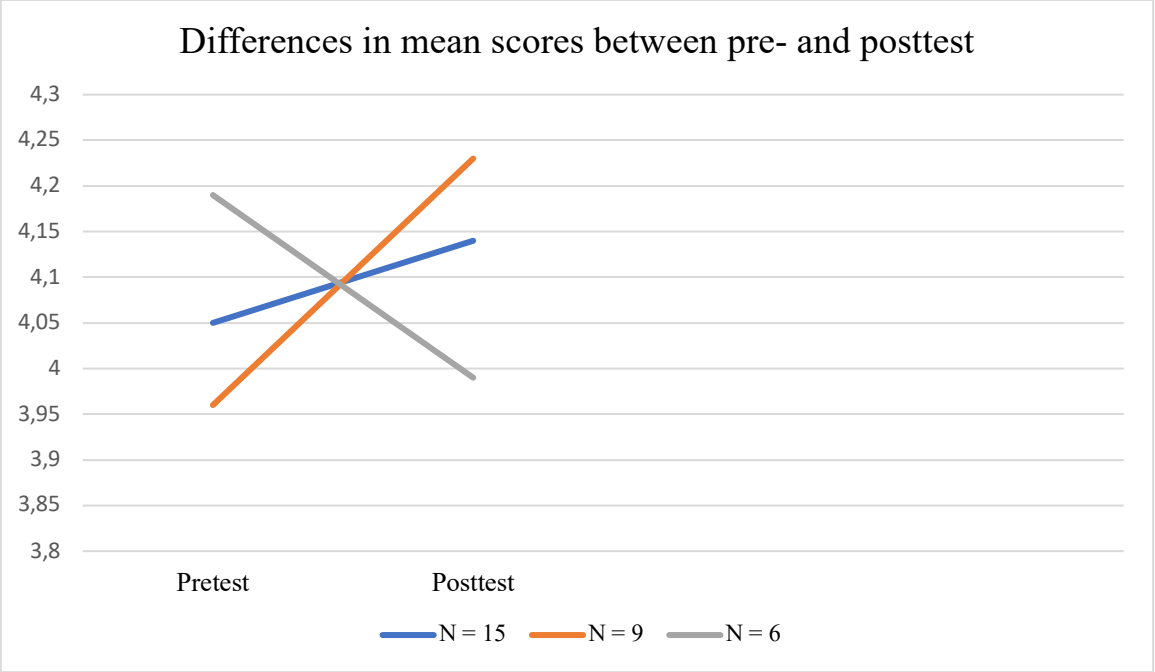
Paired sample t-test SDLRNE pre- and posttest (N = 6)

	Mean	Std.Dev.	*t* value	df	Sig. (two-tailed)
Total SRL-readiness (pre-test)	4.19	0.21	-2,189	5	.080
Total SRL-readiness (post-test)	3.99	0.31			

A visualization of the differences in mean scores between pre- and posttest is demonstrated in Graph 2. It is demonstrated that the group ($N = 9$) reveals the highest increase of SDL readiness. This group represented the participants who both completed the pre- and posttest, who met the criteria of a minimum of three learning moments per phase, with a minimum of four phases. The group ($N = 15$) also demonstrated an increase of SDL readiness after completing the pre- and posttest, but not all participants met the criteria. The group ($N = 6$) revealed a decrease of SDL readiness. Although the participants completed the pre- and posttest, none of them met the criteria of a minimum of three learning moments per phase, with a minimum of four phases. The results indicate that participation in this study has increased the SDL-readiness, although the number of participants is not adequate to state the outcome as significant.

Graph 2

Differences in mean scores between pre- and posttest



Note. The number of participants differ per group.

Conclusion and Discussion

The major intention of the current study was to explore the effect of micro-interventions of nurses' regulatory readiness and their SRL behaviour, regarding their learning intentions, strategy control and future planning behaviour in the clinical context. To explore nurses' SDL readiness, a pre- and posttest was included in the study design. Additionally, several descriptive and statistical tests, and visual analyses were performed to explore the effect of micro-interventions on nurses' SRL during the baseline and intervention phase. In the following section, the results are elaborated upon.

Descriptives

How and with whom is learned?

Although the question '*How and with whom is learned?'* was not part of the scope of this study, interesting results did occur and are worthwhile taking notice of. The question *'How did you learn?'* was answered mostly with 'Getting information', followed by 'Doing/experiencing something', and 'Discussing with others'. These results are completely in line with Sitztman and Ely's (2011) examples of informal learning, namely trial and error (testing), discussions with peers, and searching for information offline and online. In addition, most of the participants who answered the question if other people were involved during their learning moment with 'yes', demonstrated that the fast majority involved with 'colleagues from their own team', and to a small degree by 'experts from their own hospital' and 'colleagues from another team', followed by a minority of involvement with 'their manager' or 'a patient or someone involved with the patient', and finally, to a very small degree 'with an expert from another hospital'. These findings are in line with the statement of Tasselli (2015), who revealed that knowledge sharing in healthcare occurs generally between job-related professionals within their group instead of with external professionals; and with earlier research of Aagten (2016), Berings et al. (2008), and Jantzen (2019), who stated that nurses generally learn by social interactions, i.e., analyzing a case or situation with colleagues, observing others, questioning peers, and from feedback of others. In addition, Siadaty, Gašević, et al. (2016a, 2016b), revealed that social interference affects SRL commitment and participation the most. In sum, SRL at the workplace prospers from and with colleagues.

SRL-behaviour on the workplace

With the answers in the daily questionnaire, participants SRL-behaviour was recorded and analyzed by means of different activities during recursive phases, namely forethought (learning intentions), performance (strategy control) and self-reflection (future planning) (Zimmerman, 2008). Regarding the learning intentions, most of the participants did not plan the learning activity and/or did not use a learning goal. Learning mostly appeared ad-hoc. Regarding the strategy control, most of the participants did not determine the way on which they learn in advance. These findings are in line with Tynjälä (2008), since a lot of learning is informal and unplanned in a hectic and dynamic environment.

However, most of the participants displayed a bit of SRL-behaviour towards future planning, Additionally, to a small degree, participants demonstrated full SRL-behaviour, reflecting on their learning moment and how to benefit from it in the future.

