The effect of strategy instruction on the perceived use of learning strategies and self-efficacy with higher education students

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Abstract

Literature agrees that self-regulated learning exists of a set of skills that help students to gain control over their own learning processes. Which, in turn, leads to higher learning outcomes and self-efficacy. However, becoming a self-regulated learner is not something that happens overnight. The development of self-regulated learning requires metacognitive skills, cognitive skills, organizational skills and the skill to be able to motivate and trust yourself. It is a process that is demanding as it takes time and life experience, and is in need of support. This support can be facilitated by offering strategy instruction to teach students about learning strategies that support self-regulated learning. This study investigated the effect of a strategy instruction intervention for higher educational students (n = 20) and the impact of knowing one's perceived level of use of learning strategies at forehand. The intervention existed of three online sessions in which theory and practice on the use of learning strategies were combined. Results showed that the intervention had a significant effect on students' perceived use of learning strategies within the whole group, but not significantly more in the group of students that received the level of their perceived use of learning strategies at forehand. The interviews that were held with a number of students, supported these results. In the interviews, the students indicated that more structural attention for self-regulated learning would be a nice addition to the current educational offer. This is an interesting fact for higher education institutions, which may be able to devote more structural attention to developing students' self-regulated learning by facilitating strategy instruction about learning strategies.

Table of contents

Introduction

During the COVID-19 pandemic, groupwork and face-to-face classes have been reduced to a minimum, resulting in online learning and online working on assignments for most students in the Netherlands (Schoenmacker & Popken, 2020). Research on the effects of this sudden shift to online education due to the COVID-19 pandemic, shows various results. There are students that perform significantly better than average due to a lack of distraction and are, thus, able to spend more time studying (Remi & Veldhuis, 2020). There are also students who perform significantly worse due to a lack of self-regulation and motivation when it comes to learning (Hagen, 2020; Remie & Veldhuis, 2020; Seyahi et al., 2020). This often resulted in procrastination, not getting any work done and feelings of low self-efficacy and even mental health issues (Greene, 2017). This last group can benefit from developing learning strategies they can use to become self-regulated learners and thus taking back control over their own learning (Duckworth & Carlson, 2013; Dijkstra, 2019; McDaniel & Einstein, 2020). Knowing how to self-regulate learning, means being able to set goals, developing skills like planning tasks in terms of time and priority, monitor progress, implement strategies and monitor the use and outcome of the use of these strategies, combined with the ability to self-evaluate this complete and complex process, which all contributes to higher levels of self-confidence, self-efficacy and academic achievement (Zimmerman et al., 1992; Foerst et al., 2017). These skills are needed to make learning as effective and efficient as possible. Without the ability to self-regulate learning, students are risking to lose focus and tend to fail to achieve full potential when it comes to academic achievement and being prepared for life-long learning (Nota et al., 2004; Duckworth & Carlson, 2013; Dijkstra, 2015; Ergen & Kanadli, 2017; Greene, 2012; Dijkstra 2019).

Self-regulated learning is not something every student develops naturally (McKeachie et al., 1985; Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019; McDaniel & Einstein, 2020). It takes practice and instruction on how to self-regulate within learning environments and it takes knowledge of learning strategies that are needed to do so (Pizzimentie et al., 2015; Zepeda et al., 2015; Dijkstra, 2019). In order to be able to develop self-regulated learning, it is important that students know which effective learning strategies there are and how to use them (De Boer et al., 2012; Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019). The use of learning strategies is something pupils and students tend to develop over a longer period of time, while gaining life experiences in learning situations (Greene, 2017; Dijkstra, 2019). One cannot expect first graders to achieve the same level of use of learning strategies as a higher education student. There is a possibility to speed up the process a bit. Research shows that providing conscious, direct instruction on how to use learning strategies to support and improve the learning

process, helps students to consciously develop metacognitive skills and the ability to self-regulate the learning process (De Boer et al, 2012; Donker et al., 2014; De Boer et al, 2018, Dijkstra 2019; Surma et al., 2019). Instruction on how to develop these skills to learn in a self-regulated way and use effective learning strategies is, however, lacking in most forms of education (Donker et al., 2014; Dijkstra, 2015; Dijkstra, 2019; Piza et al., 2019; Zepeda et al., 2015). Creating possibilities to learn about self-regulated learning and the use of learning strategies, can be done by means of strategy-instruction. This strategy-instruction is about explaining which learning strategies there are and how to use them in daily practice (Chamot & O' Malley, 1996, Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019). Strategy-instruction will help students identify which strategies they can use in which specific learning context and what room there is for them to improve this use (Akkakoson, 2013; Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019; McDaniel & Einstein, 2020).

This study aims to gain insight in the perceived improvement of the use of learning strategies through strategy instruction. This insight can lead to a better understanding of the need for strategy instruction within higher educational institutions.

Theoretical framework

Self-regulated learning

As Pintrich (2000b, p. 453) states: *"Self-regulated learning is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment"*. This statement gives an overview of the various factors that define Self-Regulated Learning (SRL): goal setting, monitoring, regulating and controlling of cognition, motivation and behaviour. Zimmerman (1990) has a slightly different definition, which actively introduces metacognition into the process of SRL, leading to the following definition: the degree to which students are metacognitively, motivationally and behaviourally active participants in their own learning processes. More specifically, self-regulated learners use specific processes that transform their pre-existing abilities into task related behaviour in diverse areas of functioning (Zimmerman, 1990; Zimmerman & Schunk, 2011).

There are two main models that formed the basis of studying SRL. The model of Schunk & Zimmerman (1998), which focuses on the interpersonal part of self-regulation related to learning. This model consists of three phases in a circular model. Forethought is the first phase, in which task and motivation are explored and goals on both aspects are set. Performance is the second phase, in which metacognitive processes are dominant, focusing on self-control and self-observation. The final phase, which directly leads to new input for the first phase, is self-reflection. In this phase, self-judgement and self-reaction are metacognitive constructs that help learners to evaluate the outcome and process of learning.

The model of Pintrich (2004) contains elements of the model of Zimmerman, supplemented with other phases and elements, which leads to an adjusted model. The phases of self-regulation have been broadened, resulting in the first phase, forethought, planning and activation which is linked to the cognitive area of self-regulation. The second phase is monitoring, which is linked to the motivational area of self-regulation. The third phase, control, is linked to the behavioural area of self-regulation and the last phase, reaction and reflection is linked to the contextual area of self-regulation. These models have been the basis of and have inspired many research projects on self-regulated learning, which resulted in a meta-analysis of De Boer et al. (2012) to determine which learning strategies are best capable of supporting self-regulated learning. This meta-analysis defined five domains, containing fourteen learning strategies to support and develop self-regulated learning.

Sufficient self-regulation requires that learners evaluate whether they will be able to accomplish the task, whether the environment is conducive to learning, and what changes are needed for better learning (Schunk, 2005). This leads to following assumptions about learners and learning: learners are active and constructive participants in learning, learners have some choices or the potential for control over key activities, learners have a goal or criterion level of performance against which they can assess progress, and self-regulatory processes mediate the relation between personal factors and performance outcomes (Pintrich, 2000b; Schunk, 2005; Weinstein et al., 2011). Research supports the idea that students' self-regulatory processes can be enhanced and that better self-regulation results in higher academic performance and higher levels of self-efficacy (Schunk, 2005; Nota et al., 2004; Duckworth & Carlson, 2013; Dijkstra, 2015; Ergen & Kanadli, 2017).

