



MASTER THESIS

Investigating The Role Of A Learning Diary On Professionals' Awareness Of How And When And Strategic Planning

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Abstract

Workplace learning happens mostly informally, so professionals are expected to be good self-regulated learners. However, their self-regulated learning process can be hindered by the fact that professionals often do not recognise informal workplace learning. In particular, two self-regulated learning strategies that might be affected are awareness of how and when, the ability to recognise learning opportunities and affordances in the working context; and strategic planning, the process of selecting the appropriate learning activity for the task at hand. To ensure an effective self-regulated learning process, it is important to sustain both these strategies. This thesis investigates whether a learning diary can sustain professionals' awareness of how and when, and reflective prompts about informal learning activities can improve their strategic planning.

Quantitative data was collected through a multiple-baseline design. Knowledge workers ($N=18$) completed a learning diary on their informal learning for 15 working days and received reflective prompts as an intervention. Moreover, to increase the study validity, five participants were interviewed for the synthesized member checking, in which they had the opportunity to review the synthesized data and provide their input.

Results show no improvement in both awareness of how and when and strategic planning. From the interviews, it emerged that participants gained more insights about their (use of) informal learning activities, but they did not change their behaviours. Different elements that could have affected the results were discussed. On the methodological side, the study overlooked long-loop self-regulated learning, and participants' learning needs and goals, emphasising day-to-day learning instead. In this type of learning, characterized by limited time, professionals prioritize performance over learning opportunities and planning. Other methodological aspects, such as the type of prompts, measurement methods and frequency for specific variables, might have played a role in the results. By considering these aspects, a more comprehensive understanding of the impact of the learning diary on awareness of how and when and reflective prompts on strategic planning might be achieved.

Keywords: self-regulated learning, strategic planning, learning awareness, reflection.

Table of Contents

Abstract	2
Table of Contents	3
Introduction	5
Theoretical Framework	6
Workplace learning	6
Self-regulation of Professional Learning	7
Strategic Planning	11
Reflective Prompts to Support Strategic Planning	12
Present study	13
Method	14
Design	14
Participants	16
Interventions	17
Learning diary.....	17
Reflective Prompts.....	17
Instrumentation	18
Awareness of how and when.....	18
Strategic planning.....	19
Employed Learning Activity.....	20
Demographics.....	20
Synthesized Member Check.....	20
Pilot	21
Procedure	21
Data Collection.....	21
SMC interviews.....	25
Data Analysis	25
Longitudinal Multilevel Analysis.....	26
Comparative analysis.....	28
Results	29
Descriptive analysis	29
What is the effect of a daily learning diary on professionals’ awareness of how and when (AHW)?	30
Effect of learning diary on ALO.....	30
Effect of learning diary on RLA.....	33
What is the effect of additional prompts to reflect on their engagement in informal learning activities on professionals’ strategic planning (StP)?	35
Effect of reflective prompts on planning.....	35
Effect of reflective prompts on LAC.....	37
Synthesised Member checking outcome	39
Effect of learning diary on AHW.....	39
Effect of reflective prompts on StP.....	41

New AHW data analysis	42
<i>Discussion</i>	44
Short-loop and long-loop self-regulation of professional learning	44
Awareness of how and when	44
Strategic planning	48
<i>Limitations and future research</i>	49
Conclusion	50
<i>References</i>	52
<i>Appendix 1 – List of learning activities</i>	64
<i>Appendix 2 – Learning diary</i>	66
<i>Appendix 3 – Reflective prompts</i>	68

Introduction

The rapid development of information and communication technology requires professionals to remain up to date (de Moraes & Borges-Andrade, 2015; Renner et al., 2020), and continuous advancement of skills and knowledge is of utmost importance for them and their organizations to remain competitive (Cuyvers et al., 2021). In addition to formal training courses, workplace learning (WPL) can be considered a means of professional development (van Loon, 2018). That is, the workplace context is increasingly seen not only as a more informal setting where learning is applied but also where learning takes place (Milligan et al., 2014; Tynjälä, 2008). To take full advantage of the learning opportunities offered by the workplace, professionals need to properly self-regulate their learning (van Loon, 2018).

Self-regulated learning (SRL) was originally conceptualized and studied in educational settings (Chaudhari, 2021) and it refers to learning by a person who deliberately modulates and adapts affective, cognitive, and behavioural processes to reach desired goals (Brydges et al., 2015; Zimmerman, 2000). SRL has gradually gained attention and popularity in workplace contexts, where it is labelled as self-regulation of professional learning (SRpL; Cuyvers et al., 2020). SRpL plays a central role in informal WPL (Fontana et al., 2015; Kittel et al., 2021), a learning that is strictly intertwined and mediated through everyday work (Fontana et al., 2015; Kyndt et al., manuscript submitted for publication). Thus, the tasks that professionals carry out to do their job are also potential learning activities (Eraut, 2007).

However, the learning potential offered by informal WPL might be hindered by the fact that employees often do not recognise it (Milligan et al., 2014) and sub-optimally plan and select the learning activities (Margaryan et al., 2013; Schillemans et al., 2009). This low recognition and active regulation of workplace learning activities is related to two important SRpL regulatory strategies: professionals' awareness of how and when (AHW), and strategic planning (StP). AHW is the ability to recognise learning opportunities and affordances in the working context (Cuyvers et al., 2021), which is essential to facilitate the progress of their (learning) goals (Bauer & Gruber, 2007; Billet, 2001). StP is selection process of the appropriate learning activity to reach a (learning) goal (Zimmerman, 2000). Selecting the appropriate learning activity is essential not only to obtain the desired knowledge or skill but also for the quality of the learning outcome (Milligan & Littlejohn, 2014).

As SRpL strategies are essential for professionals (Cuyvers et al., 2020) it is important to find ways to support them (cf. Fontana et al., 2015). A possible way to do it is the use of a learning diary, which can help professionals increase their awareness of learning on a daily basis (Panadero et al., 2016). In addition, reflective prompts were found useful in fostering professionals' learning process (Kohen and Kramarski, 2012) and might improve professionals' StP. Therefore, this study aims to investigate whether a learning diary can improve professionals' AHW, and improve their StP with the inclusion of reflective prompts.

Theoretical Framework

Workplace learning

WPL is conceptualized as a type of learning that is highly integrated with the work process (Cuyvers et al., 2022; Kyndt et al., manuscript submitted for publication). This integration results in new knowledge and skills that are useful for the job (Kyndt et al., manuscript submitted for publication). As seen in Figure 1, WPL is part of the bigger concept of work-related learning, and it varies according to its level of interwovenness (between work and learning), formality, and directedness.

WPL comprises both formal and informal learning (Cuyvers et al., 2020), but rather than a dichotomy, the level of formality can be seen as a continuum (Kyndt et al., manuscript submitted for publication). Formality is defined by the degree of structure of the learning process, which can go from a completely structured educational setting to learning as a by-product of the work activity (Kyndt et al., manuscript submitted for publication). Therefore, in this study, informal learning is conceptualised as a type of learning that is highly interwoven with everyday work and with a low-to-none level of formality.

Given its embeddedness with the work process, informal WPL happens through work activities. In the context of WPL, they take the name of informal WPL activities, behaviours that offer opportunities for learning while carrying out work-related tasks and interacting with the professional context (Gijbels et al., 2010; Haemer et al., 2017; Lohman, 2005; Tynjälä, 2013). Examples of informal WPL activities are participating in group processes, asking questions, or working with clients (Eraut, 2007; see Appendix 1 for an extensive list of informal WPL activities). In the literature, the term learning activity is often used interchangeably with learning strategy (cf. de Moraes & Borges-Andrade, 2015; Haemer et al., 2017; Kittel et al., 2021; Kyndt et al., 2016; Littlejohn et al., 2016b; Locke & Latham,

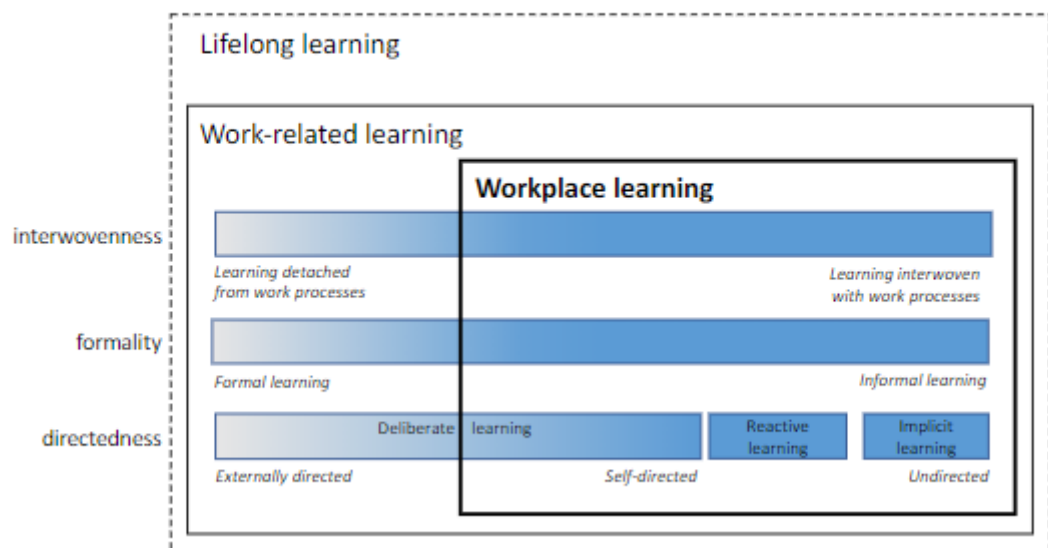
2002). However, to avoid confusion between learning strategies and SRpL strategies subsequently defined, the term learning activity will be used.

Informal learning can be triggered by both internal and external stimuli. External triggers can be, for instance, changing tasks or solving a problem (Leicher & Mulder, 2016). Examples of internal triggers can be the desire to prepare for a future situation or improve a skill. Regardless of the nature of the stimuli, the learning process in informal WPL is in the control of the learner (Kittel et al., 2021). In this sense, WPL can also vary in the level of directedness, going from externally directed to proactive self-regulated learning (SRL).

Figure 1

Model of WPL in Kyndt et al., manuscript submitted for publication

Conceptualising workplace learning



Self-regulation of Professional Learning

SRL is a concept that has many definitions, which vary according to the model, the context, and the focus of the research (Pérez-Álvarez et al., 2018). As the current study will focus on self-regulation in the professional context, SRpL is defined as both an outcome (Siadaty et al., 2016a) and an active constructive process (Pintrich, 2000; Sitzmann & Ely, 2011) that involves thoughts, actions (Pintrich, 2000; Sitzmann & Ely, 2011), cognition (Brydges et al., 2015; Sitzmann & Ely, 2011), and metacognition (Cuyvers et al., 2021; Kohen

and Kramarski, 2012) that are oriented at achieving performance-related goals (Cuyvers et al., 2021).

Therefore, when professionals self-regulate their learning they do it to improve their work performance and not for learning per se (Cuyvers et al., 2021). By being triggered by their work practice, professionals can self-regulate their learning proactively, reactively and implicitly (Cuyvers, 2019). Proactive SRpL is the highest level of SRpL (see Figure 1) in which professionals deliberately set learning goals to improve their work-related skills or knowledge. Implicit SRpL happens unconsciously as a result of carrying out their work tasks, while reactive SRpL is in between, happening in the midst of action but with a certain degree of intentionality (Cuyvers et al, 2021; Kyndt et al., manuscript submitted for publication). The distinction between deliberate SRpL and reactive SRpL is sometimes described as long-loop SRpL and short-loop SRpL. As the name suggests, short-loop SRpL takes place in a shorter timeframe and is related to solving immediate problems that can arise while performing the work process. On the other hand, in long-loop SRpL the focus is on the longer period and it entails a longitudinal approach that needs planning (Cuyvers, 2019).

SRpL includes multiple strategies (Sitzmann & Ely, 2011) which occur before, during and after learning events (Cuyvers et al., 2020), and are divided into different components. In classic (educational) models, these components are usually called phases, as the learner is supposed to go from one phase to the subsequent one. In the working context, SRpL strategies are used more openly (Cuyvers, 2019; Cuyvers et al., 2021; Fontana et al., 2015), therefore, instead of phases, is better to use another type of categorisation (Margaryan et al., 2013).

An SRpL model that fits this idea is that of Sitzmann and Ely (2011), where they distinguish between regulatory agents, regulatory mechanisms, and regulatory appraisals (Table 1). Regulatory agents entail SRpL strategies and elements that trigger or start the self-regulatory cycle (Sitzmann & Ely, 2011), like the above-mentioned internal and external stimuli. Regulatory mechanisms are the core of SRpL because they are the elements necessary for efficient progress towards the (learning) goal. Finally, regulatory appraisals are strategies used to evaluate the learning process and to decide whether to proceed or not with it.

In addition to these regulatory components, in her study in the medical context, Cuyvers (2019) identified a new SRpL component which she named regulatory readiness.

Regulatory readiness comprises SRpL strategies that are conditional for SRpL to take place (cf. Table 1), and it is linked to all the other SRpL regulatory components (i.e., regulatory agents, regulatory mechanisms, and regulatory appraisals; Cuyvers, 2019).

The current study will focus on specific SRpL strategies regarding regulatory readiness and regulatory mechanisms.

Table 1

SRpL strategies in relation to SRpL components¹

	SRpL components	SRpL strategies
Regulatory agents	Regulatory agents initiate SRL toward the achievement of objectives	Perception of a case/task/situation Analysis of a case/task/situation Prior experience activation Goals
Regulatory mechanisms	Regulatory mechanisms are the strategies which are instrumental for an efficient progress	Planning Learning activity control Learning activities Metacognitive awareness Metacognitive monitoring
Regulatory appraisals	Regulatory appraisals are instrumental in the evaluation of the progress towards the goals	Self-evaluation judgments Self-efficacy judgment
Regulatory readiness	Regulatory readiness comprises elements that are essential to initiate, advance or evaluate learning	Being alert Wondering Awareness of how & when Awareness of learning needs Recognising affordances

Note. 1 This table is retrieved and adapted from Cuyvers (2019)

Awareness of How and When

As regulatory readiness regards strategies that make professionals perceptive to recognise the (possible) learning that takes place around them (Cuyvers et al., 2021; Oomen, 2021) it is a pre-condition for SRpL. Amongst the different regulatory readiness strategies (see Table 1), this study will focus on AHW. In her research, Cuyvers (2019) describes AHW

as the ability of professionals to describe those situations where learning could take place. In the current study, AHW will be conceptualised as the professionals' ability to recognise both learning opportunities and learning affordances in their working context (Oomen, 2021).