Effects of micro-interventions on nurses' SRL-behaviour

A visual analysis is performed, and the effect size of micro-interventions is calculated to answer the research question *"To what extent do micro-interventions, provided via the ED-app, support nurses' SRL-behaviour at the workplace?"* Additionally, several statistical tests were performed to explore if the type of micro-intervention affected nurses' SRL behaviour. In general, it was expected that nurses' SRL-behaviour is positively supported and influenced via micro-interventions. This would also be in line with the effect of the third wave of measurement, wherein SRL measurement procedures also performed as instruments to stimulate or support the self-managing competences in learners (Panadero et al., 2016).

The visual analysis did not demonstrate a particular pattern, in other words, nurses' SRL-behaviour did not seem to increase during the intervention phase, compared to the baseline phase. However, the between-case standardized mean difference (BC-SMD estimate) demonstrated a medium effect size of MI on nurses' SRL-behaviour, although Cohen's revealed not enough power to state that the effect is only caused through MI. A repeated measures ANOVA (analysis of variance) to analyze the relationship between the reception and response to MI and nurses' SRL-behaviour, and one-way ANOVA (univariate analysis of variance), to analyze the relationship between the types of MI and nurses' SRL-behaviour revealed the same outcome. In sum, it can be stated that within this study, micro-interventions did not support nurses' SRL-behaviour at the workplace.

However, despite the lack of effect of micro-interventions, learning intentions, learning strategy control and future planning, the results, obtained from the daily questionnaires, demonstrated that learning moments do occur and can be reflected upon in a retrospective manner. In other words, unexpected learning experiences without pre-set goals still can actively be checked, assessed, and reflected upon, after the learning moment was experienced, and become deliberative learning. This is in line with previous research of Endedijk et al., 2012.

Specific circumstances could be an underlying factor of influence on the results. The research was accomplished during the second and third wave of COVID-19. Nurses of the participating departments were confronted with severe influx of COVID-patients and understaffing due to illness and replacement of colleagues. The increased stress and shortage of time could explain why the daily reports were missing and/or there was a high variety in SRL-behaviour. This is in line with the findings of Chakkaravarthy et al. (2004), Ibrahim et al. (2018), Jantzen (2019), Pool et al. (2015), and Tynjälä, (2008), who state that nurses' learning mostly appears in tumultuous and changing surroundings, influenced by their changing private lives and careers, and the diversity, time-significance, and paradoxical engagement of nurses' activities at the workplace. In addition, for professional development, nurses need to have time to reflect on the learning process, time for feedback moments and to select efficient learning strategies (Cuyvers, 2019; Schulz & Stamov Rossnagel, 2010). It might be the case that those aspects of SRL at the workplace is not fully facilitated. A coincidence could also be lack of catalysts for nurses' workplace learning. According to Jantzen (2019), these catalysts are mentor-guides, highly functional teams and workplace camaraderie. I.e., the participating departments could not be entered physically during the research, and the absence of researcher's physical presence and therefore the ability to give support and guidance during the study might have reduced the motivation among nurses to be dedicated constantly. This might be an example of Jantzen's (2019) lack of mentor-guides. However, the COVID-19 waves could also have been a learning trigger. According to Joynes et al. (2017), learning can be provoked by patients demonstrating demanding or unexpected conditions. But it appears that this is not the case in the present study.

Finally, Azevedo and Hadwin (2005) recommended acquiring instructional instruments to detect specific issues, to encourage to learn how to self-regulate learning, and to develop adjusting support to decide on what category of support should be provided to learners. In line with this statement, it could be the case that the micro-interventions, despite of being built on the four common change factors (Allemand & Flückiger, 2017) and the Dutch professional

code (Beroepscode van Verpleegkundigen en Verzorgenden, 2020), did not address to nurses' needs for support, and the way they should be supported.

Nurses' SDL readiness

A visualization of the differences in mean scores between pre- and posttest of the N-groups indicated that participation in this study has increased the SDL-readiness, although the number of participants is not adequate to state the outcome as significant.

As such, there could be several explanations for the results. First, the results can be explained by the fact that the pretest demonstrated a highly above average score that is almost impossible to improve, known as the ceiling effect. Additionally, the participating nurses might already demonstrate a higher SDL readiness on average, as they were willing to participate in this research. At the same time, reflection on their SRL was offered by the daily questionnaire, and this continuing reflection might have influenced nurses' metacognitive monitoring (Zimmerman, 2002), also referred to as regulatory mechanisms (Cuyvers, 2019), which in turn, effects regulatory readiness en vice versa (Cuyvers, 2019). The diary could have encouraged learning and awareness of the relevance of SRL (Schmitz & Perels, 2011). The diary allows participants to gain more knowledge of – and to reflect on their SRL-process (Panadero et al., 2016). Consequently, regulatory readiness could have been increased. However, positive changes in regulatory readiness are conditional to start the SRL-process although they are no guarantee for changes in behavior (Aagten, 2016; Albarracin & Shavitt, 2018).

Second, even more significant, there is the possibility of nurses being unable of utilizing SRL-behaviour at the workplace, and/or the discrepancy between a person's beliefs and currently demonstrated behaviour (Endedijk & Vermunt, 2013). In addition, nurses' workplace learning and refining nursing practice is catalyzed by mentor-guides, highly functional teams and workplace camaraderie, and requires getting grounded, recognizing a learning need and puzzling and enquiring (Jantzen, 2019). Therefore, it is suggested to further explore the relationship and the influencing factors between nurses' SDL readiness and their substantial SRL-behaviour at the workplace in future research.

Finally, the factorial construction of a self-report questionnaire is currently determined as a more outmoded analysis procedure (Schmitt, 2011). Therefore, it is relevant to include more research instruments, and to avoid relying on one instrument (Schmitz & Perels, 2011; Panadero et al., 2016). This is in line with the statement of Panadero et al. (2016), who

recommended combining a pre- and post-questionnaire with the daily measurements to explore the effect of interventions.