Higher academic performance, or academic achievement, has been seen as a result of successful self-regulation in learning, which explains why so many research is done to map out what self-regulated learning is and how students learn to effectively self-regulate learning and use effective learning strategies (De Boer et al, 2012; Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019). This effective use of learning strategies depends on the actual use of learning strategies and the perceived use of learning strategies. Both are important indicators for students' levels of self-efficacy, which is strongly related to academic achievement, self-efficacy and self-regulated learning (De Boer et al., 2018; Dijkstra, 2019). Even the perception of being able to self-regulate learning and to use effective learning strategies can have an impact (Greene, 2017; Dijkstra, 2019). Students that feel confident about their abilities to self-regulate their learning and that feel well equipped with a 'toolbox' they can use in the learning process, tend to have higher levels of self-efficacy, resulting in better use of learning strategies and more motivation (Greene, 2017; De Boer et al., 2018; Dijkstra, 2019; Mc Daniel & Einstein, 2020). The same goes for students having the perception that they do not have the ability to self-regulate their learning. Their levels of self-efficacy are low and the consequence of a self-fulfilling prophecy is lurking (Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019). It is, therefore, important for students to learn about learning strategies and their own strengths and weaknesses in using learning strategies, so they can implement this knowledge and develop the needed skills to be able to self-regulate the learning process.

Learning strategies

The meta-analysis of self-regulated learning and the strategies students use to self-regulate the learning process, conducted by De Boer et al. (2012) forms the basis for the chosen learning strategies within this research. Theses fourteen learning strategies that have been found to be the most effective learning

strategies out of the many learning strategies that have been studied in this meta-analysis, have been addressed to their own domain. Five domains have been determined: meta-cognitive knowledge, meta-cognitive skills, cognitive skills, organizational skills and motivation (De Boer et al., 2012; Donker et al., 2014; Dijkstra 2019; Dijkstra, Bunnik & Krikke 2021). The distribution of the fourteen learning strategies within these five domains can be found in Table 1.

Table 1.

Overview of learning strategies per domain by De Boer et al. (2012)

Domain	**Strategies**
Metacognitive knowledge	*To oversee*
	To know yourself
Metacognitive skills	*Look ahead*
	Keep track
	Look back
Cognitive skills	*Repeat*
	Deepen
	Structure
Organisational skills	Organize yourself
	Organize the environment
	Organize the other
Motivational skills	Trust yourself
	See the use
	Motivate yourself

The four strategies that are cursive have proven to be the most effective learning strategies within the meta-analysis of De Boer et al. (2012).

These fourteen learning strategies are learning strategies students can use to be able to learn as effective and efficient as possible (De Boer et al., 2012; Donker et al., 2014; Dijkstra 2019). There are four learning strategies that are known to be most effective (De Boer et al., 2012), which, combined with the other ten learning strategies, provide a complete pallet to regulate ones' ability to self-regulate learning (Dijkstra, 2019). The first most effective learning strategy is "to oversee', which belongs to the domain of metacognitive knowledge. To oversee means using knowledge about learning and how to do it best

(Dijkstra, 2019). It means that one knows which learning strategies are available to perform a learning task and when it is sensible to use this learning strategy while learning. The second most effective strategy is 'looking ahead', which belongs to the domain of metacognitive skills. Looking ahead is about planning apprenticeships in terms of tasks, time and priorities. The third most effective strategy is 'to repeat', which belongs to the cognitive domain and is about literally repeating the subject matter. The last most effective strategy is 'to see the use', which belongs to the motivational domain and which is about using different methods to gain insight into the value of the subject matter or a learning task and using that insight to motivate yourself. Knowing that these fourteen learning strategies exist and developing the use of these fourteen strategies, gives pupils and students a foothold to be in control of the learning process themselves (Donker et al., 2014; Dijkstra, 2019). Several studies show evidence that students who self-regulate their learning, perform better than their counterparts with worse self-regulatory learning behaviour (Artelt et al. 2010; Dresel et al., 2008; Donker et al., 2014; Pizzimentie & Axelson, 2015; Zepeda et al. 2015). Which leads to the question how to develop these learning strategies.

Unfortunately, developing learning strategies does not happen by itself (Donker et al., 2014; Zepeda et al., 2015; Dijkstra, 2019; Mc Daniel & Einstein, 2020). Learning strategies are often unconsciously part of the instruction on and processing of the subject matter (Greene, 2017; Mc. Daniel & Einstein, 2020). This immediately exposes the biggest problem: when learning strategies are not explicitly named or taught, it is difficult for pupils and students to recognize learning strategies as such and learn how to use these strategies themselves (Dijkstra, 2019; Mc Daniel & Einstein, 2020). Implicit use of learning strategies means little to no transfer to new learning situations (Donker et al., 2012; Dijkstra, 2019; Mc Daniel & Einstein, 2020). Learning to recognize and use learning strategies consciously is therefore essential and, in most cases, occurs when the teacher models the learning strategies, when assignments contain prompts and structure assisting to learn how to self-regulate the learning process or when the teacher provides students with strategy instruction on the use of learning strategies (Akkakason, 2013; Donker et al., 2014; Dijkstra, 2019; De Boer et al., 2018; Mc Daniel & Einstein, 2020).

Strategy instruction

Strategy instruction can be seen as a teaching practice which uses explicit instruction to learn students how to master skills and content they need to learn (Akkakason, 2013; Donker et al., 2014; De Boer et al., 2018). Strategy instruction involves not only explicit instruction, but also ensures integrating knowledge, skills and attitudes, which can be transferred to daily life and work settings (Van Merriënboer & Kirschner, 2012). In order to learn about the knowledge, skills and attitudes, needed for self-regulated learning and

using effective learning strategies, an explicit intervention can be done (Mc.Keachie et al., 1986; Chamot et al., 1996; Donker et al., 2014; Mc Daniel et al., 2020). According to Dijkstra (2019) an effective strategy instruction contains the following steps: discussing the various learning strategies with students, discuss the theoretical background of these learning strategies, give examples of what using a particular learning strategy would look like, connect this learning strategy to a specific task students have to fulfil and practice. After the task is completed, evaluate the use of the learning strategy and repeat these steps using the principles of scaffolding. The supervision of the students can be intensive in the beginning, after which it is gradually phased out in order to give the students more and more control over their own learning process, also known as scaffolding the learning process (Hogan & Pressley, 1997; Van der Stuyf, 2002). It is known that teaching learning strategies through strategy instruction improves the use of learning strategies, improves study motivation, self-efficacy and academic performance (Donker et al., 2014; Zepeda et al. 2015; De Boer et al., 2018; Mc. Daniel & Einstein, 2020)

Metacognitive knowledge and prior knowledge on self-assessment tests

To participate successfully in learning, training or other interventions, knowing ones' strengths and weaknesses can be helpful (Dochy, 1988; Tobias & Everson, 2002). This is also the case when it comes to the use of learning strategies. This meta-cognitive knowledge on learning strategies helps to know what learning strategies need extra attention and what learning strategies are already well-developed (De Boer et al., 2018; Dijkstra, 2019). Metacognitive knowledge develops over time and is largely dependent on previous learning experiences and learning outcomes (Greene, 2017; Foerst et al., 2018). Positive learning experiences have shown to improve the use of metacognitive knowledge, the use of learning strategies, student motivation and self-efficacy. Successful students tend to pick up on effective strategy use and improve themselves accordingly. Negative experiences have shown to decrease the use of effective learning strategies, motivation and self-efficacy. The metacognitive knowledge and self-efficacy tend to spiral down into a self-fulfilling prophecy that "Learning and/ or school is not going to work for me anyway." (Greene, 2017; Foerst et al., 2017; De Boer et al., 2018; Dijkstra, 2019). As research by Foerst et al. (2017) and De Boer et al. (2018) has shown, students that have negative experiences withing a learning situation, tend to stick to the strategies they have been using before, even if the results are bad. They tend to avoid questioning their method and do not ask questions about what they could be doing better. It is here where the use of learning strategies and strategy instruction on these learning strategies can help reverse the spiral (De Boer et al., 2014; De Boer et al., 2018; Dijkstra, 2019). Giving students tools to self-regulate their learning will help with building confidence in learning and self-efficacy (Foerst et al.,