AHW plays an important role for SRpL in the context of informal WPL, because professionals often struggle to distinguish between learning and working when the learning activity is not evident (Eraut, 2004, 2007). That is, professionals are often unaware of the informal learning that they encounter and experience in the workplace (i.e., learning opportunities and affordances; Eraut, 2004, 2007; Gijbels et al., 2010; Milligan et al., 2014; Persico et al., 2015; Tynjälä, 2013) and sometimes they fail to recognize it as learning (Milligan et al., 2014; Tynjälä, 2008). Simply put, professionals may have a low AHW regarding informal WPL. A possible tool that could help professionals improve their AHW is a learning diary.

Increasing regulatory readiness (AHW) with learning diaries

Learning diaries are tools that help learners focus on their learning experiences (van Loon, 2018). By using learning diaries, people can record their learning insights, behaviours, and outcomes in a structured way (Fessler et al., 2017) which can lead to an increased awareness about learning (Panadero et al., 2016).

Therefore, learning diaries can be beneficial for SRpL (Panadero et al., 2016). In the context of SRpL research, learning diaries serve not only as a means of measurement but also as a pedagogical tool (Rausch et al., 2022). More specifically, tools that are used to measure SRpL strategies can also promote them (Panadero et al., 2016). Repeated measurements might in fact cause the so-called reactivity effect, wherein the behaviour being measured changes as a result of the measurement itself (Panadero et al., 2016; Rausch et al., 2022). This might be due to the fact that the diary can remind the learner of the use of specific SRpL strategies (Schmitz & Wiese, 2006), such as AHW. Therefore, a learning diary might contribute to improving professionals' awareness of their learning (Panadero et al., 2016). More specifically, by using a learning diary on a daily basis (Ohly et al., 2010), professionals can be asked to recall the learning they experienced in their working context through specific items focused on their AHW. In this way, it would be possible not only to measure professionals' AHW, but also stimulate it. In other words, a learning diary can be a way to encourage professionals to pay more attention to the learning opportunities and affordances in their context, making them more aware of how and when they learn.

Because learning diaries can cause the reactivity effect, it is argued that professionals should improve their ability in recognising the learning opportunities and affordances that they experience. In particular, the more professionals fill in their learning diaries, the more their AHW should increase. However, some studies show that learning diaries do not always have a positive effect on participants' SRL (Pesonen et al., 2020). Previous research (Oomen, 2021) investigated AHW using a learning diary, finding a small (not significant) increase. However, the effect of the learning diary on AHW was not investigated. Therefore, the effect of a learning diary on professionals' AHW needs to be explored.

Strategic Planning

As previously stated, regulatory mechanisms are particularly important in the context of informal WPL, as they are in control of the learner and essential to achieving the (learning) goal (Sitzmann & Ely, 2011). More specifically, an essential process to obtain the desired knowledge or skill is the selection of the appropriate learning activity (Zimmerman, 2000) to obtain it. In the context of this study, this selection process is defined as StP. Notwithstanding its importance, StP is scarcely researched.

Regulatory mechanisms strategies that entail StP are planning and learning activity control (LAC; see Table 1). Planning and LAC regard the level of directedness of the selection process (Bloemendal, 2019; Oomen, 2021). Namely, planning is about how much in advance professionals plan to use specific learning activities, and LAC is a concept first introduced by Endedijk et al. (2016), and subsequently use in other studies about SRpL (cf. Bloemendal, 2019; Gerrits, 2021; Kattenberg, 2021) to explore the reason why a learning activity is chosen.

Factors influencing StP are the (learning) goal that professionals want to achieve; contextual factors (Haemer et al., 2017; Jeong et al., 2018; Litteljohn et al., 2016; Pintrich, 2000; Siadaty et al., 2012; Tynjälä, 2013), such as the organizational structure, the learning climate, and the characteristics of the job/task; personal factors (Haemer et al., 2017; Kittel et al., 2021; Litteljohn et al., 2016; Pintrich, 2000; Tynjälä, 2013) like self-efficacy and goal orientation; and the interpretations of both contextual and personal factors (Litteljohn et al., 2016b; Marsick et al., 2008; Tynjälä, 2013). This interpretation is influenced by the previous experience and knowledge professionals have of learning activities (Cuyvers et al., 2020; Roessger, 2014; Schillemans et al., 2009), and it is a process that affects subsequent

behaviours. Namely, if this interpretation is wrong, it will influence the choice of the learning activity, negatively affecting the resulting performance (Cuyvers, 2019).

Indeed, different problems that can hinder the interpretation and the subsequent selection process were identified in the literature. Firstly, different studies (Butler & Winne, 1995; Siadaty et al., 2016b; Winne, 2017) suggest that people's knowledge of learning activities might be lacking, and their perception of the needed activity is wrong. Additionally, in some cases, learners under-appreciate the efficacy of (some) learning activities (Siadaty et al., 2016b; Winne, 2017), or they even do not recognize them as learning activities (Siadaty et al., 2016b). Moreover, habits can bias the selection of the learning activity. That is, professionals often automatically rely on the learning activities they are most accustomed to (Locke & Latham, 2002; Lord et al., 2010; Schillemans et al., 2009), without scanning the repertoire of other possible activities and critically choosing the most appropriate one (Winne, 2017). Finally, professionals find it difficult to make it explicit why they chose a certain learning activity (Cuyvers, 2019).

Therefore, for an efficient StP, it is important for professionals to have a good knowledge of (how they use) informal WPL activities. Although learning diaries can increase their awareness of the learning activities they use, it is not sufficient to support SRpL strategies such as StP, for which they need extra aid (Kattenberg, 2021). A possible solution is the use of reflective prompts.

Reflective Prompts to Support Strategic Planning

Reflective prompts can be questions, hints or requests (Davis, 2003; Ifenthaler, 2012) that focus professionals' attention on important aspects of their work experience and underlying process (Fessl et al., 2017; Kramarski & Kohen, 2016). As the name suggests, reflective prompts are designed to elicit reflection, which in this study is defined as a cognitive (Roessger, 2014) process that enhances understanding of both oneself and the situation, to inform future actions (Sandars, 2009). Reflection plays a central role in learning, as it transforms past experience into knowledge (Šarić & Šteh, 2017) and tacit knowledge into explicit knowledge (Dochy et al., 2011; Hackett, 2001; Tynjälä, 2008). Kinsella (2007) also suggests that reflection increases awareness of one's actions and the reasons behind them, leading to the consideration of alternative courses of action. Thus, if professionals pause to reflect on their use of learning activities, their StP can improve both in planning and LAC.

Because professionals lack the necessary skills to engage in effective reflection (Van Eekelen et al., 2005; Margaryan et al., 2013;) the use of prompts is an effective way to scaffold it (Kohen and Kramarski, 2012; Fessl et al. 2017). Reflective prompts in the form of open-ended questions give a degree of autonomy to professionals, whilst scaffolding them (Ifenthaler, 2012; van Loon, 2018). This allows people to connect the questions with their subjective experience, making sense of it, and creating their subjective knowledge which in turn affects future action (Knipfer et al., 2013).

More specifically, reflective prompts specifically directed at the use of learning activities can help professionals improve their knowledge about learning activities (e.g., where they work better, what are their strengths and weaknesses, etc.), and also (re)consider the reasons behind their choice. Professionals might discover unknown aspects of the effectiveness of learning activities, as well as their own cognitive and behavioural patterns. These insights might help professionals to make future selections more informed, by improving the evaluation (LAC) and planning of the activities that best fit their goals.

Present study

The general goal of this study is to investigate professionals' AHW and StP. In particular, the study aims to investigate the influence of a learning diary on professionals' AHW. Additionally, it will explore whether the addition of reflective prompts regarding the utilization of informal learning activities affects professionals' StP.

To achieve this twofold goal, a learning diary in the form of a questionnaire will be delivered to the participants. Because participants will receive the questionnaire after the work shift, the current research can be conceived as a day reconstruction method (DRM). While in common diary studies it is the participants' initiative to give their input (e.g., answer questions; van Berkel et al., 2017), in DRM they are reminded to do it. Namely, people are asked to recollect what happened during the day after the (working) activity (Kahneman et al, 2004). Thus, participants do not have to interrupt what they are doing (e.g., a working task), reducing the burden on them (Kahneman et al, 2004; Rausch et al., 2022).

It is expected that, by completing a learning diary on a daily basis, participants' AHW will gradually increase throughout the period of the study. In addition, participants will receive reflective prompts in the form of questions specifically designed to stimulate professionals to reflect on their use of informal WPL activities. It is expected that by

engaging in this reflection professionals' StP will improve. It should be noted that these expected effects have not yet been explored. Therefore, the following research questions were formulated:

1. *What is the effect of a daily learning diary on professionals' awareness of how and when (AHW)?*
2. *What is the effect of additional prompts to reflect on their engagement in informal learning activities on professionals' strategic planning (StP)?*

Method

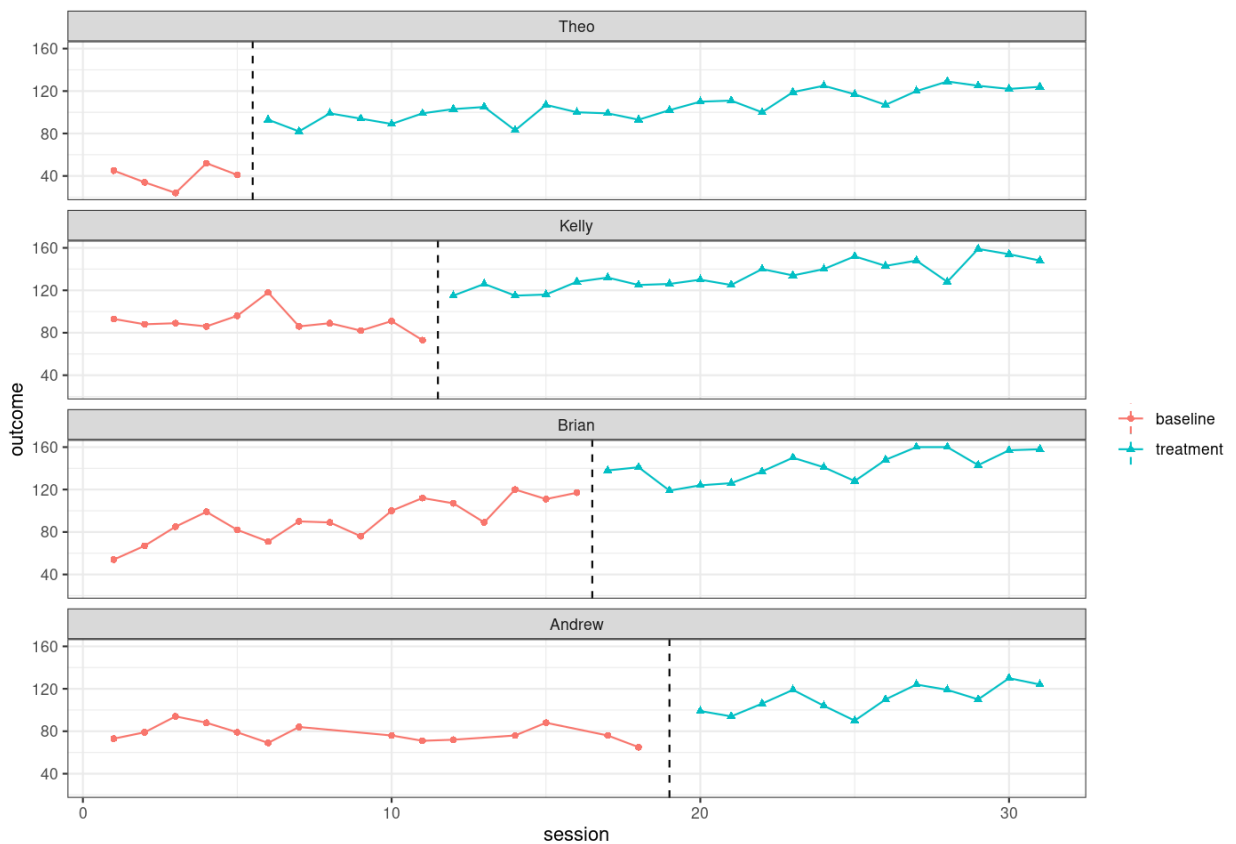
Design

To answer the research questions, a single-case design (SCD) was adopted, specifically the multiple-baseline design (MBD) across participants. SCDs usually involve repeated measurements of a dependent variable before and after the introduction of an independent variable (Kratochwill et al., 2010). SCDs are often used to evaluate the effects of interventions (Kratochwill et al., 2010; Pustejovsky et al., 2014), and according to Smith (2012), they are increasingly used in conjunction with learning diaries.

MDBs involve repeated measurements of the dependent variable on different targets, in this case, participants, during the baseline phase (A), followed by the introduction of a treatment (i.e., independent variable) during the intervention phase (B). The intervention phase usually starts at different points in time for each participant (Pustejovsky et al., 2014; see Figure 2 for an example). Because of this disparate beginning, the (potential) change in the dependent variable demonstrates that it was caused by the independent variable (Kazdin, 1982; Smith, 2012). The MBD is particularly indicated for application scenarios where the effect of the independent variable cannot be reversed when it is withdrawn (Hedges et al., 2013; Kratochwill et al., 2010; Smith, 2012; Valentine et al., 2016). In the current research, the independent variable is represented by reflective prompts. It can be assumed that the effect of reflective prompts is permanent, as people would hardly forget what they reflected on. Therefore, the MBD was the most appropriate SCD type for this study.