In sum. Continuous professional development (CPD) is imperative for secure and qualified practice (Bloemendal, 2019; Pape, 2019; Jantzen, 2019), and stresses the importance of nurses' SRL at the workplace to persist as a professional (Bloemendal, 2019; Cuyvers, 2019, Pape, 2019; Jantzen, 2019). Additionally, SRL is solidly linked with a more successful performance (Cuyvers, 2019; Kyndt et al., 2016), and excellent patient care (Jantzen, 2019). On the other hand, SRL at the workplace can be quite demanding, since nursing is subjected to multiple and conflicting obligations, time constraints, and patient enumerations (Hoffman & Donaldson, 2004). Additionally, SRL requires to be more aware of learning needs and opportunities (Cuyvers, & Endedijk, 2020; Siadaty et al., 2016b), and to regulate knowledge construction, motivation, and behaviour (Cuyvers & Endedijk, 2020). Consequently, a low degree of SRL-behavior often does occur (Aagten, 2016; Cuyvers, & Endedijk, 2020; Siadaty et al., 2016b).
Interestingly, work experience in the clinical context continuously offers a lot of learning opportunities (Hadwin et al., 2018; Hardy III et al., 2018). Additionally, Pool et al. (2015) revealed daily work on the ward, performing new or extra tasks and roles, and learning experiences in nurses' private lives, are important prompts for nurses' engagement in workplace learning activities. Those prompts could be applied to develop support of nurses' development strategies, with a decisive impact on motivation, and a positive influence on metacognition. In turn, an increase of reflection will occur, which is one of the most essential metacognitive SRL-strategies, and necessary for SRL (Cuyvers, 2019; Wesiak et al. 2014). To support SRL, interventions should therefore be concentrated on regulatory readiness, which is stated as conditional to start the SRL-process, and metacognitive control, altogether referred to as SRL strategy-use (Cuyvers, 2019).
Based on her findings, Cuyvers (2019) developed a conceptual model for self-regulation of professional learning (SRpL), in which regulatory components (readiness, agents, mechanisms, and appraisal) initiate, promote, and assess the SRL process. Therefore, the focus of this study covered SRL and its regulatory components (and to a small and informal extent the social/interactional factor) of Cuyvers' SRpL model (2019). It is recommended to apply the complete SRpL in future research, since performance context, with personal context factors and organizational and task factors; and individual learners, with personal conditions, are also crucial for the support of nurses' regulatory readiness and their SRL (Cuyvers, 2019). This is

in line with the findings of Chakkaravarthy et al. (2018), and Pool et al. (2015), who state that nurses' private life changes and lifetime career stages affect the involvement in CPD, just as time constraints and barriers in the work environment.

To support nurses' regulatory readiness and their SRL, interventions can be designed as micro-interventions (MI), which are small messages provided via a smartphone. MI are strongly used in previous research, due to the compact time frame, compared to live interventions (Stieger et al, 2020). Other benefits of micro-interventions, provided via an application on a smartphone, are its self-guided nature, easy access, capability to monitor one's learning activities, and timing of involvement (Bunge et al., 2017; King et al., 2013). To maximize the effect on SRL, in current study, the MI are based on four empirically derived common change factors from psychotherapy process-outcome (Allemand & Flückiger, 2017), and the Dutch professional nursing code (Beroepscode van Verpleegkundigen en Verzorgenden, 2020). The four common change factors are activation of discrepancy awareness, activating strengths and personal resources, increased self-reflection and to realize insight, and practicing SRL behaviours. It is recommended in future research to detect specific individual issues and on what category of support should be provided to learners, according to the statement of Azevedo and Hadwin (2005).

Altogether, the aim of this study was exploring the effect of micro-interventions, the independent variable, of nurses' regulatory readiness and their SRL behaviour (Cuyvers, 2019), which are the dependent variables. SRL is divided into and described as learning intentions, strategy control and future planning (Cuyvers, 2019; Zimmerman, 2002). An experience sampling method (ESM), also referred to as a daily diary study, is applied in the present study to obtain data for analysis and proved to be a sufficient method to access data, in line with the findings of Endedijk et al. (2016), who state that SRL can be measured in a valid and reliable way. The ESM involved questioning the participants on their learning experiences, behaviours, awareness, and reflection on multiple learning moments over time, in line with Sather's description of ESM (2014). The data is collected by a multi-method approach to avoid relying on one instrument (Schmitz & Perels, 2011; Panadero et al., 2016). Additionally, Panadero, Klug, and Jarvelä (2016) recommended combining a pre- and post-questionnaire with the daily measurements, which was considered in present study.

Although a medium size effect of MI on nurses' SRL-behaviour did occur, unfortunately, the outcome could not be stated as statistically significant. Additionally, the research results also indicated that participation in the current study has increased the SDL-readiness, although the

number of participants was not adequate to state the outcome as significant. However, these results indicate that further research with a larger sample size and micro-interventions based on the complete SRpL-model of Cuyvers (2019), the four common change factors, and nurses' customized learning needs, i.e., a top 10 critical professional situations, might reveal a larger effect size with a higher power.

Limitations and practical implications

Limitations. The current study provided understanding in nurses' SRL, and how to support their SRL. Nevertheless, limitations did occur. The research started with the number of 22 participants, of which 15 participants completed the pre- and posttest. In total, 660 daily questionnaires could have been registered, but 329 daily questionnaires were completed, of which 267 were included for analyses, with a sample size of $N = 9$.

Additionally, the second and third COVID-19 wave caused severe limitations due to severe influx of COVID-patients and understaffing, as forementioned. Due to a higher level of work pressure and exhaustion, energy and time, participation may have been undermined.

Furthermore, it is reasonable to assume that nurses, especially during the stressful pandemic circumstances, were not fully aware of or able to utilize their learning opportunities and moments, and therefore did not report them, when in fact a learning moment may have appeared. Awareness of learning opportunities is required but they can be challenging to identified, because learning at the workplace often happens unintentionally (Tynjälä, 2008). In this manner, the administered learning moments may be characteristic exclusively for conscious learning moments.

Additionally, in present study only the effect of micro-intervention on nurses' regulatory readiness and their SRL-behaviour was analyzed and interpreted on a working day level. It might be interesting to explore the lag effect (APA Dictionary of Psychology, n.d.), and to study the long-term effect on nurses' regulatory readiness and their SRL-behaviour with increased separation ('lag') between repeated presentations of the micro-interventions within a single period.

The questionnaires were provided by mobile phones. Nurses usually do not use their cellphones during work, due to infection prevention measurements. During this research an exception was made, and nurses were permitted to use their cellphone at the workplace. Not having the habit to use the cellphone at work might have influenced the number of missing daily questionnaires. Additionally, according to Bloemendal (2019), a previous study of V&VN

in 2015 revealed that 63% of the nurses did not feel self-assured towards their digital skills. During research, nurses reported problem with logging in the ED-app and/or missing and/or wrongly timed notifications, and other technical issues. The communication regarding these issues were only possible online due to the pandemic. In short, underlining the relevance of participation, could have improved participation if face-to-face communication would have been possible. Interestingly, it was noticed that a positive stimulation from the manager of the department immediately boosted nurses' participation. This refers to the performance context, in particular, the organizational & task factor 'Manager support and motivation', of Cuyvers' SRpL model (2019). Additionally, nurses also spontaneously sent text messages that so far, they were not aware of the fact that they learned so much during a working day. One nurse texted that she did not want to give the impression of not participating because she filled in 'no learning moment experienced' several times, since she was performing administration which was already standardized, as she explained. A factor to consider was the feedback that the research period was experienced as too long, since every participant worked parttime, and a minimum of 15 measurements per phase – 30 measurements in total – mostly took 10 weeks or more. Furthermore, it is recommended to add an exit in-depth interview to future research design, to collect data regarding the type of micro-interventions.