2017; De Boer et al., 2018). For a student to know which learning strategies are weakly or strongly developed, can influence the impact of a strategy instruction intervention on learning strategies. Based on previous research, expectations are that having metacognitive knowledge on own competencies and abilities, can lead to a better focus on areas that need improvement during the learning process (Tobias & Everson, 2002; Foerst et al., 2017; De Boer et al., 2018). This implicates that if you know which of your own learning strategies are well developed and which are not, you can better focus on learning strategies that need more development during strategy instruction (Hailikari et al., 2008; Donker et al., 2014, De Boer et al, 2018; Dijkstra, 2019). Presenting students with their perceived use of learning strategies by providing them with the scores on self-assessment tests on effective use of learning strategies, can thus help them during this strategy instruction to gain focus on which strategies can be improved, which can possibly maximise the students' yield following this instruction (Hirsch, 1952; Hailikari et al., 2008; Foerst et al., 2017; De Boer et al., 2018).

Self-efficacy

The experience that students have with developing self-regulated learning strategies impacts the beliefs a student has on own capabilities and the trust a student has that a task can be executed and the outcome will be met (McDaniel & Einstein, 2020). This trust in the ability to be able to do what has to be done and to be successful at it, is often described as self-efficacy (Maddux & Gosselin, 2012, Artino, 2012). Many studies have shown that students who have a high level of use of self-regulated learning strategies, also have high levels of self-efficacy (Zimmerman et al., 1992; Greene, 2017; De Boer et al., 2018; Dijkstra, 2019). Question remains which condition needs to be met first. Helping students to take control over their learning process by using learning strategies, can give them more self-confidence, which can lead to higher levels of self-efficacy, which leads to better use of logical and effective learning strategies (Dijkstra, 2019). It can also be the other way around; students that are successful in learning tend to have high levels of self-efficacy and choose better learning strategies due to earlier successes, which leads to an even higher level of self-efficacy (Dijkstra, 2019). Either way, self-efficacy is an important factor in motivation and achievement and correlates with the effective use of learning strategies (Zimmerman et al., 1992; Artino. 2012; De Boer et al., 2018; Dijkstra, 2019).

Current study

Based on the theoretical framework above, this study attempts to shed light on the effect of strategy instruction, and metacognitive knowledge on students' own perceived use of self-regulated learning strategies and self-efficacy, leading to the following research question.

Research question:

To what extent does strategy instruction on self-regulated learning strategies affect students' perceived use of self-regulated learning strategies and self-efficacy, and is this relationship influenced by having access to one's initial level of perceived use of self-regulated learning strategies?

In order to gain insight in their own perceived use of learning strategies, students take a self-assessment test on learning strategies that has been developed for students in higher education by Barelds & Dijkstra (2018). By using this test, called the 'Nederlandse Vragenlijst Effectieve Leerstrategieën" (Dutch questionnaire on effective use of learning strategies), data is collected to answer the first hypothesis: *The students' perceived use of learning strategies will significantly increase after following the strategy instruction intervention.*

Previous research has shown that having metacognitive knowledge of one's own strengths and weaknesses on the use of self-regulating learning strategies can lead to better focus during training of for example learning strategies. By getting access to the results of a self-assessment test on the use of learning strategies, a better focus can be achieved during strategy instruction. This leads to the second hypothesis: *Having access to one's own perceived level of use of self-regulating learning strategies will show significantly greater progress in the perceived use of self-regulated learning strategies after following the intervention on strategy instruction.*

Self-efficacy is strongly related to academic achievement and the ability to self-regulate learning processes. Therefore, the collected data hopes to find proof for the third hypothesis: *The perceived self-efficacy of students will increase after strategy instruction, for self-efficacy and the use of self-regulating learning strategies are related.*

Method

Participants

Originally, 47 full-time second year higher education students of a teacher education, were asked to participate in this research by their tutors. All students were informed about the research procedure and goals of this study, including the possibility to be approached to participate in a semi-structured interview, and gave active consent for their participation. Four students decided not to participate in this research due to full schedules, health issues and/ or doubts about leaving school. In a later stage, six more students were eliminated from the database due to too many missing values from not completing the questionnaire. The final sample consisted of 37 students (4 men, 33 women; *M* age = 19.84 years, *SD* = 1.708 years, ranging from 18-25 years).

Within this study, 18 students (2 men, 16 women; *M* age = 19.32 years, *SD* – 1.712, ranging from 18-23 years) were randomly assigned to the experimental group which received the scores on the first administration of the questionnaire on perceived use of self-regulating learning strategies and 19 students (2 men, 17 women; *M* age = 19.89 years, *SD* = 1.721, ranging from 18-25 years) were assigned to the control group which did not receive these scores.

Out of the 37 students that filled out the first questionnaire, 20 students participated in all three sessions of the intervention and also filled out the second questionnaire. Some students participated in only one or two sessions, but did fill out all questionnaires and some students followed no sessions and just filled out the questionnaires or only the first questionnaire. The data of the 17 students that did not participate in all three sessions and that did not fill out all questionnaires was left out during the final data analysis. Seven students (3 men and 4 women; *M* age = 19.12 years, *SD* = 1.686, ranging from 18-22 years) of the original 37 were randomly selected for an in-depth interview. The reason to randomly select from this first group of 37 students is to also be able to gain insight in why students did or did not participate in all sessions or decided to just participate in the questionnaires or in one of the questionnaires.

Context and design

A pre-test - post-test-design was used to test the hypotheses, comparing two conditions in which students were either provided with the scores on their perceived use of learning strategies, or not. Data on students' self-efficacy and their perceived use of learning strategies were collected in the context

of an intervention that contained three sessions of strategy instruction, in which students learned about learning strategies and how to use them.

Students were asked to fill out an online questionnaire that measured their general and academic self-efficacy and perceived use of self-regulating learning strategies. Next, the students participated in an intervention consisting of three sessions. These sessions consisted of a theoretical part and a practical part in which students integrated the theoretical knowledge in their assignments. The sessions were designed according to the strategy instruction as described by Dijkstra (2019). Next to the described strategy instruction the outcome of the NVEL and feedback of the students have also been used as input to develop next sessions.

Intervention

In this study, three sessions of ninety minutes each were provided online using Zoom. Preliminary to the online sessions, students had access to pre-recorded screencasts on the subject and documents that provided them with more theoretical background if wanted. All sessions consisted of an introduction in which a check-in with students took place and prior knowledge was refreshed. After the introduction, there was a lecture covering the theory for the learning strategies, followed by a control of understanding. An example of the assignment was then given, with the instructor modelling how to handle the assignment, after which students went to work in groups in break-out rooms. Finally, the outcome of the assignment was discussed and the session was evaluated. Table 2 gives an overview of the activities per session.

Table 2

Overview of session structure

Phase	**Content**
Introduction (10 minutes)	Checking in on students and their well-being. Refreshing (prior) knowledge with quiz or questions
Lecture (20 minutes)	Covering the theory for the different domains and learning strategies that are part of this session.
Control of understanding (5 minutes)	Checking in with students to see if there are any questions, instructor asks questions if there aren't questions.