Figure 2

Hypothetical data outcome of a Multiple-baseline design study



Note. Image retrieved from <https://jepusto.shinyapps.io/scdhlm/>. The black vertical-dotted lines indicate the introduction of the treatment.

Horner et al. (2005) recommend having a minimum of three participants but having more than four is desirable (Kratochwill et al., 2010). Moreover, Lanovaz and Turgeon (2020) found that having at least three data points for the baseline phase and five data points for the intervention phase reduces type I error rate. However, having a higher number of measurements in both phases improves the accuracy of the results (Bouwmeester & Jongerling, 2020).

Furthermore, it is essential to consider practical constraints such as the study settings or type (Bouwmeester & Jongerling, 2020; Kratochwill et al., 2010) and potential threats to internal validity. Specifically, the length of the study can increase the risk of participant dropout, which can result in a data series that is too short to analyse and interpret (Kratochwill et al., 2010). Therefore, this study will measure participants for 15 working days

(3 working weeks), which should provide a sufficient amount of data while limiting the risk of dropout.

For a MBD, it's important that the baseline phase starts at the same time for each tier (Valentine et al., 2016). Also, to increase the credibility of the results and the power of the test, it is good practice to randomize the start times of the intervention phase (Bouwmeester & Jogerling, 2020; Valentine et al., 2016). Having different starting moments guards against threats to internal validity due to maturation or common history (Bouwmeester & Jogerling, 2020).

Finally, to ensure accurate results, additional measures will be collected using different means, following the recommendations of Panadero et al. (2016). Specifically, they suggest adding measures that do not intervene with the measured variables. In the current study, member-checking will be employed.

Participants

The participants of the research were knowledge workers working in various domains. Knowledge workers learn continuously through informal learning and are more expected to self-regulate their learning (Milligan et al., 2015). A combination of convenience sampling and snowball sampling was used to recruit participants. The researcher initially contacted personal contacts ($N=9$) and an online group of professionals ($N=101$). These individuals were asked to forward the participation request to other knowledge workers. In one instance, one of the initially contacted individuals forwarded the documentation to all the employees of her company. Even though this type of sampling is usually used for hard-to-locate populations, it was employed for time reasons. That is, an international company was initially contacted to carry out the study with its employees. However, as the company delayed the decision multiple times, the researcher opted for the alternative solution previously described. Although non-probability sampling methods have limitations in terms of generalization, the sectors in which the participants worked are theoretically relevant to the study, which enhances the representativeness of the sample (Frey, 2018).

A total of 18 professionals enrolled in the study. Of these, 5 participants (27.8%) worked in the Public sector or Education, 4 (22.2%) in Marketing, 2 (11.1%) in Scientific or Technical services, 2 (11.1%) in Arts, Culture and Entertainment, 2 (11.1%) in Legal and Law occupations, 1 (5.6%) in Businesses and Finance, 1 (5.6%) in Communication, and 1 (5.6%) in Management and Administration. The majority of participants (38.9%) had a work

experience between 0-5 years, 33.3% had 6-10 years of experience in their sector, and the remaining 27.8% had more than 10 years of experience. Finally, more than a third of the participants (77.9%) had a master's degree or higher, 2 (11.1%) participants held a bachelor's degree, and 2 participants (11.1%) had a high school diploma.

Participants for the SMC ($N=5$) were people that participated in the study. People were contacted through convenience sampling. Because people's participation in the daily questionnaire was anonymous, the researcher did not have the means to reach other participants than those initially contacted for the study. The 5 people that participated in the SMC were 2 men and 3 women. All the participants were from Italy, working in different companies and sectors.

Interventions

Learning diary

The daily learning diary was delivered in the form of a daily questionnaire - which was also the means to measure all the different variables - through the Twente Intervention and Interaction Machine (TIIM) mobile application. This application enables researchers to both collect data (e.g., daily measurement) and present stimuli to the user (e.g., reflective prompts), based on pre-determined conditions, such as a pre-defined time and day (Twente Intervention and Interaction Machine [TIIM], n.d.). Except for the interviews, all the means necessary to carry out the research (i.e., informed consent, learning diary, reflective prompts, and different types of communication) were delivered through the app. Before each daily questionnaire, to prevent participants from linking learning with more formal activities (Littlejohn et al., 2016a) they were informed about the meaning of informal learning in the context of the study and received a general reflection question to think about a specific learning experience they had at work that day.

Reflective Prompts

During the intervention phase, reflective prompts were added to the usual questions of the learning diary. These prompts were displayed as additional open-ended questions at the end of the questionnaire. Making the prompts in the form of open-ended questions forced participants to write their answers, thus making "their thinking visible" (Davis, 2003, p.102).

The reflective prompts were designed using the reflection model of Peters (1991), which consists of four steps: describe, analyse, theorize, and act (DATA). The DATA model

guides individuals to reflect on a critical aspect of their job (Imel, 1992). The first step involves identifying and describing an event, followed by a more detailed analysis in the second step, where underlying assumptions are identified. In the third step (theorize), a theory is constructed, and alternatives are produced. Finally, during the act step, the new theory is implemented in the real context (Imel, 1992; Peters, 1991). Therefore, by following the DATA model's steps, professionals can reflect on their use of learning activities, and potentially increase both their procedural knowledge and conditional knowledge.

By using the DATA model as a base and adapting it to the context of this study, prompts regarding the categories of learning activities presented in Appendix 1 were developed. On each day of the intervention phase, participants received four prompts to reflect on a different category. The full list of reflective prompts can be seen in Appendix 3. As there is no objective knowledge about learning activities, the formulation of the questions (i.e., reflective prompts) did not hint at right or wrong answers, allowing participants to build their own personal and context-specific knowledge of the learning activities (Knipfer et al., 2013).

Instrumentation

As in previous studies (Gerrits, 2021; Kattenberg, 2021; Oomen, 2021), the questionnaire was built by adapting the Structured Learning Report of Endedijk et al. (2016). According to the authors, the tool is a reliable way to measure SRpL in different contexts without the need for participants to rate themselves on the different SRpL components. The questionnaire of the current study consisted of one open item and 13 close-ended items (14 items in total), that measured participants' AHW and StP. Participants took different routes through the questionnaire based on their responses to certain items. The full version of the learning diary can be found in Appendix 2. To ensure simplicity and clarity, no jargon was used (i.e., way of learning instead of learning activity), consistent with the wording used in Endedijk et al. (2016).

Awareness of how and when

AHW was operationalised as the awareness of learning opportunities (ALO) and recognition of learning affordances (RLA; Oomen, 2021). To measure these two variables, items 1 to 7 were used. In particular, the items from 1 to 3 were used to measure participants' ALO, while items from 4 to 7 measured their RLA.

Awareness of learning opportunities. Items 1 to 3 used a 1-100 scale (1 = strongly disagree, 100 = strongly agree) and asked questions about the learning opportunities that people see in their context, such as “Today at work I have noticed ways in which I could learn”. These questions were developed by Oomen (2021), who estimated reliability of .31 at the daily level and .69 at the individual level. Notwithstanding the low reliability at the daily level, Oomen (2021) considered the items reliable due to the small number of items in the scale.

Recognition of learning affordances. Items 4-7 were focused on the recognition of learning events that took place that day. Participants were first asked if they learned something that day (item 4), and a hint was given (item 5) if they selected either “No” or “I’m not sure, give me a hint”. Then, they had to indicate how many learning experiences they had that day (item 6). These questions were adapted from the studies of Bloemendal (2019) and Oomen (2021). Lastly, item 7 asked participants to write down what they learned that day. That is the content of the learning event(s) they had. Although the answer to this last question was not included in the analysis, the item was designed to help participants think about concrete learning events they experienced that day.

Strategic planning

StP in the current study was operationalised using two variables, planning (item 10) and LAC (item 11).

Planning. Item 10 is based on the question “Did you choose beforehand this way of learning?” of Endedijk et al. (2016). In its original version, the possible answers were “No, this was no conscious choice” or “Yes, I thought about that beforehand”. The item was changed to “I carefully decided to use this way(s) of learning in advance”, where participants could answer through a five-point Likert scale (1= *strongly disagree*, 5= *strongly agree*). This was done to provide participants with the possibility to give a more nuanced answer.

Learning Activity Control. Item 11 was originally developed by Endedijk et al. (2016) and subsequently used in other studies (Bloemendal, 2019; Gerrits, 2021; Kattenberg, 2021). In the current study, the possible answers were slightly rephrased to avoid possible misinterpretation. Moreover, two additional options were added. Namely, the added answers were “It was a choice based on intuition” and “This was the way of learning leading to the best results”. The former is based on the findings of Cuyvers et al. (2021), which found

that often professionals intuitively choose what learning strategies to employ, while the latter was added to include an option about efficiency.

Employed Learning Activity

Items 9a, 9b, 9c, and 9d were used to make participants more aware of how they learn. These items are an adapted version of the question “How did you learn this?” from Endedijk et al. (2016). Unlike the original version, a more extensive list of learning activities was provided to the participants (see learning activities reported in Appendix 1). Seeing the list might broaden their AHW.

The new set of learning activities was built using the studies of Kyndt et al. (2016), Eraut (2011), and Moore and Klein (2020). To avoid presenting an excessively long list of options every time, the set was divided into three categories. Item 9a was used as a pre-selection, where people could indicate if they learned alone, with others, or alone and with others. Depending on the selection, a different list was presented (items 9b, 9c, or 9d).

Demographics

Before the beginning of the study, a few demographic questions were asked to the participants. These comprised the work experience and the highest achieved level of education to get a simple profile of the participants; and a question about the motivation of the participation in the study to control for self-selection bias.

Synthesized Member Check

The Synthesized Member Checking (SMC) method of Birt et al. (2016) was employed to increase the reliability of the study (Doyle, 2007) by gaining further insights into the participants' experience. In SMC synthesized data are returned to the participants, giving them the opportunity to check if their experience resonates with the data and provide their input (Birt et al., 2016, Carlson, 2010). In this way, researchers' potential bias in data interpretation is reduced and data validity is increased by seeking disconfirming voices (Birt et al., 2016).

For this study, the results were provided through a written document. To make it accessible to non-experts, the document reported data in an easy-to-understand language, without using jargon that might hinder participants' understanding and discourage their participation. The document included an explanation of what is expected of the participants, a summary of the structure of the study (i.e., learning diary and reflective prompts), and a summary of interim quantitative results with an explanation of the analysed concepts.

Based on the provided document, interviews were conducted where participants were asked to provide their opinion on whether the synthesized results aligned with their personal experiences (Birt et al., 2016). As participants' experiences may vary, they might see data in different ways. Therefore, their viewpoints were reported, and the feedback received was used to finalize and refine the interpretation of the outcomes (Doyle, 2007).

Pilot

Before the data collection, a small pilot was conducted with a few volunteers ($N=10$) over the course of one week. The goal of the pilot was threefold: firstly, potential issues with the app, misspelling in the questionnaire, and other problems needed to be identified. Secondly, some items of the learning diary as well as the reflective prompts were proposed in two versions (i.e., the first version was presented during the first days of the pilot and the second version during the last days). Participants in the pilot were asked to indicate the one that helped them the most in either answering a specific question (item) or reflecting (prompt). Thirdly, feedback on the experience with the learning diary and the reflective prompt was collected (e.g., time to complete the questionnaire). The items and reflective prompts as reported in the Appendix 2 and Appendix 3 corresponds to the post-pilot version.

Based on the feedback of the participants, some rephrasing was done for those items that were not easy to understand (e.g., items 1 to 3 regarding ALO, the original phrasing was reported as confusing, because the three original questions were too similar to each other. Therefore, the three items were rephrased to make the distinction clearer.). Above all, a few important choices were made. Firstly, item 10 was changed from a multiple-choice question to a Likert scale. The pilot's participants reported that the Likert scale version was easier to relate with and answer. Secondly, the reflective prompts employed in the current study were chosen. Finally, participants reported that the effort required for reflecting on the prompts could be demanding. Therefore, the maximum number of days for the intervention phase was reduced to 7, instead of the 9 originally planned.

Procedure

Data Collection

Before the start of the study, the Ethical Committee was contacted to get permission to carry out the current research and to use the TIIM app. Then, a participation request was sent to the (possible) participants via email. The request included details to enrol in the

study via the TIIM app and information about the study itself. Instructions on how to use the app were also provided to minimize noncompliance risks (Smith, 2012). Since participants were located in Italy and The Netherlands, the documentation and intervention content were offered in both Italian and English. To ensure anonymity, participants were asked to create a pseudonym when registering on the TIIM app. To increase the participation rate, participants were informed of the benefits of participating in the study, such as the benefits of reflection on their performance. Since the time commitment required of participants was significant, personal communication was sent via the TIIM app every week to show appreciation for their effort and reduce the dropout rate.

After logging into the app for the first time, participants were required to fill in the informed consent and provide some demographic information. Only after completing these steps were participants eligible to receive the learning diary.

While the starting day of the baseline phase was the same for all participants, the starting day of the intervention phase was randomized to increase the test's power (Bouwmeester & Jogerling, 2020). More specifically, Bouwmeester & Jogerling (2020) recommend specifying in advance the possible start moments' range of the intervention phase, and then randomly assigning participants to the different ranges. In this study, the intervention phase ranged from a minimum of five days to a maximum of seven days. Limiting the intervention phase to a maximum of seven days helped to reduce the risk of dropout as participants may lose motivation to fill in reflective prompts for a longer period. Even though participants had a different number of measurements for the baseline and intervention phase (e.g., participant A started the intervention on day 9, and participant B on day 10), as specified by Bouwmeester & Jogerling (2020), with only 15 measurements the difference does not cause any problem for the power of the test. A summary of the different starting moments of the intervention is shown in Table 2.

Every day, for 15 working days, participants received a notification on their smartphone to fill in the learning diary. The time set for the notification was the end of the working day. Ifenthaler (2012), states that the timing for presenting prompts needs to be in line with the goal of the prompts. When professionals need to think of what they have done, it is appropriate to deliver the prompts after the action. In this case, it meant after their working shift. Moreover, the timing chosen for delivering the questionnaire has three main benefits. Firstly, participants did not have to interrupt their activities to fill in the

questionnaire (Fessler et al.; 2017; Kahneman et al., 2004). Secondly, in this way the risk of cognitive overload was reduced, as participants did not have to complete the questionnaire when working (Panadero et al., 2016). Thirdly, retrospective bias was reduced, because participants were asked to report information shortly after their shift had ended (Bolger et al., 2003; Ohly et al., 2010).