Unfortunately, the ED-app used during current research, did not provide features for interactive social learning, e.g., sharing learning moments or discussing with colleagues via the app. Social learning at the workplace with and from colleagues is known from previous research to be most affective towards nurses' SRL (Aagten, 2016, Jantzen, 2019; Berings, et al., 2008; and Tasselli, 2015), and should be considered in future research. E.g., by using or developing a LM-app with features to facilitate interactive learning with and between colleagues.

Practical implications. Although the importance of SRL has broadly been acknowledged, research on self-regulated professional learning at the workplace is minimal (Littlejohn, Milligan, Fontana, & Margaryan, 2016), and research of SRL in the clinical context is even more scarce (Cuyvers, 2019). Improvement in nurses' SRL is required, and to develop nurses' SRL, interventions can be used (Cuyvers, 2020). Therefore, this study aimed to contribute to the limited amount of research done regarding nurses' regulatory readiness and their SRL at the workplace, and how to support and increase their SRL-behaviour. Additionally, educational advisors might benefit from the insight regarding the effect of micro-interventions on employees' regulatory readiness and their SRL. SRL is considered to have a positive impact on employees' performance, rate of employability and wellbeing, and finally, on the safe care

of patients in the clinical context (Cuyvers, 2020). Moreover, the outcome might be broadly useful to other disciplines in the clinical context, and even to other types of organizations.

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Appendix A.1 Questionnaire

General background - Algemene achtergrond

1.	**Wat is je geslacht?**	○ Man ○ Vrouw ○ Overige
2.	**Wat is je leeftijd?**	○ < 20 jaar ○ 21 – 25 jaar ○ 26 – 30 jaar ○ 31 – 35 jaar ○ 36 – 40 jaar ○ 41 – 45 jaar ○ 46 – 50 jaar ○ 51 – 55 jaar ○ 56 – 60 jaar ○ 61 – 65 jaar ○ > 60 jaar
3.	**Wat is je hoogst afgeronde opleiding?**	○ Mbo 4 ○ In-service opleiding ○ Hbo-bachelor ○ Hbo-master/+ ○ Universitaire bachelor ○ Universitaire master
4.	**Hoeveel jaren werkervaring heb je in de zorg?**	○ 0 -5 jaar ○ 6 – 10 jaar ○ 11 – 15 jaar ○ 16 – 20 jaar ○ 21 – 25 jaar ○ > 26 jaar
5.	**Welke functie heb je binnen ZGT?**	○ Open answer
6.	**Op welke afdeling ben je werkzaam?**	○ Kinderafdeling ○ Moeder-kindafdeling ○ Dialyseafdeling
7.	**Hoeveel uur per week werk jij gemiddeld?**	○ 1 – 8 uur ○ 9 – 16 uur ○ 17 – 24 uur ○ 25 – 32 uur ○ 33 – 40 uur

Note. The questionnaire is adapted from Bloemendal (2019), and Pape (2019).

Appendix A.2 Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE)

Directions
Please read each statement and circle the number that best describes your thoughts and feelings about your own learning. There is no right or wrong answer. *(1) no, (2) to a small degree, (3) satisfactory, (4) to a great degree and (5) to a very great degree.*

Subscale	Statement SDL Learning Readiness	Answer
Self-management	1. I am self disciplined	1 2 3 4 5
	2. I am disorganised	1 2 3 4 5
	3. I set strict time frames	1 2 3 4 5
	4. I have good management skills	1 2 3 4 5
	5. I am methodical	1 2 3 4 5
	6. I am systematic in my learning	1 2 3 4 5
	7. I set specific times for my study	1 2 3 4 5
	8. I priortise my work	1 2 3 4 5
	9. I can be trusted to persue my own learning	1 2 3 4 5
	10. I am confident in my ability to search out new information	1 2 3 4 5
Desire for learning	11. I want to learn new information	1 2 3 4 5
	12. I enjoy learning new information	1 2 3 4 5
	13. I have a need to learn	1 2 3 4 5
	14. I enjoy a challenge	1 2 3 4 5
	15. I do not enjoy studying	1 2 3 4 5
	16. I critically evaluate new ideas	1 2 3 4 5
	17. I learn from my mistakes	1 2 3 4 5
	18. I need to know why	1 2 3 4 5
	19. When presented with a problem I cannot resolve, I will ask for assistance	1 2 3 4 5
Self-control	20. I am responsible for my own decisions/ actions	1 2 3 4 5
	21. I am not in control of my life	1 2 3 4 5
	22. I have high personal standards	1 2 3 4 5
	23. I prefer to set my own learning goals	1 2 3 4 5
	24. I evaluate my own performance	1 2 3 4 5
	25. I am responsible	1 2 3 4 5
	26. I am able to focus on a problem	1 2 3 4 5
	27. I am aware of my own limitations	1 2 3 4 5
	28. I can find out information for myself	1 2 3 4 5
	29. I have high beliefs in my abilities	1 2 3 4 5

Note. SDLRSNE is adapted from Fisher& King, 2010

Appendix B.1 Measurements (LM) in the ED-app (Baseline phase)

Phase	Variable	Item	Categories	Next item
Introduction	Introductory question	1. Heb je gewerkt vandaag?	• Ja • Nee	• 2 • Einde
		2. Heb je iets geleerd vandaag?	• Ja • Nee • Ik weet het niet zeker, geef me een hint	• 4 • Einde • 3
Introduction	Introductory question	3. Misschien heb je iets geleerd op deze manier... • Ging iets anders dan verwacht? • Ben je iets nieuws te weten gekomen? • Heb je hulp en/of advies gevraagd? • Heb je iets opgezocht? • Had je een gesprek met een collega? • Heb je iets voor het eerst gedaan of toegepast?	• Ja • Nee	• 4 • Einde
Self-reflection	Reflection on learning outcome	4. Wat heb je geleerd tijdens deze ervaring?	[Input Respondent]	• 5
Forethought	Planning and strategy choice	5. Had je gepland om dit te gaan leren?	• Ja, ik had gepland dit te gaan leren • Ik wilde dit al langer leren, maar had dit niet gepland voor dit moment • Nee, het is me overkomen	• 6 • 6 • 7
	Learning goal orientation	6. Wat was de belangrijkste aanleiding om dit te leren?	• Er was geen aanleiding, het overkwam me • Het was nodig voor mijn rol in het team • Ik wilde iets verbeteren • Uit nieuwsgierigheid • Ik werd door anderen aangemoedigd mezelf hierin te ontwikkelen • Ik wilde mezelf verder ontwikkelen op dit gebied • Mijn leidinggevende vond dit noodzakelijk • Ik liep tegen een probleem aan	• 7