Explaining and modelling the assignment (5 minutes)	Explaining the assignment that will be done in break-out rooms in groups of three or four students. Modelling the assignment to make sure goal and procedure of assignment is clear.
Students work in break-out rooms (30 minutes)	Students work on the assignment and prepare a short presentation in Padlet.
Evaluate assignment, present results and reflect (20 minutes)	Students present their findings and reflect on the assignment and how they will use the gained insights the coming week.

Metacognition was the subject to be covered in the first session. Students were able to watch a screencast (pre-recorded theoretical session online) with in-depth information on metacognition in advance, if they wanted to. There was also a document provided that contained more information on metacognition and several links to short movies explaining metacognition and literature/ research which they could 'dive into'. During this session, the lecture consisted of sharing knowledge on metacognitive knowledge and metacognitive skills. The strategies belonging to these domains; to oversee, knowing yourself, look ahead, keep track and look back, were shortly explained and examples were given and modelled. After that, students worked on an assignment in break-out rooms, focusing on the learning strategy 'looking forward'. This strategy helps to oversee the tasks that lay ahead and plan the work that has to be done for semester two in a SMART way. The students shared insights and information with each other using Padlet. Within Padlet, each group had their own space to present their insights. The presentations led to new insights for all students and to evaluating the session and collecting input for the next session from students' feedback.

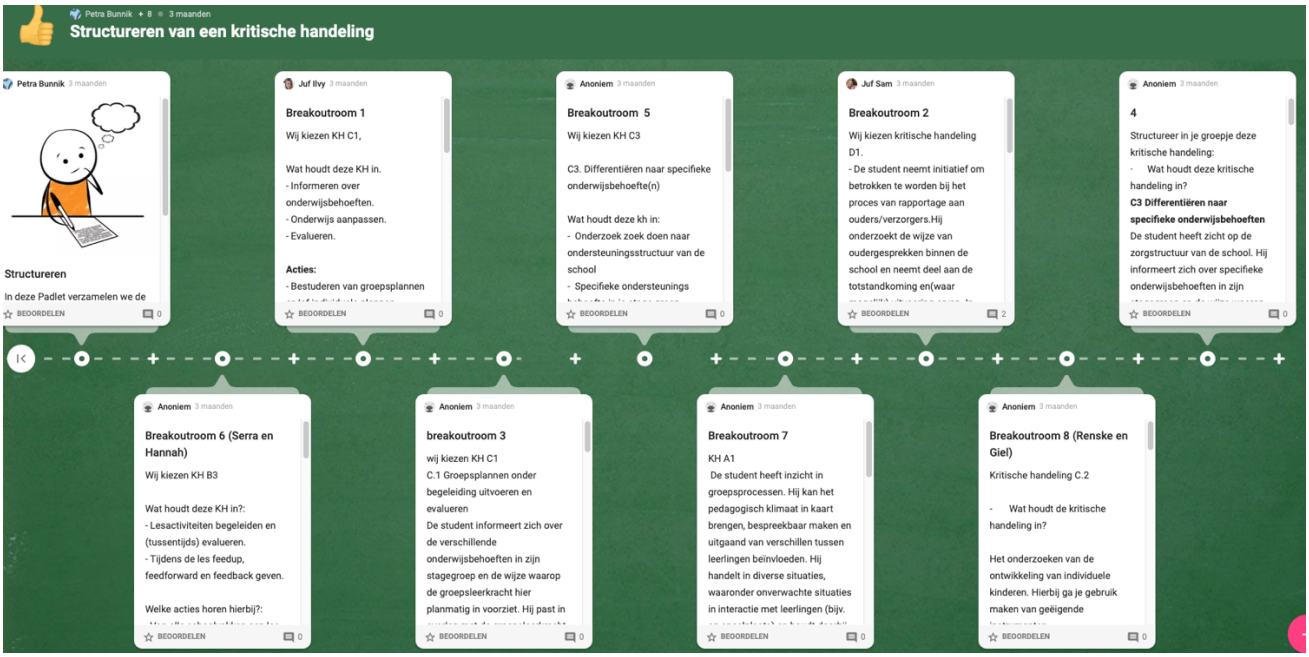
Cognitive skills and organizational skills were subject of the second session. Students were again able to watch a screencast and a document with extra theoretical information was provided. The lecture consisted of sharing knowledge and examples on the cognitive learning strategies: to repeat, to immerse and to structure and the organizational learning strategies: to organize oneself, the other and the environment. Based on feedback from the students, collected at the end of the first session, and the results of the NVEL, the learning strategy 'Structuring' was chosen as main focus point for the assignment. Students were asked to structure 'critical actions', as described in the curriculum of the PABO, of their own choice according to a provided pattern which was modelled by the instructor. The results were again

collected in Padlet and were discussed at the end of the session. An example of this Padlet is given in figure 1.

Motivation was subject of the final session. Again, a screencast was provided, along with a document containing links to research, articles and short films of motivational concepts. During the session, the lecture consisted of sharing knowledge and examples on the motivational learning strategies: trusting yourself, seeing the use and motivate yourself. The instructor modelled a 'critical action' in terms of 'seeing the use': what use does this 'critical action' have for my future job as a teacher. Students were again asked to work together in break-out rooms to help each other to gain insight of the use of several, self-chosen 'critical actions'. This led to another Padlet in which students shared the use of 'critical actions', which can help to motivate yourself to pay attention to this 'critical action' during the internship in schools. After presenting the Padlet, a short overall evaluation of the sessions was held. Students were asked to give feedback on the three sessions and the assignments.

Figure 1

Screenshot of the Padlet "Structuring a critical action".



Measurements

The study made use of two online questionnaires, both including questions about self-efficacy and learning strategies. Self-efficacy will be measured using the new general questionnaire on self-efficacy by

Chen et al. (2001) and the self-efficacy questionnaire on self-regulated learning by Zimmerman et al. (1992). Next to that, the NVEL (Nederlandse Vragenlijst Effectieve Leerstrategieën) for students in higher education, developed by Barelds and Dijkstra (2018) will be used to measure the students' perceived use of learning strategies. Qualitative data will be collected using semi-structured in-depth interviews. Semi-structured interviews are the appropriate instrument, since it allows respondents to voice their own opinion for more extensive information and still offer the opportunity to compare the answers from respondents to each other (Baarda, et al., 2015).

NVEL

The aim of the NVEL, Nederlandse Vragenlijst Effectieve Leerstrategieën (Dutch Questionnaire on the use of Effective Learning Strategies), developed by Barelds & Dijkstra (2018), is to give insight in the students' perceived use of learning strategies as defined by De Boer et al. (2012). The NVEL consists of 112 items, each item relates to one of the 14 specific learning strategies. The NVEL has been developed to be able to distinguish which learning strategies are sufficiently developed and which learning strategies are not sufficiently developed. Examples of items are: *"I learn important things during college"*, *"I know my weaknesses and strengths when it comes to studying,"*, *"I find it hard to focus during studying."*, *"I check for mistakes regularly during an assignment."*, *"When it comes to studying, I often wait until the last minute to do so."*, *"I often don't see the use of an assignment that has to be done."* and *"If there is something I don't understand, I'll ask a teacher to explain it to me."*. The items are rated on a 3-point scale. Students are asked to answer 'yes' or 'no' and in case they really cannot choose, they can fill out a question mark. If answered 'yes', there was a rating of three points, if answered the question mark, there was a rating of two points. If answered 'no', there was a rating of one point. Reliability of the NVEL gave a result of α 0.743 in this study.

The experimental group of 18 students, received the scores on this test after the first administration. These scores gave insight into the total score on the NVEL, but also gave an overview of the perceived level per learning strategy and explanation of the scores. An overview of the used learning strategies and explanation of these learning strategies was also added. An anonymised example of these results has been added in table 3.