Each daily questionnaire lasted 23 hours. This was done to accommodate different working shifts and give participants enough time to complete it, but also to avoid overlapping with the questionnaire of the subsequent day. A set of notifications was also implemented to remind participants to fill in the questionnaire when they did not do it after receiving the first notification. Namely, a first reminder was sent two hours after the delivery of the questionnaire, and a second one two hours before the daily questionnaire was closed. Because asking participants to respond to the same questionnaire repeatedly may be challenging (Ohly et al., 2010), the daily questionnaire took about 5 minutes to be completed.

Table 2*Overview of the Multiple-Baseline Design With the 18 Participants*

Participant	Starting day of the Intervention
1	9
2	9
3	10
4	11
5	11
6	10
7	9
8	11
9	9
10	11
11	9
12	10
13	10
14	10
15	9
16	11
17	10
18	10

Table 3*Assignment of reflective prompts per number of intervention days*

Number of intervention days	Prompt category
5	AFI, CWO, LFO, DEE, CIS,
6	AFI, CWO, LFO, DEE, CIS, RET
7	AFI, CWO, LFO, DEE, CIS, RET, UNO

Note. AFI = Asking for information, CWO= Collaborating with others, LFO= Learning from others, DEE= Doing/ experiencing/experimenting, CIS= Consulting (offline/ online) information sources, RET= Reflecting/thinking, UNO = Using networks outside work

During the intervention phase, together with the learning diary, participants also received the reflective prompts. These were shown as additional open-ended questions in the learning diary. More specifically, the prompts were shown after item 11. Because some participants had a lower amount of days for the intervention phase, they did not receive the reflective prompts on all 7 categories of learning activities presented in Appendix 1.

However, the order of presentation of the reflective prompt's categories was the same for

all participants. The final presentation order of the reflective prompts (Table 3) followed the order of the informal WPL categories of Appendix 1.

SMC interviews

For the SMC, participants were contacted several months after the end of the study. This is in line with the SMC methodology, as the initial data analysis can take time (Birt et al., 2016). To carry out SMC, individual interviews were carried out. A document containing the synthesized results was emailed to the participants before the interviews (Slettebø, 2020). This was done to give them the time to go through the results and think about their experience, to be prepared to discuss it during the interview (Doyle, 2007). The document contained information about its purpose, a summary of the study they participated in, and the synthesized results. Moreover, the results were divided into two main themes (i.e., effect of the learning diary, effect of the reflective prompts).

All the interviews were held online. At the start of each interview, participants were asked permission to record it, specifying that the transcription would be subsequently anonymized. Moreover, the summarized data contained in the document was explained once more to the interviewee, to ensure that there was mutual understanding and agreement on the meaning of concepts. For each theme (i.e., AHW and StP), the researcher asked if the data reflected the participant's experience. When needed, follow-up questions were asked to further investigate a specific aspect or to clarify unclear points of the answer. Interviews lasted between 20 and 30 minutes.

Data Analysis

Different types of quantitative analyses were conducted to answer the research questions What is the effect of a daily learning diary on professionals' awareness of how and when (AHW)? and What is the effect of additional prompts to reflect on their engagement in informal learning activities on professionals' strategic planning (StP)?

A descriptive analysis was first performed on the entries provided through the TIIM-App. Secondly, a longitudinal multilevel analysis (LMA) was conducted on ALO and RLA, preceded by visual inspection, to explore the effect of the study on participants' AHW. Thirdly, the variables regarding StP (i.e., planning and LAC) were visually and statistically analysed. Finally, the content of the interview was organised according to the different themes of the study (i.e., AHW, StP; Slettebø, 2020).

Longitudinal Multilevel Analysis.

To investigate whether the learning diary had an impact on AHW (i.e. ALO and RLA), a LMA was conducted for both variables. LMA is a suitable method for analysing longitudinal data where participants are measured repeatedly (Bell et al., 2018; Hox & Roberts, 2011). In longitudinal data, repeated occasions are nested within individuals (Bell et al., 2018; Curran & Bauer, 2011). LMA considers the nested data structures, and the analysis corrects for non-independent observations (Hair Jr. & Fávero, 2019). Additionally, LMA can handle missing data efficiently, as it does not require all participants to have the same number of measurements (Heck et al., 2014, Hox & Roberts, 2011). In longitudinal data, measurement occasions follow a specific order (i.e., t1 precedes t2, which is followed by t3, etc.), allowing the analysis of the effect of the passage of time (Bolger & Laurenceau, 2013) and the developmental process of the dependent variable unfolded (Heck et al., 2014). Furthermore, repeated measurements can provide information on within- and between-person differences and relationships, by including appropriate fixed and random effects in the model (Curran & Bauer, 2011). In the context of LMA, fixed effects are structural parameters whose effect is identical for all participants (Heck et al., 2014; Hoffman, 2015), while random effects represent effects that are unique for each person (Hoffman, 2015). Fixed effects represent between-person change for the means while random effects represent within-person differences in the variance.

To conduct LMA properly, many different choices need to be made (Seltman, 2018). Different authors (Heck et al., 2014; Hoffman, 2015; Myin-Germeys & Kuppens, 2022) suggest that it is best to run the analysis several times with different settings to analyse various models and assess model fit. These authors recommend proceeding gradually by introducing fixed and random effects in three steps. Hoffman (2015) suggests introducing the fixed effect first and then proceeding with the random effects, adding them one by one. This approach enables evaluation of their individual impact on the model fit, which can be assessed through a likelihood ratio test ($-2\Delta LL$). To compare the different model fit, the analyses must be conducted using Maximum Likelihood (ML) estimation (Heck et al., 2014). However, for presenting the results, Restricted Maximum Likelihood (REML) estimation is deemed more suitable in the case of small samples (Hoffman, 2015). Therefore, all analyses were first carried out using ML to compare the models and assess model fit. Then, they were repeated using REML. The results presented will pertain to the latter method.

A first analysis was performed on the so-called empty model (Model-0). The empty model is used as a baseline to explore the variation of the interested variable across individuals, without including the effect of time (Myin-Germeys & Kuppens, 2022; Shek & Ma, 2011). Even though this model is not adequate for describing the data, it is a useful baseline to compare more complex models (Hoffman, 2015). Another advantage of the empty model is that the intraclass correlation coefficient (ICC) can be calculated (Heck et al., 2014; Hoffman, 2015, Myin-Germeys & Kuppens, 2022; Bolger & Laurenceau, 2013). ICC indicated how much of the dependent variable's variance is due to between-person differences in that variable at the beginning of the study (Hoffman, 2015; Shek & Ma, 2011), and the within-person variance over time (Myin-Germeys & Kuppens, 2022; Shek & Ma, 2011). ICC can range between 0 and 1 (Hoffman, 2015). A higher ICC indicates a low within-person variance and a high between-person variance (Heck et al., 2014; Twisk, 2006).

A second model (Model-1) was then explored, in which the time variable was introduced as a fixed effect, and the intercept for the time variable was set as a random effect. In this way, each participant can have a different intercept (Hoffman, 2015). This means also that the slope is assumed to be the same for everyone.

Lastly, a third model (Model-2) was analysed. In this model, both the intercept and the slope were set as a random effect, so that every participant can have their random intercept and slope (Hoffman, 2015). With a random slope, each person can have their own version of the time's effect. That is, the model checks whether people's change rate is different over time.

The LMA was conducted using IBM SPSS Statistics (Version 27). Unlike other software programs, conducting LMA with SPSS requires making several choices. One of these choices is selecting the appropriate Repeated Covariance Type. In the current study, Auto-Regressive Heterogeneous (ARH1) was chosen. ARH1 assumes that the variance of the observed variable changes across days, and that the correlation between measurement occasions decreases as time points become further apart (Heck et al., 2014). This was determined to be the Repeated Covariance option through visual analysis of daily variable variances and by running the analyses different times to identify the best model fit. As a preliminary step, a visual inspection of the data was performed (Bolger & Laurenceau, 2013) using scatterplots, where time was used as the independent variable.

Comparative analysis.

To explore the effect of the reflective prompts on StP, a comparison between the baseline phase and the intervention phase was done for planning (item 10), and LAC (item 11). Before conducting this analysis, a numerical value was first assigned to each categorical value of item 11 (Table 4). The values are based on previous studies (Aagten, 2016; Kattenberg, 2021). The answers where participants selected the “other” option ($n=2$) were assigned a value according to the reason indicated.

To perform the comparative analysis, the scdhlM (single-case design hierarchical linear model) web application was used (Pustejovsky et al., 2022). This application provides a graphical depiction of the data of each participant, which is employed to make a visual analysis of the results (Lanovaz & Turgeon, 2020; Smith, 2012; Valentine et al., 2016). The graphical representation provided shows also a best-fit trend line for both phases (Valentine et al., 2016). These lines “represent Empirical Bayes estimates of the case-specific levels within each phase” (Valentine et al., 2016, p. 18). The method used to generate the trend lines was the restricted maximum likelihood estimation. Valentine et al. (2016), recommend using this estimation method as it's more flexible than the moment estimation method, and it can be applied to a broader variety of cases.

Moreover, because the visual analysis can suffer from subjectivity, Bouwmeester & Jogerling (2020) suggest complementing it with a statistical analysis of the data. Therefore, the between-case standardized mean difference (BC-SMD) was used as additional statistical evidence of the data analysed. The BC-SMD is theoretically comparable to Cohen's-d (Chen et al., 2022) and it can be interpreted like it. Thus, the BC-SMD effect size estimation was also calculated through the scdhlM.

Table 4*Numerical scores assigned to the different learning activities control answer options*

Learning activity control	SRL behaviour	Score
I don't know.	Not	0
There was no other way.	A bit	0.5
It was a choice based on intuition	A bit	0.5
Someone else suggested me to learn this way.	A bit	0.5
Compared to other ways, I prefer this way of learning (I always/often use it).	Fully	1
This was the fastest way to learn it.	Fully	1
This was the way of learning leading to the best results.	Fully	1
Other	Based on the answer	Based on the answer

Results

Descriptive analysis

Out of the total number of people who signed up for the study (N=18), seven participants (n=7) were excluded from all the analyses, as they did not meet the three-responses per phase requirement. Therefore, the participants taken into account for the study were 11. In total, these 11 participants completed 151 entries in the learning diary. However, 2 of these entries were not considered as they regarded formal learning activities. Thus, a total of 149 entries were used in the analyses. Table 5 displays the distribution of the learning diary's completion for each phase. Of the entries, 94 (63.1%) were completed during the baseline phase, and 55 (36.9%) were completed during the intervention phase. Finally, participants reported having a learning experience in 101 entries, of which 68 (67.3%) were during the baseline phase and 33 (32.7%) were during the intervention phase. Table 6 shows the frequencies of the entries for each phase.

Table 5*Entries divided by phase with column percentages*

Type of entry	Baseline phase		Intervention phase	
	<i>n</i>	%	<i>n</i>	%
Completed	94	94.0	55	84.6
Not completed	5	5.0	9	13.8
Invalid	1	1.0	1	1.5
Total	100	100	65	100

Table 6*Learning affordances divided by phase with column percentages*

Did you learn something today?	Baseline phase		Intervention phase	
	<i>n</i>	%	<i>n</i>	%
Yes	68	73.1	33	60.0
No	12	12.9	12	21.8
Give me a hint	9	9.6	4	7.3
I did not work today	4	4.3	6	10.9
Total	93	100	55	100

What is the effect of a daily learning diary on professionals' awareness of how and when (AHW)?

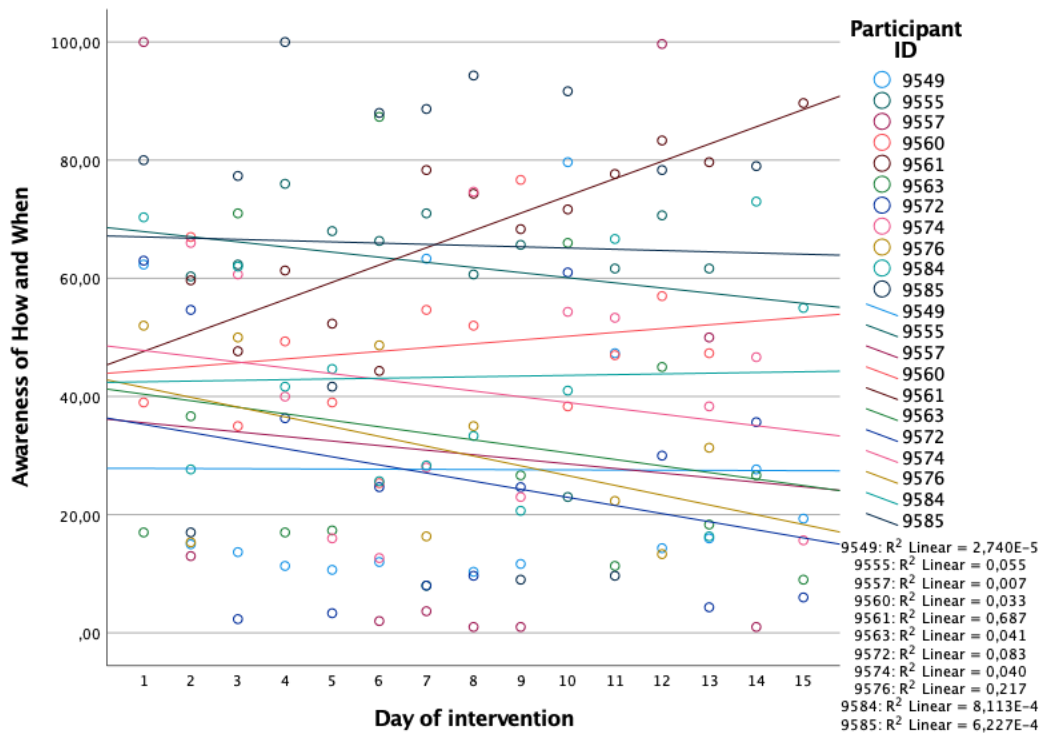
To analyse if the learning diary had an effect on the AHW of participants a visual inspection analysis of the ALO and RLA was conducted as a preliminary investigation (Heck et al., 2014). In addition to this, a LMA was conducted. As previously explained, the analysis started from Model-0, in which only the inspected variable was included (Shek & Ma, 2011). As LMA is complex and long, the results of the analyses conducted for two variables are separately discussed.