Performance	Learning strategy control	7. Kies de activiteit waardoor je hebt geleerd	Ik heb geleerd door... • Iets te doen of ervaren • Te experimenteren of iets te testen • Iets wat ik al goed kan eens op een andere manier te proberen • Op een ervaring te reflecteren • Informatie op te zoeken met een boek, internet, etc. • Te observeren hoe anderen iets aanpakken • Met anderen over iets te discussiëren • Feedback van anderen te krijgen • Hulp of informatie van anderen te zoeken • Een workshop, training of cursus te volgen • Uitleg, een klinische les, of instructie te geven	• 8
	Learning strategy control	8. Waarom leerde je het op deze manier? Omdat…	• Dit de enige manier is om dit te leren • Dit de snelste en makkelijkste manier is om dit te leren • Deze manier het beste bij mij past • Ik de opdracht van een ander kreeg het op deze manier te leren (learning intention) • Weet ik niet	• 9
Performance	Seeking social assistance	9. Waren andere mensen betrokken bij je leerervaring? Denk aan collega's, patiënten etc.	• Ja • Nee	• 10 • 11
Performance	Seeking social assistance	10. Welke mensen waren betrokken bij deze activiteit?	• Een collega uit mijn eigen team • Een collega uit een ander team • Een expert (arts, deskundige) binnen het ZGT • Een expert (arts, deskundige) buiten het ZGT • Mijn leidinggevende • Een patiënt of betrokkene van een patiënt	• 11
Self-reflection	Future planning	11. Hoe ga je nu verder met deze leerervaring?	• Ik heb (nog) geen nieuwe plannen • Het was niet gegaan zoals ik wilde dus probeer ik het nog een keer • Ik weet nu precies wat ik ga doen in een soortgelijke situatie • Wat ik heb geleerd, blijf ik zo doen • Wat ik heb geleerd, wil ik nog verder verbeteren • Wat ik heb geleerd, ga ik toepassen in de praktijk • Ik stel een nieuw leerdoel op basis van mijn leerervaring	

	• Ik ga mijn kennis/vaardigheden delen met anderen

Note. Items are shown in chronological order as presented in application. Questions are based on Aagten (2016), Endedijk (2012), Pape (2019), Pintrich (2000), & Zimmerman (2000).

Appendix B.2 Implementation intentions (Intervention phase)

Introductie

1. Beste {{user_fname}},
Je zult via de Ethica-app soms korte berichten ontvangen in de vorm van tips, feiten, leerdoelen en voornemens.
Deze gaan over *de voordelen van werkplek leren, het stellen van leerdoelen, de bewustwording van leermomenten* en *voornemens* om het leren op de werkplek toe te passen.
Als deze tips beschikbaar zijn, ontvang je een melding via de Ethica-app.

2. De voordelen van leren op de werkplek
We weten wat de voordelen zijn van leren op de werkplek. Deze willen we graag met je delen. Hiermee willen we duidelijk maken waarom werkplek leren ten goede komt aan jou als verpleegkundige en aan de zorg voor jouw patiënten.

3. Leerdoelen
Leerdoelen geven heel precies aan wat je concreet wilt bereiken op het gebied van kennis, inzichten en vaardigheden.
Je ontvangt berichten over welke leerdoelen je bijvoorbeeld kunt nastreven en bereiken op de werkplek.

4. Leermomenten
Leermomenten zijn kansen en situaties waarin het leren kan plaatsvinden.
Je zult berichten ontvangen die je helpen om je (meer) bewust te worden van die leermomenten op de werkplek.

5. Voornemens
Je zult een aantal voornemens voorgesteld krijgen, die je kunt toepassen tijdens je dienst.
Dit zijn concrete activiteiten (leerstrategieën) die je kunt inzetten om het leren op de werkplek vorm te geven.
Daarmee kun jij je leerdoelen tijdens de komende periode gemakkelijker bereiken.

6. Veel succes en plezier!
We hopen dat de tips, feiten, leerdoelen en voornemens je zullen helpen bij het leren op de werkplek.

Micro-interventie 1

Hallo **{{user_fname}},**
We weten wat de voordelen zijn van leren op de werkplek.
Bijvoorbeeld: Door leren op de werkplek blijf ik competent als verpleegkundige.

Is dit een doel dat je de komende tijd zou willen bereiken op de werkplek?
Ik wil graag iets nieuws leren. Nee/Ja

Wil je wel een voornemen voor vandaag ontvangen?
Nee bedankt/Ja graag

Suggestie voor een voornemen voor vandaag.
Als ik onbekend begrip of verschijnsel tegenkom, dan zoek ik het op (internet, vaktijdschrift, databank, etc.).
Denk er even over na. Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag niet/Ja dat ga ik doen!

Succes!
Aan het einde van je dienst vraag ik of het gelukt is om je voornemen uit te voeren en of je iets hierbij hebt geleerd vandaag.
Bedankt voor het invullen **{{user_fname}}.** Werk ze!

Bedankt voor het invullen {{user_fname}}.
De volgende keer beter. Werk ze!

Micro interventie 2

Beste {{user_fname}},
Een voordeel van leren op de werkplek is dat je je meer bewust wordt van leermomenten die zich voordoen.

Is deze stelling op jou van toepassing?
Ik wil graag het 'waarom' achter iets weten.
Nee/Ja

Wil je wel een voornemen ontvangen voor vandaag?
Een voornemen helpt je bij het bewust leren op de werkplek.
Nee, bedankt/Ja, prima

Suggestie voor een voornemen voor vandaag.
Als ik iets niet weet of kan dan vraag ik hulp aan een collega, leidinggevende of expert (medisch specialist, inhoudsdeskundige, etc.).
Denk er even over na. Ga je proberen om dit voornemen vandaag uit te voeren?
Nee/Ja

Wat goed!
Ik ben benieuwd naar jouw leermoment dat je hieruit meeneemt. Ik kom hier later op terug.
Bedankt voor het invullen {{user_fname}}.
Een fijne dag nog!