Table 3.

Anonymised example of the scores on the NVEL which has been provided to students in the experimental group.

Results student x. Total score 275 (min. score 192, max. score 336)						
To oversee	■	■	■	■	■	■
Knowing yourself	■	■	■	■	■	■
Looking ahead	■	■				
Keeping track	■	■	■	■		
Looking back	■	■	■	■		
Repeat	■	■	■	■	■	■
Deepen	■	■	■	■	■	■
Structure	■					
Organize yourself	■	■	■	■		
Organize surroundings	■	■	■	■	■	
Organize others	■	■	■	■		
Trust yourself	■	■				
See the use	■	■	■	■		
Motivate yourself	■	■	■	■	■	
	VL	L	BA	A	H	VH
VL = very low, L = low, BA = below average, A = average, H = high, VH = very high						

General self-efficacy questionnaire

The aim of the self-efficacy questionnaire that Chen et al. (2001) developed is to best capture the general self-efficacy of contestants. This new general self-efficacy questionnaire (NGSE) consists of eight constructs to measure self-efficacy beliefs. Examples of items from the NGSE are: "*I will be able to achieve most of the goals that I have set for myself.*", *"I am confident that I can perform effectively on many different tasks."* and *"Even when things are tough, I can perform quite well."* The NGSE scale was scored on a 5-point Likert-type scale from strongly disagree (1) to strongly agree (5). The eight NGSE items yielded a scale that is theory based, unidimensional, internally consistent, and stable over time. The NGSE has an internal consistency reliability of α 0.833 in this study.

Self-efficacy questionnaire on self-regulated learning

The aim of the self-efficacy questionnaire Zimmerman (1992) developed is to best measure the self-efficacy of contestants when it comes to self-regulated learning. This self-efficacy questionnaire on self-regulated learning consists of two parts. Eleven items measure the self-efficacy level on self-regulated learning and nine items measure the academic self-efficacy. The latter nine items have not been included in this study, for aim of this study is to measure self-efficacy related to self-regulated learning and not academic learning. Therefore, the first eleven items have been used. Examples of items are: *"How well can you study when there are other interesting things to do?"*, *"How well can you concentrate on school subjects?"* and *"How well can you motivate yourself to do schoolwork?* The items are rated on a 7-point scale. The descriptions were 'not well at all' for a rating of 1, 'not too well' for 3, 'pretty well' for 5, and 'very well' for 7. The self-efficacy questionnaire on self-regulated learning has an internal consistency reliability of α 0.751 in this study.

Regarding the questionnaires on self-efficacy: two questionnaires were used, one on general self-efficacy and one on self-efficacy regarding self-regulated learning. Self-efficacy can be measured within many different contexts and settings (Chen, 2001). In this study, the general context of self-efficacy is valuable to see how students look at themselves in general. Measuring self-efficacy on self-regulated learning is valuable because the intervention is designed to improve the use of self-regulating learning strategies, which could also mean an improvement in self-efficacy within the context of self-regulated learning (Dijkstra, 2019).

Interviews

The questions of the semi-structured interviews were formulated to find answers on questions about self-regulated learning, strategy instruction, access to the test-results of the first administration of the NVEL and external factors that might influence the ability to self-regulate the learning process. First of all, students were asked some general questions about their participation, this section consisted of four questions. For example: *"Have you joined all sessions?"* and *"Did you receive the results of your first questionnaire?"*. After that, three questions were asked about self-regulated learning, for example: *"Did you have any knowledge on self-regulated learning before this intervention?"*. Three questions about strategy instruction were added. Example of the questions about strategy instruction: *"Were the instructions on what learning strategies are and how to use them clear?"* and *"What could have been done better in these strategy instruction sessions?"* Three questions were added about having access to the test results on the first administration of the questionnaire. An example of these questions is *"If you did receive the results, did it help you to focus better during the sessions of the intervention? What effect did that have on you personally?"* And finally, six questions about external factors that influence self-regulation and learning were addressed, for example: *"Do you think that there are other, external factors, right now that impact your capability of learning effectively?"*, *"What impact do you think these factors have right now?"* and *"What do you need to be able to study (more) effectively, taking these factors into account?"*. After the construction of the interview, a pilot was held in order to find flaws in the items and to test the online setting and time duration of the interview. This led to deleting two questions that had too much overlap with other questions. The complete questionnaire has been added as Appendix A.

Procedure

This study consists of a series of events: filling out the first self-efficacy test and NVEL online, following online sessions and filling out the second self-efficacy test and NVEL online, after which seven students were asked to participate in a semi-structured interview. First of all, students were asked to fill out the first questionnaires. The 18 students in the experimental group received the results of the first administration of the NVEL. After that, in a three-week period, three online sessions of 90 minutes were held to provide the students with strategy instruction. After the strategy instruction sessions, students again completed the NVEL and the self-efficacy test. All questionnaires were filled out online.

The semi-structured interviews were held in the weeks after the final questionnaire was filled out online. The interviewing took place in an online videocall and in a rather wide timetable of five weeks, due to

schedules and illness of the students that were selected for the interviews. Besides the prepared questions, the interviewer gained more information by enquiry when needed. During the interviews, students were eager to also give an evaluation the organisation of their education, so a question about the organisation of their educational program was added after completing two interviews.

Data analysis

The participants filled out an online questionnaire twice via Qualtrics, containing questions on general self-efficacy, self-efficacy regarding self-regulated learning and on the students' perceived use of learning strategies. The results of the online questionnaires will be analysed using SPSS. A paired sample t-test will be used to check if students score significantly higher on the second administration of the NVEL after following the strategy instruction intervention. Also, effect size will be measured by calculating Cohen's d effect size. Pearson correlation tests will be used to check if students with high scores on self-efficacy also score high on the perceived use of learning strategies. A repeated measures ANOVA will be used to check if data of students that did get their test results show significant more improvement than students that did not get their test results.

Data analysis of the semi-structured interview has been carried out in five steps (Boeije, 2005; Evans, 2018). The recordings of the interviews were transcribed, organised and structured. After that, preliminary categories, codes and descriptions were made, based on the operationalisation of strategy instruction, metacognitive knowledge and self-regulated learning as mentioned in the theoretical framework and in the interviews. The verification of the preliminary codes to establish patterns and connections was the third step, after which reoccurring themes were established in step four. Final step was the inquiry of the themes, to give a more in-depth insight in what the data from the interviews is showing. This resulted in a coding scheme as to be found in Appendix B, where quotes were added to each example and code of the shared information by the students. The results of this coding scheme will be used to support the answering of the research question and hypotheses.

Results

Strategy instruction

Regarding the expected increased score of perceived use of learning strategies after strategy instruction, regular data checks have been administered, leading to a check on normality for the total score on learning strategies in the pre-test and post-test of the NVEL. This resulted in a Shapiro-Wilk significance on the total pre-test scores on perceived use of learning strategies of W (20) = 0.964, p = .637 (*M* = 278.8, *SD* = 24.903) and a Shapiro-Wilk significance on the total post-test scores on perceived use of learning strategies of W (20) = 0.963, p = .608 (*M* = 287.15, *SD* = 21.875). This suggests that the data for the total scores on the pre- and post-test on perceived use of learning strategies are normally distributed. With data being normally distributed, a paired sample T-test was done to see if the scores on the NVEL significantly increased after participating in the strategy instruction intervention. The results on the NVEL in the post-test show a significant higher score (*M* = 287.15, *SD* = 21.875) than the results on the NVEL in the pre-test (*M* = 278.8, *SD* = 24,903). This difference was significant *t* (19) = 2.8, *p* = .012, and represented a medium-sized effect, *d* = .625. Results suggest that the scores on the second administration of the NVEL have significantly increased, compared to the scores on the first administration of the NVEL. Pearson's correlation coefficient between the pre-test and post-test scores showed a fairly strong positive relationship between the scores on the pre-test and post-test on perceived use of learning strategies, *r* = .757, *p* = < .001 (two-tailed).