Effect of learning diary on ALO

Figure 3 illustrates the trend lines of the different participants' ALO during the study. As it is shown, for most participants the trend has a downward trajectory. Only in 3 cases (i.e., 9560, 9561, 9584) the line follows an upward trend.

Figure 3

Individual linear awareness of learning opportunities



LMA ALO Model-0. As can see in Table 7, the estimated grand-mean of AHW was 43.4. This means that, at a group level, the estimated intercept was 43.4. Using the Estimate of the Residuals and the Intercept Variance (Table 7) ICC was calculated (ICC= .28). This means that participants differ by 28% in their intercepts at the beginning of the study, and it also indicates a moderate within-person variance (Hoffman 2015, Shek & Ma, 2011).

LMA ALO Model-1. Afterwards, the time variable was included in the analysis (Model-1). In Table 7, it can be seen that the intercept slightly decreased as compared to Model-0. This is because it was adjusted for the time variable (Heck et al., 2014). This represents the average group mean adjusted for time. Moreover, the t-test for the significance of the intercept only tells us that the intercept is not equal to 0 (Heck et al., 2014). Regarding the fixed effect of time, it can be seen that it is not significant ($p= .90$). However, time's random effects are explored anyway as nonsignificant fixed effects describe the average results, but random individual differences can still be found (Hoffman, 2015). This can be done by looking at the Wald Z statistic in Table 8. In this case, the results

($W=1.95$, $p=0.05$) indicates that a random intercept is needed (Seltman, 2014), indicating differences in ALO intercepts between participants.

Table 7

Estimates of Fixed Effects of awareness learning opportunities

Parameter		Estimate	Std. Error	df	t	Sig.	Lower Bound	Upper bound
Intercept	Model-0	43.4	4.77	10.04	9.1	<.001	32.78	54.03
	Model-1	41.8	6.16	14.05	6.8	<.001	28.64	55.05
Time	Model-1	-.58	.4	35.48	-.15	.90	-.86	.75

Table 8

Estimates of Covariance Parameters of awareness of learning opportunities

Parameter		Estimate	Std. Error	Wald Z	Sig.	Lower bound	Upper Bound
Residual	Model-0	537.19	67.13	8.0	<.001	420.49	686.28
Intercept ^a	Model-0	206.82	111.71	1.85	.64	71.75	596.16
	Model-1	304.14	155.57	1.95	.05	111.60	828.82

^a Intercept [subject] Variance

LMA AHW Model-2. When trying to run the analysis for Model-2 (i.e., with both random intercept and random slope) SPSS returned an error. In such cases, the results cannot be taken into account (Beaumont, 2012). The error might be due to a small sample size or an actual irrelevance of the random effects. Indeed, when Model-2 analysis was performed using ML instead of REML, its fit was not significantly different from Model-1. Therefore, a random slope might not be needed in this case, indicating that the slope's differences between participants are not significant. Therefore, the results of the LMA on ALO indicate a negative non-significant association between time and ALO.

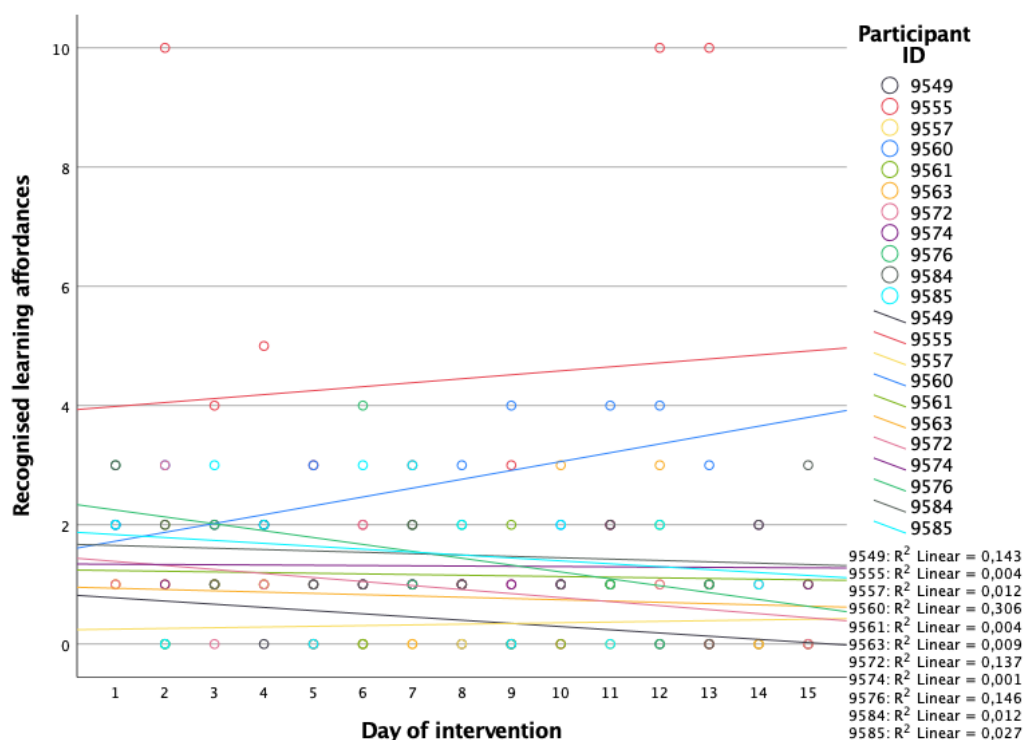
According to the results of both the visual analysis and the LMA, it cannot be stated that the learning diary helped participants being more aware of the learning opportunities in their context.

Effect of learning diary on RLA

To see if the learning diary helped participants recognise more learning affordances, a visual inspection analysis was first conducted (Heck et al., 2014). As it is shown in Figure 4, most of the trend lines follow a downward trend. Only in three cases (i.e., 9555, 9957, 9560) the line goes upwards. As previously done with ALO, a LMA was conducted by analysing three different models.

Figure 4

Individual linear recognition of learning affordances



LMA RLA Model-0. At a group level, as seen in Table 9, the estimated intercept was 1.5. This corresponds to the estimated grand-mean of RLA at the beginning of the study. Again, using the results shown in Table 9 the ICC was calculated ($ICC=0.39$). The ICC indicates that participants differ by roughly 40% in their intercept at the beginning of the study, and it also indicates a moderate within-person variance (Hoffman,2015; Shek & Ma, 2011).

LMA RLA Model-1. As previously stated, in Model-1 the time variable was added. Moreover, the intercept was set to random to allow every participant to have a different

intercept. The fixed intercept was adjusted for the effect of time, bringing it to 1.76. It must be noted that 1.76 is the predicted outcome at day 1, and not the grand mean (Hoffman, 2015). The fixed effect of time is significant ($p = .02$) and decreasing over time (-.05). In other words, according to the results in Table 10, the group-level RLA score has a significant daily decline of .05, which means that on average, participants recognize fewer learning moments as the study progresses.

Table 9

Estimates of Fixed Effects of recognition of learning affordances

Parameter		Estimate	Std. Error	df	t	Sig.	Lower Bound	Upper bound
Intercept	Model-0	1.5	.35	9.93	4.3	.002	.72	2.27
	Model-1	1.76	.29	12.4	6.0	<.001	1.14	2.4
Time	Model-1	-.05	.02	19.23	-2.7	.02	-.09	-.01

Table 10

Estimates of Covariance Parameters of recognition of learning affordances

Parameter		Estimate	Std. Error	Wald Z	Sig.	Lower bound	Upper Bound
Residual	Model-0	1.85	.23	8.02	<.001	1.45	2.36
Intercept ^a	Model-0	1.18	.6	1.98	.05	.44	3.18
	Model-1	0.66	.36	1.84	.06	.23	1.9

^a Intercept [subject] Variance

LMA RLA Model-2. Once again, the SPSS returned an error when trying to run the Model-2 analysis, indicating the results are not trustworthy. Even in this case, the cause might be the irrelevance of the slope's random effect. To test this hypothesis, another model was run with a random slope-only (results not reported). The same error was shown, confirming the irrelevance of a random slope.

The findings suggest a negative association between time and RLA. The strength of this relationship is -0.05, with a 95% confidence interval ranging from -0.09 to -0.01, and a p-value of 0.02 (Twisk, 2006). It must be noted that the regression coefficient of -0.05 is a combination of both within- and between-participant effects. Interpreted on an individual

level, this means that for every additional day, there is a difference of -0.05 in RLA between two participants. The within-person analysis indicates when RLA decreases by one unit, there is a corresponding decrease of 0.05 in RLA for the same participant.

Therefore, the evidence shows that there was a significant change in RLA over time. However, the amount of recognized learning affordances is decreasing, even though only slightly. Therefore, it cannot be stated that the learning diary helped participants recognize more learning moments.

What is the effect of additional prompts to reflect on their engagement in informal learning activities on professionals' strategic planning (StP)?

To investigate if reflective prompts increased participants' StP, the planning and LAC variables were analysed. More specifically, a visual analysis and a BC-SMD effect size analysis were performed on each of the variables.

Effect of reflective prompts on planning

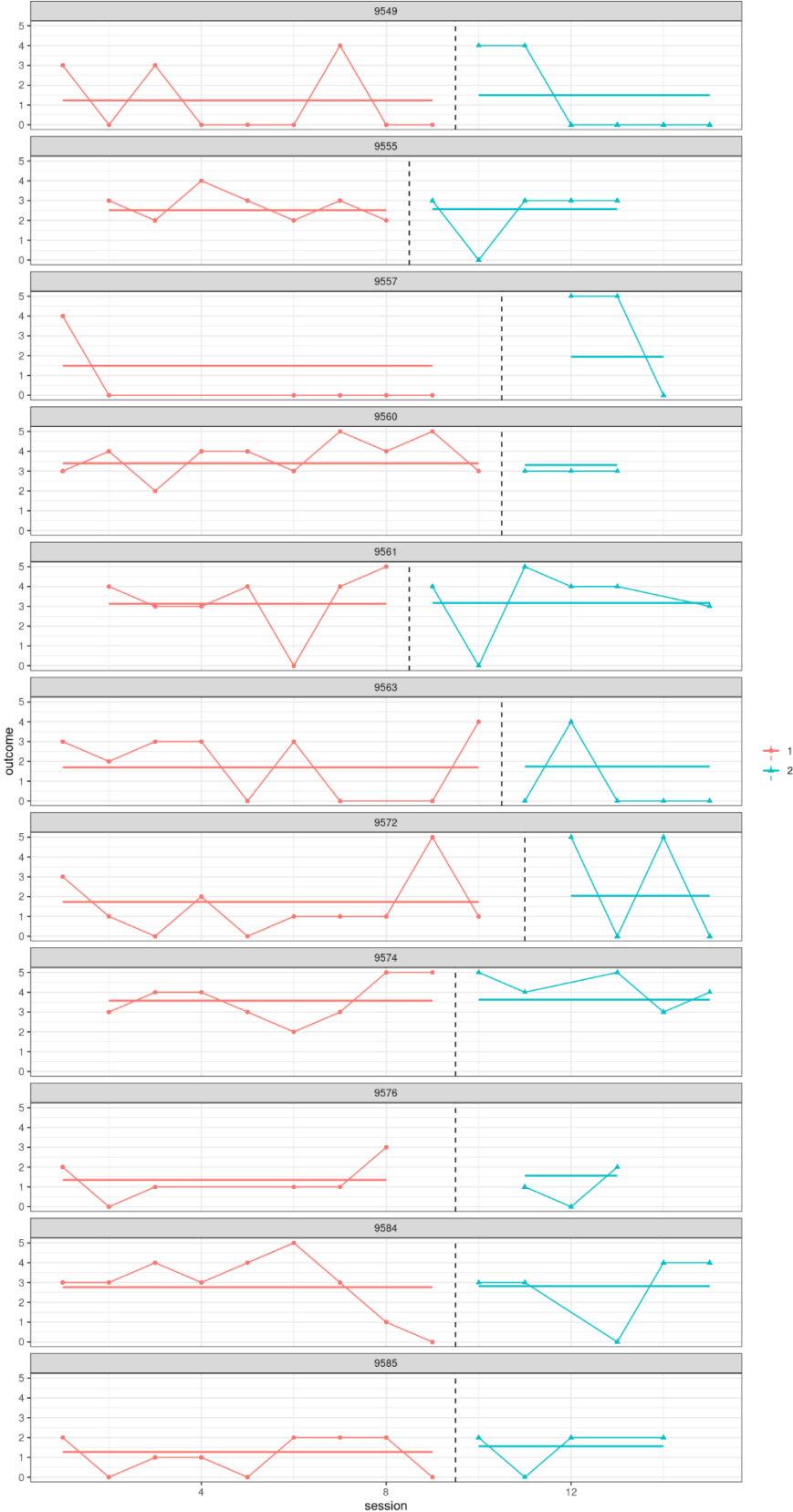
A visual inspection was first performed on the planning of the participants who met the standards of Kratochwill et al. (2010) ($N=11$). According to Smith (2012), baseline data needs to meet certain requirements to have a reliable visual analysis. Namely, the data of the baseline phase should be relatively stable and with no substantive trend. As it is shown in Figure 5, these characteristics were met, so the visual analysis was conducted.

As can be seen, the best-fit trend line of the baseline phase is at the same level as the best-fit trend line of the intervention phase. Only in a few cases (i.e., 9549, 9557, 9572, 9576, 9585), the line of the intervention phase is slightly higher than the baseline phase line, but the difference is insubstantial. This indicates that the reflective prompts did not affect the level of planning of the participants.