Bedankt voor het invullen {{user_fname}}.
Misschien lukt het de volgende keer?
Een fijne dag nog!

Micro interventie 3

Beste {{user_fname}},
We weten wat de voordelen zijn van leren op de werkplek.
Bijvoorbeeld...
Door het leren op de werkplek word ik mij meer bewust van mijn competenties en beperkingen als verpleegkundige.

Past dit leerdoel bij je?
Ik wil mij (meer) bewust worden van leermomenten op de werkplek.
Nee/Ja

Wil je een voornemen voor vandaag ontvangen?
Vandaag niet/Ja, dat is goed

Suggestie voor een voornemen voor vandaag.
Als ik een nieuwe of weinig voorkomende handeling moet uitvoeren dan vraag ik een collega of expert (arts, deskundige, patiënt) om deze handeling met mij te bespreken en aan te geven wat er goed ging en wat nog beter kan.
Denk er even over na. Ga je proberen om dit voornemen vandaag uit te voeren?
Nee/Ja

Wat goed dat je het gaat proberen {{user_fname}}!
Ik verneem later graag of het is gelukt.

Bedankt voor het invullen. Werk ze!

Misschien was dit niet zo'n goed moment voor jou.
Doe je de volgende keer weer mee?
Bedankt voor het invullen **{{user_fname}}.** Werk ze!

Micro interventie 4

Hallo **{{user_fname}}.**
Bedenk dat er voordelen zitten aan het leren op de werkplek.
Zoals: Door te leren op de werkplek leer datgene wat ik nodig heb als verpleegkundige.

Suggestie voor een doel voor de komende periode.
Ik wil competent zijn en mij blijven ontwikkelen als verpleegkundige.
Past dit doel bij jou?
Nee/Ja

Wil je wel een voornemen voor vandaag ontvangen?
Nee, bedankt/Ja, prima

Suggestie voor een voornemen voor vandaag.
Als ik een nieuwe of weinig voorkomende handeling moet uitvoeren, dan verdiep ik mij (van tevoren) in de juiste werkwijze/procedure.
Laat het even op je inwerken. Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag liever niet/Ik ga het proberen
Wat een goed voornemen!
Ik verneem er later graag meer over.
Bedankt voor het invullen van de vragen.
Een fijne dag **{{user_fname}}**!

Bedankt voor het invullen van de vragen.
Misschien is het vandaag niet zo'n goed moment.
Graag tot een volgende keer.
Een fijne dag **{{user_fname}}**!

Micro interventie 5

Beste **{{user_fname}}.**
Zoals je misschien wel weet is leren op de werkplek een manier om competent te blijven als verpleegkundige.
Zelfsturend leren op de werkplek heeft met andere woorden een positieve impact op de door jou verleende zorg aan jouw patiënten!

Past deze stelling bij jou?
Ik hanteer hoge professionele waarden en normen tijdens mijn werk.
Nee/Ja

Wil je graag een voornemen ontvangen voor vandaag?
Nee/Ja

Suggestie voor een voornemen voor vandaag.
Als ik een handeling bij een patiënt uitvoer, dan probeer ik zo goed mogelijk rekening te houden met de patiënt door actief te luisteren naar zijn/haar wensen, behoeften en ervaring (met pijn, angst, kennis, privacy, etc.).
Denk er even over na. Ga je proberen om dit voornemen vandaag uit te voeren?
Nee/Ja

Door het toepassen van je voornemen op de werkplek laat je de door jouw gewenste leerdoelen en/of leergedrag zien!
Veel succes! Ik verneem er later graag meer over.
Werk ze **{{user_fname}}!**

Helaas, misschien past een ander voornemen beter bij je.
Bedankt voor het invullen. Graag tot de volgende keer **{{user_fname}}.**

Micro interventie 6

Hoi {{user_fname}}.
Wist je dat leren op de werkplek een gunstige invloed heeft op je functioneren en jouw welbevinden als verpleegkundige?

Suggestie voor een doel voor de komende periode.
Ik wil mij (meer) bewust worden van mijn 'tips en tops' als professional.
Past dit doel bij je?
NEE [3]. JA [4]

Wil je wel een voornemen voor vandaag ontvangen?
Niet nodig [6]. Graag [4]

Suggestie voor een voornemen voor vandaag.
Als ik samenwerk met een collega of expert, vraag ik om een aantal 'tips en tops' te benoemen m.b.t……
(bijvoorbeeld kennis, handeling/vaardigheid en/of gedrag/houding).
Laat dit even op je inwerken.
Ga je proberen om dit voornemen vandaag uit te voeren?
Nee, vandaag niet [6]. Ja, ik ga het proberen [5]

Dit is een geweldig voornemen! Feedback is onmisbaar bij het leren op de werkplek.
Ik ben benieuwd of het lukt, ik kom er later bij je op terug.
Een goede dienst gewenst **{{user_fname}}**.

Bedankt voor het invullen, een goede dienst gewenst **{{user_fname}}.**
Doe je de volgende keer weer mee?

Micro interventie 7

Hallo **{{user_fname}}.**
Er zijn veel voordelen van leren op de werkplek.
Ken je deze al?
Door te leren op de werkplek ontwikkel je meer zelfvertrouwen in je kennis en kunde als verpleegkundige.

Suggestie voor een doel voor jou de komende periode
Ik wil (vaker) hulp en/of advies vragen in nieuwe of lastige situaties.
Past dit doel bij jou?
Nee/Ja

Wil je wel een voornemen voor vandaag proberen toe te passen?
Nee, dank je/Ja, graag!

Suggestie voor een voornemen voor vandaag.
Als ik iets niet weet of kan dan vraag ik hulp aan een collega, leidinggevende of expert (medisch specialist, inhoudsdeskundige, etc.).

Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag liever niet/Ik ga het proberen

Dank je wel voor het invullen en succes bij het uitvoeren van je voornemen!
Ik verneem later graag of je hierbij een leermoment hebt ervaren. Werk ze **{{user_fname}}**.

Dank je wel voor het invullen **{{user_fname}}.**
Misschien past een ander voornemen beter bij je?
Graag tot een volgende keer.