Access to self-assessment scores

To test if having access to one's own perceived level of self-regulating learning strategies before the start of the intervention has had an impact, it was important to look at the differences between the scores on the pre-test and post-test, keeping in mind that there are two groups, the experimental group that did have prior knowledge on their own perceived level of use of learning strategies by having access to their scores on the first test and the control group that did not have prior knowledge on their own perceived level of use of learning strategies by having access to the results on their first test. To measure the effects, a repeated measures ANOVA has been performed with the total scores on perceived use of learning strategies in the pre-test and post-test of the NVEL as repeated measures and prior knowledge on the test results as interaction term. There was no significant effect of prior knowledge on the scores of perceived

use of learning strategies, *F* (1, 18) = .014, *p* = .907. As the results of the repeated measures ANOVA show, having access to test-results does not have a significant effect on the increase of the scores on the perceived use of self-regulating learning strategies. Students who did have access to the test results did not score significantly higher. Table 4 shows the Mean and Standard Deviation of the pre-test and post-test for the experimental and control group and the scores of the total group within the repeated measures ANOVA.

Table 4

Mean and Standard Deviation of the pre-test and post-test for the NVEL for the experimental group with prior knowledge on the results of the pre-test and the control group with no prior-knowledge

	Prior knowledge		No prior-knowledge		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Pre-test	276.20	27.56	277.40	23.43	278.80	24.90
Post-test	287.00	23.83	287.30	21.03	287.15	21.88

Level of self-efficacy

If strategy instruction has an impact on the perceived use of learning strategies of higher education students and the use of learning strategies has an impact on the self-efficacy level of higher education students, it is important to first check if self-efficacy and the perceived use of self-regulating learning strategies relate to each other in this research. In order to do so, a Pearson's correlation coefficient has been calculated for the scores on the first administration regarding self-efficacy and perceived use of self-regulating learning strategies. The scores on the self-efficacy test contains data from two different questionnaires: Chen et al.'s questionnaire on general self-efficacy (NGSE, 2001) and Zimmerman's self-efficacy questionnaire on self-regulated learning (1992). The latter test has been rescaled to fit within a 5-point Likert scale. Both tests have an α above 0.7, which makes it possible to combine the results of both questionnaires to work with a total score on self-efficacy. The outcome of Pearson's correlation coefficient for the scores on the pre-test on perceived use of self-regulated learning strategies and pre-test total scores on self-efficacy, showed that self-efficacy was significantly related to the perceived use of learning strategies, *r* = .745, *p* = < .001 (two-tailed). Table 5 gives an overview of the Mean and Standard

Deviation on the NGSE and the self-efficacy test on self-regulated learning, as well as on the total score on self-efficacy.

Table 5

Mean and Standard Deviation, minimum and maximum scores of the pre-test scores on the self-efficacy tests NGSE and self-efficacy of self-regulated learning and total scores on self-efficacy.

	General SE pre-test	**General SE post-test**	**Self-regulation SE pre-test**	**Self-regulation SE post-test**	**Total score SE pre-test**	**Total score SE post-test**
Mean	29.75	28.5	38.3	39.65	68.05	69.4
Standard Deviation	4.23	5.14	5.62	5.43	8.19	7.31
Minimum	21.0	11.0	27.0	29.0	56.0	58.0
Maximum	39.0	36.0	46.0	53.0	84.0	89.0

With a significant correlation between the total scores on self-efficacy and the scores on the pre-test of perceived use of learning strategies, a paired sample t-test has been conducted to see if the level of self-efficacy has increased after the intervention on the use of learning strategies. This paired sample t-test has been performed on the total scores on self-efficacy during the first and second administration. The results on the total scores on the self-efficacy test in the second administration (M = 69.4, SD = 7.31) show no significant increase, compared to the results on the self-efficacy test in the first administration (M = 68.05, SD = 8.19). The difference was not significant t (19) = 1.24, p = .23, and represented a small sized effect, d = .277. The scores on general self-efficacy showed a minor decline, the scores on self-efficacy related to self-regulated learning showed a minor increase. For this reason, a paired sample t-test has also been conducted with both separate scores on general self-efficacy and self-efficacy of self-regulation as well. For general self-efficacy this resulted in a non-significant result (t (19) = -.907, p = .38, d = -.203) between the first administration (M=29.75, SD=4.23) and the second administration (M=28.5, SD=5.14). For self-efficacy related to self-regulation, the results were also non-significant between the first

administration (M=38.3, SD=5.62) and the second administration (M=39.65, SD=5.43) with t (19) = 1.24, p = .23 and a small effect size, d = .277.

Interviews

The semi-structured interviews led to insights that has not been retrieved by the questionnaires. Five categories have been determined in analysing the interview data, see Appendix B. These five categories will be explained briefly, after which the data from each category will be summarized in separate paragraphs. The first category is self-regulated learning, in which students were asked about their knowledge on self-regulated learning before and after the intervention. The second category is strategy instruction, in which students were asked about their perception of the quality and organisation of the intervention on strategy instruction. The third category is about learning strategies, in which students were asked about their perception on the benefits or disadvantages in using learning strategies. The fourth category is metacognition and prior access to test results, which consists of information on students receiving their test results or not and which impact this had on following the intervention. Last category consists of external factors that might have had an impact on the ability to self-regulate learning.

Self-regulated learning

When it comes to self-regulated learning, all students mentioned that they had never heard of this concept, nor of the use of learning strategies to organise learning. Learning about these strategies and the possibility to self-regulate the learning process, gave six students more confidence and one student realised he had overestimated himself regarding the use of learning strategies and the ability to self-regulate the learning process. Motivation wise, students mentioned that it was interesting to see that you can learn how to motivate yourself to self-regulate learning when needed. Metacognition was an element that only one student recognised upfront from being a top-athlete, which has forced her to consciously use metacognitive strategies since the age of fourteen. The other six students never actively heard about metacognition and were glad to learn about it and be able to use the strategies that belong to metacognition. Also, the ability to organise learning in a more structured way was received very well by these six students. It gave them a feeling of ownership, being able to do what has to be done in an effective and logical way. Two students had hoped for a turnkey solution they could just start using. They were a bit disappointed that learning still turned out to be a personal effort in which you have to

find out what works best for you, instead of getting a ready answer you can implement straight away, with a guarantee to succeed.

Strategy instruction

When it comes to the actual instruction of the learning strategies, all students mentioned that the sessions were very clear and helpful. One student would have liked to have more theoretical background and was not a big fan of the practical part of the sessions in which students were working in groups on using a particular learning strategy. He did not take advantage of the opportunity to view the screencasts and study the documents before the sessions. In retrospect, he thinks that might have been helpful. The rest of the students, six in total, really valued the practical part, in which they could cooperate with each other to work on getting a hold of working with learning strategies. The organisation of the strategy instruction was also valued by all of the students, for they found length and frequency practical and sufficient. They all mentioned that they would have preferred face-to-face strategy instruction sessions.