The visual analysis was complemented with a BC-SMD estimate effect size analysis. The result of this analysis, BC-SMD = 0.0851, 95% CI [-0.22, 0.39], $N=11$, confirms the result of the visual inspection. Namely, the difference between the two phases is not statistically significant. Both tests then, indicate a lack of an effect of the reflective prompts on participants' planning.

Figure 5

Planning of participants divided by phase



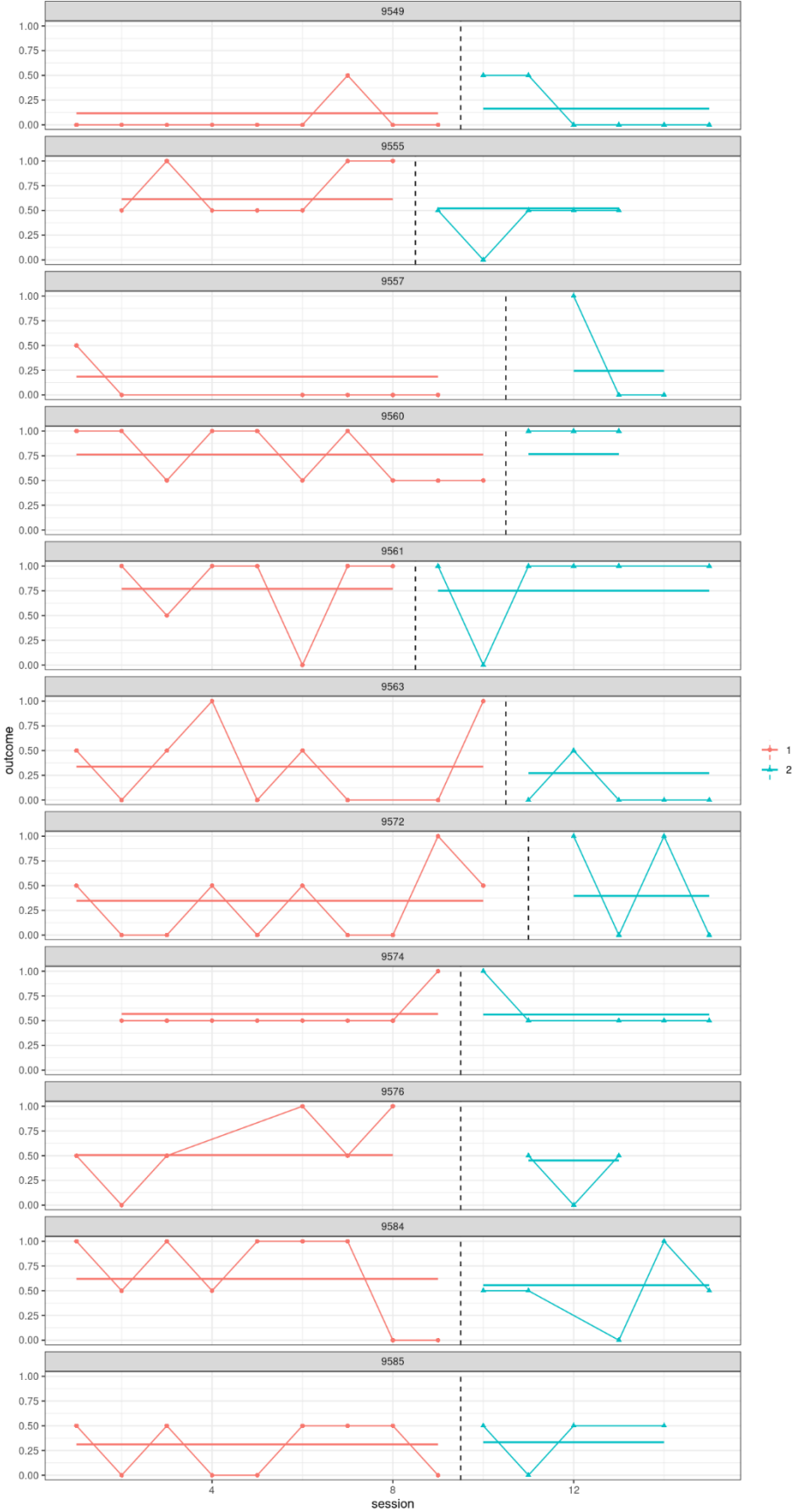
Effect of reflective prompts on LAC

Figure 6 illustrates that none of the cases shows a clear improvement in the level of LAC during the intervention phase. Only in four cases (i.e., 9549, 9557, 9572, 9585) the best-fit trend line is slightly higher in the intervention phase than in the baseline phase. However, the difference is not significant. Moreover, in five cases (i.e., 9555, 9561, 9563, 9576, 9584) the line is lower during the intervention phase than in the baseline phase. This indicates that the reflective prompts did not positively affect participants' LAC.

The visual analysis was followed by the BC-MSD effect size analysis. BC-SMD = -0.0276, 95% CI [-0.33, 0.28], $N=11$. This result indicates the absence of a statistically significant result, confirming the lack of effect of the reflective prompts on participants' LAC.

Figure 6

Learning activity control of participants divided by phase



Synthesised Member checking outcome

After the completion of the data analysis, the results were summarized and shared with some participants for member-checking. The summary document served as the basis for conducting interviews, during which they were asked about their experiences during the study and whether they felt the outcomes of the analysis aligned with their experience during the study. Selected quotes from these interviews are included.

Effect of learning diary on AHW

Firstly, all interviewees ($n=5$) did not think that the data accurately reflected their experience during the study. That is, 2 participants felt that their awareness slightly increased at the beginning of the study, and remained quite stable throughout the study. Namely, even though interviewees perceived an increase in their AHW, it seems that the difference they were talking about is between the AHW before and during the study. In other words, their AHW might have been higher than they were used to, but it did not increase gradually during the study. This was effectively summarized by one of the interviewees who said that “in my experience, I perceive my awareness as fairly stable. That is, it improved after the initial phase in which I felt quite unaware. Then [it] remained substantially stable”.

A couple of interviewees ($n=2$) stated that the first three questions (i.e., items to measure AHW) were confusing. For example, they struggled with the 0-100 slider and were uncertain about how to answer properly.

Some participants ($n=2$) indicated that they had difficulty paying attention to learning opportunities while working because they needed to focus on their tasks. For example, one participant explained that “during the day, you are so busy on the things to do. You don't stop to reason and think ‘That is an opportunity to learn something new’”. The only exceptions to this were when they encountered something completely new and out of the ordinary, which captured their attention.

During the interviews, participants ($n=5$) mentioned that the questionnaire stimulated them to actively reflect on their informal learning while they were working. For example, one interviewee declared “I have it clear in my mind that [...] before doing something I would say to myself ‘This is a learning moment, tonight I have to remember it for the questionnaire’. I clearly remember having done this kind of reasoning more than once. I would say to myself, ‘Would this be considered a learning moment?’”.

Additionally, 4 interviewees found that the list of learning activities and the requirement to count learning affordances facilitated their recollection of the day. Furthermore, the learning diary helped participants broaden their understanding of informal learning. That is, they started to identify and recognize learning opportunities that they previously did not perceive as learning (e.g., “I definitely paid more attention because I remember noticing things that, for me, were not learning moments but then, thinking about your questionnaire, I got the impression that they were actually learning moments.”).

However, not all participants experienced this new awareness and understanding in the same way. Two opposite experiences emerged during the interviews. On the one hand, one participant clearly felt her ability to recognize learning moments while working improving. That is, it became increasingly easier for her to recognize different learning moments while working: “At the beginning [of the study], it took me some time to identify the moments. Instead, after a while, I started, during the day, to make a mental note like, ‘Hey, this thing happened or is happening. It will be useful for tonight’. And I also did it to make some personal evaluations. It's a kind of awareness that I wouldn't have had if I hadn't had to do the questionnaire”. On the other hand, another interviewee stated that she had started having doubts about what constituted actual learning affordances. She explained how, at the beginning of the study, she was more confident about what could be regarded as a learning event and what could not. However, as the study progressed, she started having doubts and it took her longer to answer the questions. Some of her colleagues that were also participating in the study shared the same doubts. They asked themselves whether something could be considered a learning event or just part of their routine. The new insights and knowledge they gained about informal learning made them more doubtful about what answers they should include in the questionnaire.

Although participants reported a level of awareness (perceived as) higher than usual, and an improved understanding of informal learning, it appears that the learning diary did not help them to be more critical about their learning. Most interviewees ($n=3$) stated that their AHW was dependent on the learning activities available in their context, rather than their attention towards their learning. Participants during the study recognized learning affordances both in real-time, as stated above, and retrospectively (i.e., while filling in the questionnaire at the end of the day). In both cases, it seems that participants did not go beyond identifying the more easily identifiable events. In this regard, it appears that the

learning diary did not encourage them to engage in deeper thinking or critical analysis of their daily learning experiences.

Effect of reflective prompts on StP

Most participants ($n=4$) found that the findings showing that reflective prompts did not change their self-perceived StP were consistent with their experience. Notwithstanding this, the reflective prompts helped participants think deeper about the way they learn. For example, some participants ($n=2$) stated that the reflective prompts made them consider why they usually do not use certain learning activities or why they had never considered the efficacy of their learning activities. For instance, one interviewee stated that "[during the intervention phase], it was more a matter of looking at each individual option, reviewing them, and maybe understanding why I don't use the ones that are less frequently used, not so much the ones that I already use more often because they may come more naturally to me. It was a way to not only confirm the techniques already used, but to question why I don't use all the other techniques that are perhaps more peripheral and less valued."

Although reflective prompts helped participants build new knowledge on learning activities, all interviewees ($n=5$) agreed that it is difficult to put this knowledge into practice. In other words, the new knowledge and awareness about learning activities did not lead to a change in behaviour regarding StP. Instead, both planning and LAC seem to be more linked to the time and reliability of available resources. Sentences such as "I choose one over the other based on where I can achieve the result more quickly", were common in all the interviews. Moreover, the sources available need to be reliable. For example, one interviewee stated that "[if I have to look for technical information about the equipment] I don't ask my colleague [...] I don't even look at the manual. The quickest way, which is certainly the company's website, is where I type and search [...] so I don't have to read page after page of documents. And surely, the data I keep is precise, secure, and reliable. On the other hand, my colleague may not remember it.". Thus, even though they'd reflected on their learning, contextual factors such as time and reliability of available resources were deemed as more important when choosing a learning activity.

Finally, there seems to be an indication ($n=2$) that, participating in the study, made people more critical about learning in general. For example, participants stated that the study "made me ask myself questions about how I can explain certain things in a way that

other people can learn” or “when [I] participate in some training, for example about soft skills, these things about learning come to my mind”.

New AHW data analysis

After the interview, the quantitative data about learning awareness was analysed again. This is because all the SMC’s interviewees stated that they did not feel the outcomes of the variables regarding AHW reflected their experience during the study. Therefore, a new analysis was conducted on the data of both ALO and RLA. In particular, the data was plotted using quadratic trajectories instead of linear trajectories. According to Heck et al. (2014) using quadratic lines, in some cases, helps to understand in what cases curvilinear trajectories better describe participants’ growth. When curvilinear shapes are found to be fitting the data, LMA should be run considering this, by coding the time variable accordingly (Heck et al., 2014). However, in the current study, the number of daily measurements was not sufficient to run such an analysis.

As can be seen in Figures 7 and 8, when quadratic trajectories are used to represent the growth of the participants, the difference with the previous visual analysis (i.e., Figures 3 and 4) is evident. Although it is not possible to interpret extensively interpret the data, this new analysis might indicate that the decrease seen in the previous analysis might not be as extended as it previously appeared. That is, both in figures some trajectories are better described by a linear shape, while for others a curve is a better fit (Heck et al., 2014).