Micro interventie 8

Beste **{{user_fname}}.**
Iets om over na te denken of om op te schrijven hieronder...
Soms is het, door allerlei belemmeringen, best lastig om leren op de werkplek toe te passen. Welke belemmeringen ervaar je en hoe zou je deze het hoofd kunnen bieden?

Zou dit doel je hierbij kunnen helpen?
Ik wil mijn vermogen om nieuwe informatie te zoeken (verder) ontwikkelen.
Nee/Ja

Wil je wel een voornemen voor vandaag ontvangen?
Nee, bedankt/Ja, prima

Suggestie voor een voornemen voor vandaag.
Als ik een onbekend begrip of verschijnsel tegenkom, dan zoek ik het op (internet, vaktijdschrift, databank, etc.).
Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag liever niet/Ik ga het proberen

Succes bij het uitvoeren van je voornemen!
Ik ben benieuwd naar je leermoment, tot later.
Een goede dienst nog **{{user_fname}}.**

Bedankt voor het invullen.
Doe je de volgende keer weer mee?
Een goede dienst nog **{{user_fname}}.**

Micro interventie 9

Hallo **{{user_fname}},**
Leren op de werkplek heeft veel voordelen.
Bijvoorbeeld…
Door werkplek leren vergroot je bijvoorbeeld jouw vermogen om samen te werken.

Suggestie voor een doel voor jou de komende periode
Ik wil mijn functioneren (vaker) kritisch bespreken met collega's, experts of leidinggevende.
Past dit doel bij jou?
Nee/Ja

Wil je wel een suggestie voor een voornemen ontvangen voor vandaag?
Liever niet/Graag

Suggestie voor een voornemen voor vandaag.
Als ik nieuwe kennis en/of ervaringen heb opgedaan dan deel ik dit met anderen (collega's, leidinggevende of experts).
Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag liever niet/Ik ga het proberen

Veel succes met het toepassen van je voornemen vandaag!
Ik ben benieuwd naar je leerervaring, tot later en werk ze **{{user_fname}}.**

Jammer dat het vandaag niet lukt {{user_fname}}.
Probeer het een volgende keer.
Werk ze!

Micro interventie 10

Hoi **{{user_fname}},**
We weten wat de voordelen zijn van leren op de werkplek.
Wist je bijvoorbeeld dat je door werkplek leren beter om kunt gaan met veranderingen op de werkvloer?

Suggestie voor een doel voor jou de komende periode.
Ik wil mij (meer) bewust worden van leermomenten op de werkplek.
Past dit doel bij jou?
Nee/Ja

Wil je wel een voornemen voor vandaag ontvangen?
Nee, dank je/Ja, graag

Suggestie voor een voornemen voor vandaag.
Als ik onverwacht een nieuwe of weinig voorkomende handeling moet uitvoeren dan verdiep ik mij (achteraf) in de juiste werkwijze/procedure en bedenk ik mij wat ik de volgende keer nog beter kan doen.
Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Nee, vandaag niet/Ik ga het proberen

Goed bezig!
Door te reflecteren op jouw leermoment wordt het effect van leren op de werkplek vergroot.
Ik verneem later graag hoe jouw leerervaring is geweest.
Een goede dienst gewenst **{{user_fname}}.**

Jammer. Dank je wel voor het invullen.
Doe je de volgende keer weer mee **{{user_fname}}?**

Micro interventie 11

Hallo **{{user_fname}},**
Wist je dat…
Een voordeel van leren op de werkplek is dat je je doorlopend kunt blijven ontwikkelen als verpleegkundige?

Suggestie voor een doel voor de komende periode.
Ik wil graag nieuwe kennis en ervaringen kritisch bespreken en/of delen met collega's, experts of leidinggevende.
Past dit doel bij jou?

Nee/Ja

Wil je een voornemen ontvangen voor vandaag?
Nee/Ja, bedankt

Suggestie voor een voornemen voor vandaag.
Als ik nieuwe kennis en/of ervaringen heb opgedaan dan deel ik dit met anderen (collega's, leidinggevende of experts).
Laat dit even op je inwerken.
Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag liever niet/Ik ga het proberen

Op de werkplek leer je veel van elkaar!
Uitstekend dus om kennis en ervaringen met elkaar te delen. Ik verneem later graag of dit is gelukt.
Werk ze **{{user_fname}}!**

Bedankt voor het invullen.
Misschien lukt het de volgende keer om een voornemen uit te voeren?
Werk ze **{{user_fname}}!**

Micro interventie 12

Beste **{{user_fname}},**
Wist je dat...
Door te leren op de werkplek word jij je (meer) bewust van je competenties en je ontwikkelpunten als verpleegkundige.

Suggestie voor een doel voor jou de komende periode.
Ik wil mijn functioneren (vaker) kritisch bespreken met collega's, experts of leidinggevende.
Past dit doel bij jou?
Nee/Ja

Wil je een voornemen ontvangen voor vandaag?
Nee/Prima

Suggestie voor een voornemen voor vandaag.**Als ik een nieuwe of weinig voorkomende handeling moet uitvoeren dan vraag ik een collega of expert (arts, deskundige, patiënt) om deze handeling met mij te bespreken en aan te geven wat er goed ging en wat nog beter kan.**
Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Nee/Ja

Mooi!
Door je bewust te worden van je competenties en aandachtspunten, kun je jezelf blijven ontwikkelen (ook al werk je al jaren).
Feedback van collega's en experts is hierbij van groot belang. Goed dus dat jij je functioneren bespreekbaar maakt. Graag verneem ik er later meer over.
Een goede dienst gewenst **{{user_fname}}**!

Dank je wel voor het invullen.
Doe je de volgende keer weer mee?
Een goede dienst gewenst **{{user_fname}}**.

Micro interventie 13

Hoi **{{user_fname}},**
Eén van de voordelen van werkplek leren is dat je meer zelfvertrouwen ontwikkelt in je kennis en kunde als verpleegkundige.
Op deze manier voldoe je bovendien aan de beroepscode (Beroepscode van Verpleegkundigen en Verzorgenden, 2020).

Suggestie voor een doel voor jou de komende periode.
Ik wil mij (meer) bewust worden van mijn 'tips en tops' als professional.
Past dit doel bij jou?
Nee/Ja

Wil je een voornemen ontvangen voor vandaag?
Nee/Ja

Suggestie voor een voornemen voor vandaag.
Als ik een nieuwe of weinig voorkomende handeling moet uitvoeren dan vraag ik een collega of expert (arts, deskundige, patiënt) om deze handeling met mij te bespreken en aan te geven wat er goed ging en wat nog beter kan.
Denk er even over na.
Ga je proberen om dit voornemen vandaag uit te voeren?
Vandaag niet/Ik ga het proberen

Een prima keuze, succes!
We weten dat feedback van groot belang is bij het leren op de werkplek. Ga zo door dus!
Bedankt voor het invullen **{{user_fname}}.** Werk ze!