Learning strategies

The learning strategies were welcomed as a kind of toolbox students can use during learning. All students mentioned that the strategies are very hands on and give structure and hold during learning, especially with getting things organised over time. The learning strategies ‘Looking ahead’ and ‘Structuring’, part of the first and second session, were judged to be most helpful. Two students mentioned that for them, the use of these strategies have been the normal way to interact in learning situations. The rest of the students, five in total, mentioned that they really benefited from the explanation and practice in using learning strategies and all students mentioned that they plan to use these strategies more consciously and frequently. Four students commented that they would like to have more theoretical insight in learning strategies and hope there will be more awareness for the need of conscious development of the use of learning strategies within the educational trajectory. They all mentioned that a scaffolding principle in the instruction on use of learning strategies would be a perfect way to gradually give students more insight in how to self-regulate their learning and take more responsibility for this process as the years go by.

Metacognition and prior knowledge on self-assessment scores

Having access to the scores on the self-assessment test about learning strategies (NVEL), really helped the four students that did receive those scores to focus on what was most important to them during strategy instruction. The three students that did not receive these scores, did not think that this impacted their attendance negatively. They were convinced that they already had metacognitive knowledge on their pitfalls and strengths and were able to engage just fine in the intervention. The four students that did get access to their scores indicated that, at forehand, they did not really have a good idea of their strengths and weaknesses regarding the use of learning strategies before getting the results and they were very pleased to have received the scores before the start of the intervention.

External factors influencing the ability to self-regulate learning

When the students were asked what other factors could be of influence on their ability to self-regulate their learning, a number of factors were cited. First factor was COVID-19, which had a great impact on the students' social life, ability to go outside, go to school and work together with fellow students. Having an 'online life' in which all interaction is planned and executed in online meetings and learning platforms, is given as a main reason for lack of motivation, lack of commitment and lack of performance drive with six out of seven students. The limitations on internships, the blur in boundaries between school and home, the loss of jobs and income have been hard and they all mentioned that they had to find a new rhythm in these unusual conditions.

Next to that, the students' mental state has been cited as a cause of not being able to perform as wanted by four students. Especially perfectionism and insecurity/ lack of self-confidence were mentioned by three female students. These students linked this insecurity to another factor cited by all students, namely the communication process at the educational institution. The way assignments are formulated and communicated causes these three students a lot of stress and an insecure feeling about whether they understand what the intention is and whether they will be able to deliver what is needed to complete assignments successfully. This affects their level of self-efficacy. Finally, there were two students who really struggled with their home situation. They both experienced problems when it comes to having a space to learn and follow online lessons without being disturbed.

Discussion

The aim of this study was to investigate to what extent an intervention on strategy instruction succeeded in improving the perceived use of self-regulating learning strategies of higher education students. Earlier research has shown that strategy instruction on learning strategies can help students develop a sufficient toolkit to self-regulate the learning process (De Boer et al., 2018; Dijkstra, 2019). Main focus in this study was the impact of the intervention on learning strategies, which existed of three online sessions with students in which they were given information on learning strategies and how to use them. A self-assessment instrument was used to measure the students' perceived use of learning strategies. Next to that, this study wanted to gain insight in the possible effect of prior knowledge on the perceived use of learning strategies of the students. For this reason, the experimental group were given their results on this self-assessment instrument before the start of the intervention and the control group entered the intervention without knowing these results. The expectation was that knowing these results at forehand would benefit the students during the intervention as seen in previous research (Dochy, 1988; Tobias & Everson, 2002). Furthermore, this study aimed to see whether the level of self-efficacy of the students would increase after following the intervention. Research has shown that an increase in the levels of self-regulated learning, also affects the levels of self-efficacy (Zimmerman et al., 1992; Greene, 2017; De Boer et al., 2018; Dijkstra, 2019).

Briefly described, the results of the study indicated that the level of perceived use of self-regulating learning strategies increased significantly after following the intervention. The students who scored the lowest on the use of self-regulated learning strategies in the first administration of the self-assessment questionnaire, showed the strongest levels of increase in their scores on the second administration. Students who had relatively high scores on the first administration showed a small increase in scores after following the intervention. It was also found that having access to the test results before participating in the intervention did not give students any significant benefit. Self-efficacy levels have also shown no significant improvements.

Strategy instruction

Using strategy instruction to increase the perceived use of learning strategies of students, within an educational context has been studied before (Donker et al., 2014; De Boer et al., 2018). Literature has shown that consciously offering learning strategies by means of this strategy instruction leads to an increase in the perceived use of learning strategies to enhance self-regulatory capacity in educational settings (De Boer et al., 2012; Donker et al., 2014; De Boer et al., 2018; Dijkstra, 2019). This study also shows that students' levels of perceived use of learning strategies increase after a strategy instruction intervention. Students with a low level of perceived use of learning strategies seem to benefit most. These students showed a relatively stronger growth in the perceived use of learning strategies compared to students with higher scores.

Within the strategy instruction intervention, attention is paid to various components of self-regulated learning (Dijkstra, 2019). Particularly in the field of metacognitive knowledge and skills, the students indicated that they experienced a lot of support working on their assignments, as was apparent from the interviews that were held with the students. This is in line with expectations with the research of De Boer et al. (2018), in which progress, with regard to the development of metacognition, continues and develops even further after following strategy instruction on the use of learning strategies and the development of self-regulatory skills. It would be interesting for future research to have the same students complete the questionnaires again, to see whether this long-term effect is also apparent in this group.

Prior knowledge

Regarding metacognitive knowledge and prior knowledge on the self-assessment test on perceived use of learning strategies, literature states that knowing ones' strengths and weaknesses, helps in gaining focus during interventions (Dochy, 1988; Tobias & Everson, 2002; De Boer et al., 2018). It helps students to estimate which parts of the strategy instruction are most important to them, because they have insight into their own perceived level per learning strategy. Asking metacognitive questions and getting students to work together to get to know and learn from each other's approaches helps students to develop these skills, which is what has been done during the intervention of this study (Alt & Raichel, 2020). Ten students received the results on their self-assessment test on the perceived use of learning strategies, while the other ten students did not get these results. In this study, it made no difference whether or not the students obtained the results of the self-assessment on perceived use of learning strategies. The fact that

this prior knowledge did not show a significant difference within the results of the questionnaire could be explained by the fact that it is known that this metacognitive knowledge often develops later in life and that this does not happen by itself (Greene, 2017; De Boer et al., 2018; Dijkstra, 2019). Not knowing your own strengths and weaknesses and not being aware of the existence of metacognition, as stated by all students in the interviews, could be an explanation for that. The interview data on prior knowledge show that students in the experimental group valued having access to the outcome of the self-assessment pre-test on perceived use of learning strategies. It helped them to focus on the elements that were, to them, most important and consisted merely of learning strategies that were, in their eyes and as a test-score, developed insufficiently. Students that did have access to the outcome stated that they found it hard to determine their own strengths and weaknesses regarding the use of learning strategies. On the other hand, not having access to these outcomes was something the students in the control group that have been interviewed did not really miss. For, in their opinion, it meant that they had to focus on the complete content of the intervention, which was fine for them. A focus point would have been appreciated, but was not thought of as necessary to participate more effectively in the intervention. These students also indicated that they had a relatively good idea about their own strengths and weaknesses after filling out the pre-test and having access to information about the learning strategies and self-regulated learning. The statements made by the students in the interviews, confirmed and contradicted the outcome of the quantitative results, which requires some further research. Looking at the perceived level of use of learning strategies of the students that have been interviewed within the control group, the average scores were relatively high with a mean of 280 and the average scores within the experimental group were relatively low with a mean of 241 (max. score 336). This could be a possible explanation for the contradictions found between the quantitative data and the qualitative data in the two groups. When the average score is relatively high, students already have a rather good idea about their own strengths and weaknesses, as also stated in the interviews. They feel more secure about their own levels of perceived use of learning strategies, which does not give them the need to know their scores to focus or benefit most from strategy instruction. The group of students that did get their results however, had a much lower average score on the self-assessment test. This could explain why they did value getting the results, for they were not so sure about their own competence and experienced hold for themselves by receiving the results.