Figure 7

Individual curvilinear awareness of learning opportunities

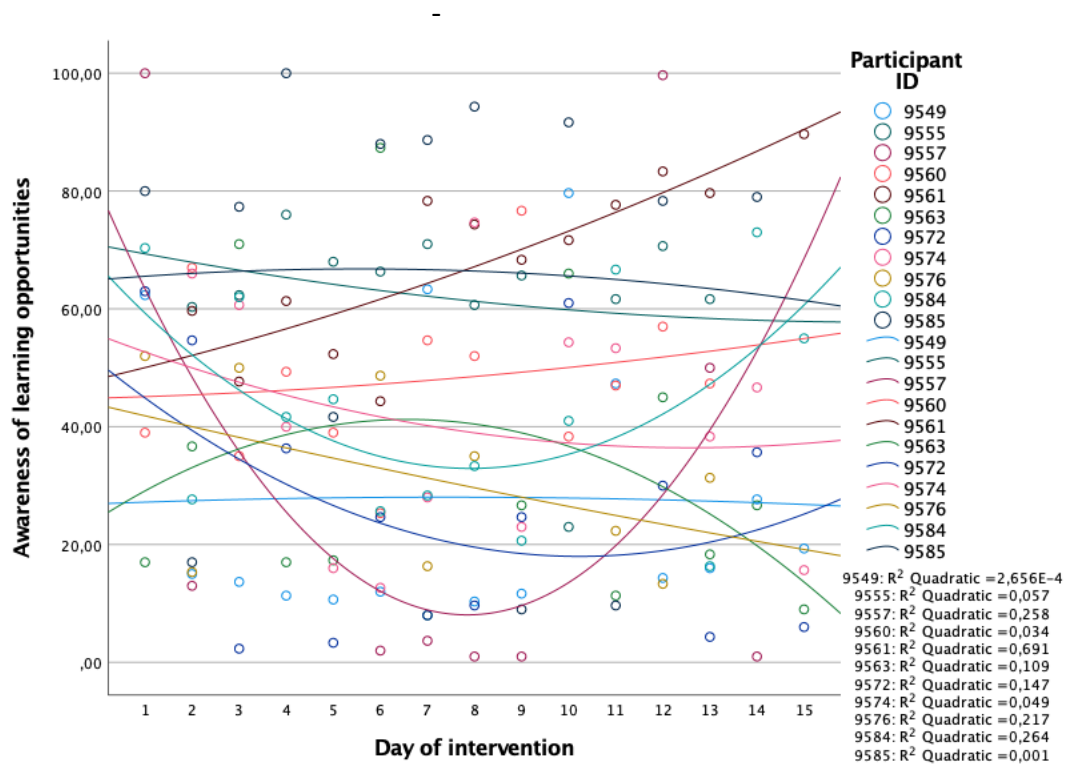
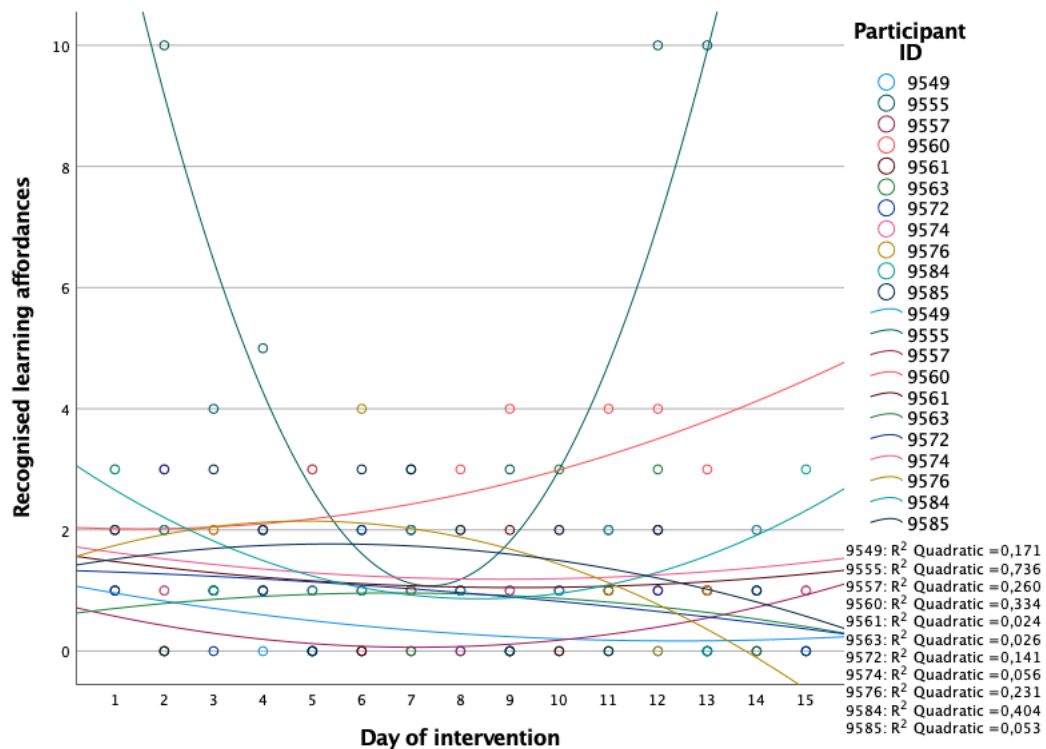


Figure 8

Individual curvilinear recognition of learning affordances



Discussion

The current study focused on professional's regulatory readiness and regulatory mechanisms in the context of informal workplace learning. More specifically, it investigated professionals' awareness of how and when and strategic planning through two research questions. The first research question examined the effect of a learning diary on professionals' awareness of how and when. The second research question explored the effect of reflective prompts on professionals' strategic planning.

Both research questions were investigated using a multiple baseline design across participants. For 15 consecutive working days, participants completed a learning diary, and as part of the intervention phase, they received reflective prompts about their use of informal learning activities. Finally, after analysing the quantitative data, member checking was used as a safeguard to ensure the study's reliability. A document summarizing the results was sent to some participants, and an interview was conducted to understand if the data reflected their experience. This allowed for eliciting participants' insights and personal experiences on the effect of both the diary and the reflective prompts, which contributed to the interpretation of the data and enriched the findings.

Short-loop and long-loop self-regulation of professional learning

An important element that might have played a role in the results of both awareness of how and when and strategic planning is the difference between short-loop and long-loop self-regulation of professional learning (Cuyvers et al., 2021). More specifically, the study only elicited (and captured) the recognition of short-loop self-regulated learning, and it did not help with longer learning loops. While long-loop self-regulated learning is more related to deliberative learning, short-loop SRpL is characterized by reactive learning. As it will be subsequently explained in more detail, this design characteristic might have impacted the results in different ways.

Awareness of how and when

Awareness of how and when was conceptualised as the ability of professionals to recognise learning opportunities and learning affordances in their working context. The concept was investigated by measuring awareness of learning opportunities and recognition of learning affordances. It was expected that the two variables would gradually increase as a result of completing a daily learning diary. However, the data do not show the expected incremental growth and, additionally, there are some inconsistent results. On the one hand,

the data analysis shows that participants' awareness of how and when did not increase throughout the study. Moreover, both the visual analysis and the longitudinal multilevel analysis show a slight decrease for most participants which, in the case of recognition of learning affordances, is significant. Only for a few people awareness of how and when's variables increased. On the other hand, when presented with the results, interviewees did not feel that they reflected their experience. Some of them had the impression that their awareness of how and when increased during the study, while others thought it remained quite stable. However, the higher awareness of how and when level reported by synthesized member checking participants might be a general increased awareness, rather than an increase over time. Due to the anonymity of the data collection, it was not possible to investigate if the interviewees were the people whose awareness of how and when increased. As the differences between participants might reveal interesting information, subsequent investigations should consider anonymizing the data in a later phase.

Important elements that might explain the differences between participants' trajectories (i.e., people whose awareness of how and when grew during the study) are learning goals and needs (which are related to long-loop self-regulated learning). In her study among nurses in a hospital, Oomen (2021) found a slight (not significant) increase in their awareness of how and when. This difference could be due to the fact that she stimulated participants to actively think about their learning needs in both her daily questionnaire and prompting. By doing so, people might have been more conscious of what they needed to learn, which might have made them more aware of the learning opportunities that could help them address their needs. Therefore, in the current study, participants whose awareness of how and when increased, might have had specific learning needs or goals to address.

Indeed, interviewees stated that it was hard, in their daily routine, to pay attention to learning opportunities because they were busy carrying out their work tasks. Also, some said that they pay attention to learning opportunities only when they need to address a specific (learning) need (e.g., solving a problem). When professionals are required to carry out multiple tasks (Bühner et al., 2006), they only allocate cognitive resources to tasks that are relevant to them (Szumowska & Kossowska, 2017). Therefore, it can be assumed that, unless they need to address a learning need or goal, professionals give priority to performance instead of allocating cognitive resources to awareness of how and when.

In addition to this, another difference with Oomen's study that might explain the different results is the design of the prompts. Namely, the prompts used by Oomen contained practical tips (e.g., "One way to learn can also be having a conversation with a colleague") in conjunction with questions. Therefore, it is possible that the practical suggestions made participants more receptive to the learning happening around them. Endedijk and Cuyvers (2022) point out that tools to support SRpL should be context-specific and sustain professionals in regulating their learning. Otherwise, their effectiveness might be hindered if participants do not find them useful. Oomen linked the increase in some participants' awareness of how and when to the concept of scaffolding, suggesting that the prompts in her study might have functioned as scaffolds for those whose awareness of how and when increased. In this regard, while the learning diary might represent an initial step to stimulate awareness of how and when, answering questions alone may not be enough to scaffold it.

A final element differentiating the current and Oomen's study is the context of the research. Unlike her study which was conducted in a hospital, the professionals who participated in the current research worked in different sectors and working settings. While the clinical context is known to be rich in learning affordances (Gerrits, 2021), different domains might present fewer learning opportunities and learning affordances, as they vary according to the context (Milligan et al., 2014).

A methodological element that might have played a role in the lack of an increase was the way awareness of how and when was conceptualised. Namely, the concept in this study only took into account discrete learning events (e.g., "I learned how to customize a tool"). However, workplace learning has also an emergent nature (De Moraes & Borges-Andrade, 2015; Hager, 2004). While discrete learning is conceptualised as a series of individual events that are easily recognizable (Hager, 2004), emergent learning gradually unfolds from social interactions (Hager, 2004; Johnsson & Boud, 2010) and it is seen more as a process rather than an element, making it difficult to recognize. As a result, becoming aware of this type of learning might take time, which means that it cannot be captured by daily measurements. For example, a skill might require weeks to be properly developed, and even when acquired, professionals can keep improving it, but becoming aware of the improvement may only happen after a longer time. The identification of such a complex type of learning might require proper facilitation (Littlejohn et al., 2016a). In this sense, it seems

that the learning diary was unsuitable to recognize a type of learning with a more emergent nature. Future studies might address this issue by focusing more on the previously mentioned long-loop self-regulated learning. More specifically, they could focus on learning needs and goals rather than learning affordances and opportunities. That is, participants could be asked if and how they addressed a specific need or goal. In this way, they can still pinpoint learning opportunities and affordances (discrete learning), but they would also have the opportunity to think about their learning on a process level (emergent learning). In addition, such an approach would require a different time frame for the measurements, for instance going from a daily basis measurement to a weekly one.

A final methodological aspect that might have influenced the outcomes is the way awareness of learning opportunities was measured. As stated by Oomen (2021), the way of quantitatively measuring awareness of learning opportunities she developed might not be suitable for the concept. She based her operationalization of awareness of learning opportunities on the research of Cuyvers et al. (2021), who described the variable on a cognitive rather than a behavioural level. In Cuyvers' study, the result was the outcome of qualitative research; therefore, the way of quantitatively measuring awareness of learning opportunities used in both Oomen's and the current study might not be appropriate. Indeed, some interviewees stated that the slider used in the first three questions was confusing. For example, they did not know what 60 meant and what would be the difference with a slightly higher or lower score (e.g., 55 or 65).

After the interviews, a new visual analysis using curvilinear trajectories was conducted. In some cases, curvilinear trajectories were more fit than linear ones to describe participants' trends (Heck et al., 2014). Even though this would call for additional statistical analyses, the amount of data available was not sufficient to conduct an longitudinal multilevel analysis, which could shed light on those factors influencing the trends of the awareness of how and when (Heck et al., 2014). Future studies should consider collecting a higher amount of data points and additional variables (e.g., presence of learning needs or goals) to investigate specific variables influencing both the single trajectories and differences between participants.

To summarise, contextual and personal factors, such as job sector, workload, and individual learning needs, might have an impact on professionals' awareness of how and when. Future studies should consider these factors when investigating it. Furthermore, there

is a need for a re-evaluation of the method and instruments used to measure awareness of how and when. A higher level of scaffolding, such as including tips and suggestions besides questions; addressing learning needs and goals in the study; measuring learning on a process level; and changing the time frame and the amount of the measurements might also be elements that need to be addressed.

Strategic planning

The second research question investigated whether reflective prompts on the use of learning activities increase professionals' strategic planning. According to the results of the different analyses, the reflective prompts did not positively affect participants' strategic planning. More specifically, both the visual analysis and the effect size analysis of planning and learning activity control showed no difference between the baseline phase and the intervention phase. This result was confirmed during the interviews, where participants stated that, although during the reflection (i.e., intervention phase) they re-validated the learning activities that they (do not) use, they did not change their informal workplace learning activities selection process.

This result was not in line with the hypothesis of the study. Specifically, it was expected that by providing reflective prompts on the use of informal learning activities, participants' strategic planning would increase. Again, short- and long-loop self-regulated learning can be the key to interpreting the results. In short-loop self-regulated learning the level of directedness is lower (or even absent) than that of long-loops, and performance is what drives professionals' choices. Indeed, during the interviews, participants pointed out that they chose the learning activities that can give them the best results in the shortest amount of time. In this regard, participants were self-regulating their learning in response to the environment (i.e., reactive learning; Doornbos & Krak, 2006; Endedijk & Cuyvers, 2022).

In his seminal work, Eraut (2004) explains that in implicit and reactive learning - short-loop self-regulated learning - the reflection on past experience is superficial and planning for future learning absent. The day-to-day practice mostly entails short-loop self-regulated learning, which could be the reason why, regardless of the insights about their way of learning gained during the reflection, participants did not engage in an active review or planning for future learning (Eraut, 2004). Intentionality in learning is mostly found in long-loop self-regulation of professional learning (Cuyvers et al., 2021; Eraut, 2004) where knowledge about different learning activities might be more useful. Thus, the absence of an

effect might be due to the study's strong focus on short-loop self-regulated learning and the absence of a clear invitation to actively reflect and plan more deliberative learning.

Additional research could explore the potential impact of reflective prompts on longer learning loops through the utilization of reflective prompts that capture and elicit them. For example, professionals might reflect on how they could deliberately use different learning activities to address learning needs or learning goals, which entail longer time spans where planning is needed and more proactive choices can be made.

Finally, another influencing factor in the results could be the scoring method used for learning activity control in the data analysis. The score used in the current research was already employed in previous studies (cf. Kattenberg, 2021), but it does not consider the choice process. For instance, the option "There was no other way" was deemed as partially self-regulated learning, with a score of 0.5. However, depending on the specific case, such an answer could be scored as Not at all self-regulated learning (e.g., when there are many other ways available but the professional is not taking them into account), partly self-regulated learning (e.g., when a professional take into consideration other options but wrongly concludes that they are not suitable), or fully self-regulated learning (e.g., when a professional carefully consider if there are other options, but there are no other ways to learn something). Therefore, to overcome such a limitation, future studies should include complementary data collection methods (Endedijk & Cuyvers, 2022), to capture choice nuances. For instance, observations or video recordings could be used as a base for subsequent interviews. The researcher could ask questions such as "Why did you make that decision? Did you evaluate other possible options?", to get a better understanding of the process underlying the choice.

Limitations and future research

Some methodological limitations should be acknowledged in this study. Firstly, the sampling methods used were convenience sampling and snowball sampling, which might limit the generalizability of the results. Moreover, the limited number of participants, and the potential of self-selection bias (i.e., participants who accepted to participate might have already been interested in WPL) further limit the generalizability of the results. However, it should be noted that the study involved participants from different companies and professional fields, which may partly attenuate these limitations. As recommended by

Endedijk & Cuyvers (2022), research should be conducted in different domains to make self-regulation of professional learning studies' results more comparable.