Jammer, van feedback op je functioneren kun je veel leren!
Doe je de volgende keer weer mee?
edankt voor het invullen **{{user_fname}}.** Werk ze!

Micro interventie 14

Beste **{{user_fname}},**
Eén van de voordelen van leren op de werkplek is dat je competent blijft als verpleegkundige.
Dit is een belangrijke competentie in de Beroepscode van Verpleegkundigen en Verzorgenden, 2020.

Suggestie voor een doel voor jou de komende periode.
Ik wil mijn vermogen om nieuwe informatie te zoeken, vaker inzetten.
Past dit doel bij je?
Nee/Ja

Wil je wel een voornemen ontvangen voor vandaag?
Nee/Ja

Suggestie voor een voornemen voor vandaag.
Als ik een nieuwe of weinig voorkomende handeling moet uitvoeren dan verdiep ik mij (van tevoren) in de juiste werkwijze/procedure.
Laat dit even op je inwerken.
Ga je proberen om dit voornemen vandaag uit te voeren?
Ja, ik ga het proberen/Nee, dat gaat vanzelf

Je bent goed bezig!
Er is soms sprake van een procedurele veranderingen, of sla je door routine (onbewust) belangrijke stappen over. Het is dus goed om je kennis weer even op te frissen!
Ik ben benieuwd naar je leermoment, kom er later op terug.

Een goede dienst gewenst **{{user_fname}}.**

Dank je wel voor het invullen.
Bedenk dat je door nieuwe informatie op te zoeken, jij je continu blijft ontwikkelen als verpleegkundige.
Doe je de volgende keer weer mee?
Een goede dienst gewenst **{{user_fname}}.**

Micro interventie 15

Hallo **{{user_fname}},**
Zoals je misschien wel weet is leren op de werkplek een manier om competent te blijven als verpleegkundige.
Werkplek leren heeft met andere woorden een positieve impact op de door jou verleende zorg aan jouw patiënten!

Suggestie voor een doel voor de komende periode.
Ik wil mij (meer) bewust worden van leermomenten op de werkplek.
Past dit doel bij jou?
Nee/Ja

Wil je een voornemen ontvangen voor vandaag?
Nee/Ja

Suggestie voor een voornemen voor vandaag.
Als ik een handeling bij een patiënt uitvoer, dan probeer ik zo goed mogelijk rekening te houden met de patiënt door actief te luisteren naar zijn/haar wensen, behoeften en ervaring (met pijn, angst, kennis, privacy, etc.).
Laat dit even op je inwerken.
Ga je proberen om dit voornemen vandaag uit te voeren?
Nee, dit gaat vanzelf/Ik ga het proberen

Dit is een goed voornemen! De bewustwording van je houding draagt bij aan goede patiëntenzorg.
Succes, ik verneem later graag of het is gelukt.
Een goede dienst nog **{{user_fname}}**!

Bedankt voor het invullen {{user_fname}}. Doe je de volgende keer weer mee?
Bedenk dat de bewustwording van leermomenten bijdraagt bij aan goede patiëntenzorg.
Een goede dienst nog!

Appendix C. Informed Consent

Informatiebrief onderzoek werkplek leren ZGT

In het aanmeldingsgedeelte van het onderzoek volgt de vraag of je akkoord gaat met onderstaande informatie. Deze vraag kun je met 'AKKOORD' of 'NIET AKKOORD' beantwoorden.

Doel van het onderzoek
Het doel van dit onderzoek is meer te weten te komen over hoe het werkplek leren binnen het ZGT ondersteund kan worden. Dit wordt gedaan door jou te vragen om jouw leermomenten gedurende 30 werkdagen bij te houden door het gebruiken van een app op je mobiele telefoon of tablet. Aan de hand van jouw leermoment kan er worden gemeten of de ondersteuning via de app werkt. De resultaten van het onderzoek worden gedeeld met de ZGT Academie om de ondersteuning voor werkplek leren (nog) beter af te stemmen op de behoeften van verpleegkundigen.

Wat wordt er van je verwacht?
Onze verwachting is dat je de vragen zo eerlijk en volledig mogelijk probeert in te vullen. Er zijn geen goede of foute antwoorden, het gaat erom hoe jij een leermoment beleefd en/of ervaren hebt. Belangrijk is wel dat je het onderzoek tot het einde toe afrondt, zodat we voldoende metingen kunnen doen. Ons verzoek is om de vragen in de app individueel te beantwoorden, zonder met je collega's te overleggen.
Je beslist zelf of je meedoet aan dit onderzoek, jouw deelname is en blijft ook tijdens het onderzoek geheel vrijwillig. Als jij je voortijdig of na uit het onderzoek terugtrekt, dan worden de antwoorden van de vragenlijsten en app verwijderd en niet meer gebruikt.

Risico's, voor- en nadelen
Het onderzoek is geheel veilig, er zijn geen risico's. Er wordt geen persoonlijke informatie gedeeld en er worden geen antwoorden openbaar gemaakt. Deelname aan dit onderzoek geeft je ondersteuning en een moment van reflectie op jouw leren op de werk, wat vervolgens weer bijdraagt aan jouw professionele ontwikkeling. Ook levert het onderzoek informatie op waarmee het ZGT vooruit kan met het faciliteren van het werkplekleren. Het onderzoek duurt 30 werkdagen.

Privacy
De hoofdonderzoekers (*xx*) en de supervisors van het onderzoek (*xx,* Universiteit van Twente) hebben standaard inzage in de onderzoeksgegevens. Daarnaast zijn wij verplicht je (gecodeerde) onderzoeksgegevens 10 jaar te bewaren in een afgeschermde map op de server van de Universiteit Twente. In rapportages/publicaties worden de gegevens niet herleidbaar/geanonimiseerd verwerkt.
Goedkeuring van dit onderzoek is aangevraagd en verleend door de Commissie Ethiek (CE) van de faculteit Behavioural, Management and Social Sciences (BMS) van de Universiteit Twente (UT).

Meer informatie nodig?
Voor vragen en onduidelijkheden kun je contact opnemen met *x* en/of met *x*.
Mocht je liever iemand spreken van de ZGT Academie, dan kun je contact opnemen met *x* of *x*.