A second limitation stems from the self-reporting nature of the data. Some scholars argue that self-reported data are always subjective and therefore exposed to the risk of bias and overestimation, and not capturing the actual behaviour under study (Araka et al., 2020). However, others argue that in the context of self-regulation of professional learning, self-report tools are widely used because of their reliability, and that overestimation can be treated as a measurement error (Milligan et al., 2015). In addition, data coming from the interviews should be guarded with some precautions. Firstly, interviewees' claims might be not entirely true (e.g., they might say what the researcher wants to hear), and they might be limited by poor or selective recall (Littlejohn et al., 2016a; Qu & Dumay, 2011; Slettebø, 2020). Finally, also the interpretation of the interviews attached by the researcher is always subjective (Qu & Dumay, 2011). Nonetheless interviews, as in the case of the current study, facilitate the exploration of personal viewpoints and experiences of the participants, which in turn allows for the emergence of new and alternative interpretations (Qu & Dumay, 2011). This is particularly true in the case of member checking, which can reduce interpretation bias and reveal aspects that are known only to the participants (Birt et al., 2016).

Final limitations might come from the items measuring planning and learning activity control. Both variables were measured with single items. Even though the items were already used in previous studies (Endedijk et al., 2016, Kattenberg, 2021) such variables might need several questions to have an adequate measure (Babbie, 2014). In addition to this, the phrasing of the questions might have also influenced the results. Namely, both questions invited participants to answer regarding "way(s) of learning". This might have been an element of confusion for the participants when they had, for example, to indicate why they made a certain choice (i.e., learning activity control).

Conclusion

From the results of this study, it appears that a learning diary does not increase participants' awareness of how and when. Even though the learning diary might have given participants a broader view of informal learning, the data show no increase in their awareness of how and when except for a few cases. Moreover, it seems that reflective prompts do not improve professionals' strategic planning. In some cases, participants stated

that they reflected on why they (do not) use certain learning activities. However, the reflective prompts did not change their behaviour.

Several methodological, contextual, and personal factors were identified that could have influenced the results of the study. Above all, the study predominantly focused on short-loop self-regulated learning, characterised by reactive learning, a lack of planning and a scarce role of reflection. In relation to this, the study did not adequately address participants' learning needs and goals, which could have served as a catalyst for increased attention towards contextual learning opportunities and affordances and explain differences between participants. Therefore, considering the learning needs and goals and extending beyond short-loop self-regulated learning could stimulate participants to engage in more strategic planning and a higher awareness of how and when.

Finally, different methodological elements require attention, such as incorporating prompts that include tips and suggestions besides questions; the need to measure learning at a process level; and re-evaluating the measurement methods and frequency for certain variables. By considering these aspects, a more comprehensive understanding of the impact of the learning diary on awareness of how and when and reflective prompts on strategic planning might be achieved.

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Appendix 1 – List of learning activities

Learning activities divided into different categories. Categories and list adapted from Kyndt et al. (2016); Eraut (2011) and Moore & Klein (2020)

Learning with others				Learning alone		
Asking for information	Collaborating with others	Learning from others	Doing/ experiencing/ experimenting	Consulting (offline/ online) information sources	Reflecting/ thinking	Engaging in other activities
Asking colleagues for help/advice/tips /consultation (Kyndt et al., 2016)	Working/collaborating with others (e.g., brainstorming, planning, etc.) (Kyndt et al., 2016; Morre & Klein, 2020)	Getting material from others (Kyndt et al., 2016)	Learning through experience/ deliberately practicing a task/skill (Eraut, 2011; Kyndt et al., 2016; Morre & Klein, 2020)	Browsing Internet and social media (e.g., articles, posts, blogs, videos, podcasts, etc.) (Kyndt et al., 2016)	Reflecting individually (on actions, ideas, interpretations, plans, etc.). If done with others, select Working/collaborating with others (Kyndt et al., 2016)	Using networks outside work (Kyndt et al., 2016)

Asking for
and/or giving
feedback
(Eraut, 2011;
Kyndt et al.,
2016)

Talking/discussing
with others
(including asking
questions, sharing
ideas/knowledge)
(Eraut, 2011;
Kyndt et al.,
2016)

Listening to or
observing
colleagues/other
s (without you
interacting with
them)
(Eraut, 2011;
Kyndt et al.,
2016)

Adapting/changi
ng way of
working
(Kyndt et al.,
2016; Morre &
Klein, 2020)

Reading offline
resources
(newspapers,
books, reports,
professional
literature,
manuals, others)
(Kyndt et al.,
2016)

Reviewing
(procedures,
errors,
processes) alone
or with others
(Moore & Klein,
2020)

Making/designin
g/testing
working
material/
tools/methods
(Kyndt et al.,
2016)

Appendix 2 – Learning diary

Learning diary. Items adapted from Endedijk et al. (2016) and Oomen (2021)

Dimension/Variable measured	N.	Item	Next item	SRL Behaviour <i>Bold italic</i> items were adapted	Score The score of the <i>bold italic</i> items was adapted
	0	<p>Before you start.</p> <p>Before starting the questionnaire, think about what you learned today at work.</p> <p>Professionals learn every day by doing their job. This is called informal learning, which is different from formal learning (when a teacher is involved).</p> <p>In informal learning, you often learn without being aware of it.</p> <p>To help you identify (possible) learning moments, think about specific things that you might have done today. For example, if you asked for help and/or advice to someone, or did you something new or in a new way, if you looked up for information somewhere, if you participated in a meeting, or realized something new/different, etc.</p> <p>(Please, do not fill in the questionnaire using information about formal learning moments)</p>			
Awareness of how and when (Oomen, 2021)	1	Today at work I have had chances to learn. Not at all (1) Very much (100)	2		
Awareness of how (Oomen, 2021)	2	Today at work I have noticed ways in which I could learn (e.g., asking questions, consulting online sources, practising, etc.) Not at all (1) Very much (100)	3		
Awareness of when (Oomen, 2021)	3	Today at work I was aware of the moments where I could have learned. Not at all (1) Very much (100)	4		
Awareness of how and when (Oomen, 2021)	4	Did you learn anything on your shift today? (Kattenberg, 2021) a. No b. Yes c. I'm not sure, give me a hint d. I did not work today	5 6 5 12		
	5	Hint: did something go differently than expected? Did you ask for help or look up something? Did you do or apply something for the first time? Did you learn something new? a. Yes b. No	7 12		
	6	How many learning experiences have you had today? Enter the number in digits Open question	7		

	7	What did you learn? Briefly describe what you learned (e.g., <i>I learned how to (better) use a software, I acquired new information about a project, I changed the way of doing something, etc.</i>)			
Self-regulation of the learning event (from Oomen, 2021)	8	What was the main reason for learning this? Choose the description that best fits your learning moment. In case you had more than one, to answer this question think about the learning moment that you consider more valuable. a. I was not satisfied with a previous experience. b. I wanted to practice c. I wanted to prepare myself for future situations. d. I was curious about it. e. It was necessary for my role. f. I was told to do it. g. Otherwise, namely...	8		
Awareness of how	9	How did you learn this? (Endedijk et al., 2016 and adapted by me) a. I learned alone b. I learned with others c. I learned alone and with others	9 (a, b, or c)		
	9°, 9b, 9c	[According to the previous selection participants see a different list of answers] Choose the description(s) that best fits your learning moment (multiple selection possible). See Appendix 1)	10		
Planning	10	Indicate the extent to which you agree to the following statement: "I carefully decided to use this way(s) of learning in advance" 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, 5 = strongly agree	11		
Learning activity control (Endedijk et al., 2016)	11	Why did you choose this way(s)? (Endedijk et al., 2016 and adapted by me) a. I don't know. b. There was no other way. c. It was a choice based on intuition d. Someone else suggested me to learn this way. e. Compared to other ways, I prefer this way of learning (I always/often use it). f. This was the fastest way to learn it. g. This was the way of learning leading to the best results. h. Otherwise, namely...	12	a. Not b. A bit c. A bit d. A bit e. Fully f. Fully g. Fully	a. 0 b. 0.5 c. 0.5 d. 0.5 e. 1 f. 1 g. 1
	12	Thank you! We look forward to seeing you again next time.			

Appendix 3 – Reflective prompts

Day 1	
N.	Prompt
1	Time to reflect. Take some time to reflect on the question in the following screens.
2	<p>Consider the ways of learning listed below, which will be referred as “asking for information”. Then answer the question.</p> <p>Describe and Analyse Asking colleagues for help/advice/tips/consultation, asking for and/or giving feedback</p> <p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize _____</p> <p>Focus on these ways of learning: asking for information.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize _____</p> <p>Focus on these ways of learning: asking for information.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5	<p>Complete the sentence below</p> <p>Act Next time, I can use (one of) these ways of learning to...</p> <p>_____</p> <p>Focus on these ways of learning: asking for information.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 2	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2	<p>Consider the ways of learning listed below, which will be referred as “collaborating with others”. Then answer the question.</p> <p>Describe and Analyse Working/collaborating with others (e.g., brainstorming, planning, etc.), talking/discussing with others (including asking questions, sharing ideas/knowledge)</p> <p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p>

	There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.
3 Theorize	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: collaborating with others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4 Theorize	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: collaborating with others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use (one of) these ways of learning to...</p> <p>_____</p> <p>Focus on these ways of learning: collaborating with others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 3	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2 Describe and Analyse	<p>Consider the ways of learning listed below, which will be referred as “learning from others”. Then answer the question.</p> <p>Getting material from others, listening to or observing colleagues/others (without you interacting with them)</p> <p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3 Theorize	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: learning from others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>

4 Theorize	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: learning from others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use (one of) these ways of learning to...</p> <p>_____</p> <p>Focus on these ways of learning: learning from others.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 4	
1 2 Describe and Analyse	<p>Time to reflect. Take some time to reflect on the question in the following screens.</p> <p>Consider the ways of learning listed below, which will be referred as “doing/ experiencing/experimenting”. Then answer the question.</p> <p>Learning through experience/deliberately practicing a task/skill, adapting/changing way of working, making/designing/testing working material/tools/methods</p> <p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3 Theorize	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: doing/ experiencing/experimenting.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4 Theorize	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: doing/ experiencing/experimenting.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use (one of) these ways of learning to...</p> <p>_____</p>

	<p>Focus on these ways of learning: doing/ experiencing/experimenting.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 5	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2	<p>Consider the ways of learning listed below, which will be referred as “consulting (offline/online) information sources”. Then answer the question.</p> <p>Describe and Analyse</p> <p>Browsing internet and social media (e.g., articles, posts, blogs, videos, podcasts, etc.), reading offline resources (newspapers, books, reports, professional literature, manuals, others)</p> <p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize</p> <p>_____</p> <p>Focus on these ways of learning: consulting (offline/online) information sources.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize</p> <p>_____</p> <p>Focus on these ways of learning: consulting (offline/online) information sources.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5	<p>Complete the sentence below</p> <p>Act</p> <p>Next time, I can use (one of) these ways of learning to...</p> <p>_____</p> <p>Focus on these ways of learning: consulting (offline/online) information sources.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 6	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2	<p>Consider the ways of learning listed below, which will be referred as “reflecting/thinking”. Then answer the question.</p> <p>Describe and Analyse</p> <p>Reflecting individually (on actions, ideas, interpretations, plans, etc.), reviewing (procedures, errors, processes) alone or with others</p>

	<p>Can you recall at least one time when you learned something using one of these ways of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3 Theorize	<p>In your working context, for what can these ways of learning be best suitable for? (e.g., they help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: reflecting/thinking.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4 Theorize	<p>And for what situations do you think these ways of learning are not useful? (e.g., they don't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on these ways of learning: reflecting/thinking.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use (one of) these ways of learning to...</p> <p>_____</p> <p>Focus on these ways of learning: reflecting/thinking.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 7	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2 Describe and Analyse	<p>Consider the way of learning, which will be referred as “using networks outside work”. Then answer the question.</p> <p>Can you recall at least one time when you learned something using one this way of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3 Theorize	<p>In your working context, for what can this way of learning be best suitable for? (e.g., it helps in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>_____</p> <p>Focus on this way of learning: using networks outside work.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>

4 Theorize	<p>And for what situations do you think this way of learning is not useful? (e.g., it doesn't help in gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <hr/> <p>Focus on this way of learning: using networks outside work.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use this way of learning to...</p> <hr/> <p>Focus on this way of learning: using networks outside work.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 8	
1	<p>Time to reflect. Take some time to reflect on the question in the following screens.</p>
2 Describe and Analyse	<p>Consider the ways of learning listed below, which will be referred as "writing". Then answer the question.</p> <p>Writing (e.g., notes, a manual, a post, an article, etc.)</p> <p>Can you recall at least one time when you learned something using one this way of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3 Theorize	<p>In your working context, for what can this way of learning be best suitable for? (e.g., gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <hr/> <p>Focus on this way of learning: writing.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4 Theorize	<p>And for what situations do you think this way of learning is not useful? (e.g., gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <hr/> <p>Focus on this way of learning: writing.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5 Act	<p>Complete the sentence below</p> <p>Next time, I can use this way of learning to...</p> <hr/>

	<p>Focus on this way of learning: writing.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
Day 9	
1	Time to reflect. Take some time to reflect on the question in the following screens.
2	<p>Consider the way of learning, which will be referred as “Using outside networks”. Then answer the question.</p> <p>Describe and Analyse</p> <p>Can you recall at least one time when you learned something using one this way of learning in your workplace? What did you learn?</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
3	<p>In your working context, for what can this way of learning be best suitable for? (e.g., gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize</p> <hr/> <p>Focus on this way of learning: teaching/explaining.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
4	<p>And for what situations do you think this way of learning is not useful? (e.g., gaining theoretical information, making new connections, having new ideas, improve your performance or some skills, etc.)</p> <p>Theorize</p> <hr/> <p>Focus on this way of learning: teaching/explaining.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>
5	<p>Complete the sentence below</p> <p>Act</p> <p>Next time, I can use this way of learning to...</p> <hr/> <p>Focus on this way of learning: teaching/explaining.</p> <p>There is no right or wrong answer. Base your answer on the characteristics of your work environment, your role, your attitude, and preferences.</p>