Next to that, the online offering of this intervention (Unger & Meiran, 2020) could have had an impact too. Many students indicated, even during the sessions, that they would have preferred the intervention face-to-face at school to create more interaction and involvement. Research has shown that in topics such

as developing metacognitive knowledge and skills, (the lack of) social presence and social distance are important for being able to develop and show progress (Unger & Meiran, 2020). This social distance and lack of social presence have significantly more impact during an online intervention than interventions that take place in the classroom. Further research into this is recommended, for example a subsequent study could ensure that the intervention is carried out face-to-face, to see if results differ.

Self-efficacy

The implications for self-efficacy while developing self-regulated learning by using effective learning strategies in literature were quite clear and unambiguous. When the ability to self-regulate learning develops and/ or grows, the sense of self-efficacy increases (Greene, 2017; Dijkstra, 2019). This study, however, shows different results. Total scores on self-efficacy show no significant growth. Several students stated in the interview that "learning about learning strategies and metacognition was something they had never done before and they had never heard of", which resulted in lower levels of self-efficacy after following the intervention. They realized they had overestimated themselves when it comes to self-regulated learning and were now able to give more accurate answers on the tests and were better able to estimate their own level of self-efficacy. In this study, students mentioned that learning about the subject led to a lower feeling of self-efficacy, which is in line with earlier research on self-efficacy, which states that increase of knowledge can lead to decrease of self-efficacy (Kirsch, 1986; Dijkstra, 2019). The latter is also in line with the criticism often cited when it comes to self-assessment in research and self-knowledge (Kruger & Dunning, 1999; Paulhus & Vazire, 2007), in which overestimation of participants, when not being an expert on something, is often the case.

Practical implications

The results of this study could imply that providing an intervention around strategy instruction when it comes to the use of learning strategies to increase the self-regulatory capacity of students, can lead to a significant improvement of students' perceived use of learning strategies, as suggested by De Boer et al. (2018). In the interviews, students indicated that the instruction strategy was experienced as very valuable and that it could be of added value for all students within the educational institution if structural attention was paid to it. In this study an intervention of three sessions has been offered to second year higher education students, which had a significant effect. This intervention can also be offered to first-year students to prepare them for the way of learning in higher education. In addition to this strategy

instruction, it would be good to also pay attention to self-regulated learning with learning strategies in the lessons, by guiding students more intensively in the beginning and allowing them to function more and more independently during the training. This could be done using the scaffolding principle (Van der Stuyf, 2002; De Boer et al., 2018; Dijkstra, 2019). In their first year, students can be intensively supervised in learning how to use learning strategies and developing the associated skills. This supervision can then be gradually reduced until the student is able to complete the assignments and internships completely independently.

Students also mentioned the value of working together on assignments, especially regarding planning and structuring. Learning from each other and gaining insight into how fellow students perform these tasks was experienced as very helpful. Several students mentioned an increase in self-confidence discussing their assignments with fellow students, which could possibly lead to higher levels of self-efficacy as well (Dunbar et al., 2018).

Limitations and future research

Within this research, there are a few factors that bring limitations with them, regarding the generalizability of the results. First of all, due to the COVID-19 circumstances, the educational institution that provided access to students for this research, outed the preference of not having a control group that did not follow the intervention. Being able to benefit from this intervention was considered considerably important for all students, which led to the choice not to form a control group. The lack of a control group makes it hard to guarantee that the significant improvement in perceived use of learning strategies can be contributed specifically to the strategy instruction. The introduction of a control group that does not follow the strategy instruction, but does complete all the questionnaires, is indispensable in follow-up research.

Next to that, it has to be taken into account that all questionnaires were self-reports. As stated by Kruger & Dunning (1999) and Paulhus & Vazire (2007), results of self-report are not always representing the actual situation, due to the chance of overestimating ones' own knowledge and skills within a specific topic. The limitations of students' self-report could be overcome by observing the students' learning behaviour and use of learning strategies in learning situations.

Final limiting factors are the low number of respondents (N = 20), which arose after having to delete incomplete results and results from students who had not attended all sessions of the intervention. This low number of respondents and the distribution of male (N = 3)/ female students (N = 17) impose limitations on the generalizability of the results. Therefore, it is desirable to extend research on this intervention in the field of strategy instruction for self-regulated learning to other studies, with a preferably more equal male/female distribution and within larger groups of students in order to improve generalizability

Two other aspects have to be discussed, both aspects that have been mentioned by multiple students, even outside the interview setting. Most students completely understood the fact that the interventions had to take place in an online environment. Nevertheless, they all were clear about one thing: impact of the intervention, in their opinion, might have been even bigger or better in face-to-face sessions. Students believe there is more social interaction and found this to be a necessary part of learning about this specific subject matter, which is also supported in literature (Fish et al., 2015; Landrum et al., 2020; Hagen, 2020).

Next to that, students also gave input on other external factors that had an impact on their ability to self-regulate their learning. Several factors were mentioned, varying from domestic issues to mental health issues and simple organisational issues within the educational institution. These factors all had their impact on the students' ability to self-regulate their learning in an optimal way. This ties in with a new line of research that addresses topics such as ego-depletion and cognitive overload as an explanation for limitations in self-regulation and self-regulated learning (Eitel et al., 2020). Several students indicated that external factors play such a big role that there is little room left for self-regulate their own learning as effectively as possible. Especially in these challenging times, attention should be paid to students who indicate that they are bothered by such external factors. More research into the precise impact of these factors therefore seems logical.

Conclusion

With levels of perceived use of learning strategies significantly increasing, levels of self-efficacy showing no significant improvement and no significant difference between receiving prior knowledge on perceived levels of use of learning strategies being found, it can be concluded that the used strategy instruction within the intervention with higher education students can be used by institutions in higher education to

give substance to developing the use of self-regulating learning strategies and with that, self-regulating capacity of their students. It will, first of all, make students aware of the existence of learning strategies and it will help students to improve their perceived use of learning strategies. Helping students develop these skills, will not only help them to successfully complete their current education, but also to be able to continue learning for a lifetime using effective learning strategies.

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Appendices

Appendix A

Interview scheme:

Construct	Question
General information on participation	Did you follow all three sessions?
	Did you make use of the screencasts before or after the sessions?
	Did you fill out both questionnaires?
	Did you receive the results on the first questionnaire?
Knowledge on self-regulated learning	Did you know what self-regulated learning was, before this trajectory started?
	After following this intervention, what is self-regulated learning to you now?
Strategy instruction	Did the three sessions on learning strategies help you improve your use of self-regulating learning strategies?
	Were the instructions on what learning strategies are and how to use them clear?
	What could have been done better in these strategy instruction sessions?
	What was already good and should be maintained?
Metacognitive knowledge on the own perceived use of self-regulating learning strategies	Do you think that getting the results or not getting the results on the first questionnaire has had an impact on following the sessions of the intervention?
	If you did receive the results, did it help you to focus better during the sessions of the intervention? What effect did that have on you personally?
	If you did not receive the results, did that have an effect on you following the sessions of the intervention? Did you know how to focus and on what?

Construct	Question
External factors (For example: emotional factors, economic factors, organizational factors, environmental factors, any other category of factors you can think of)	Do you think that there are external factors that have an impact on how well you are able to self-regulate your learning at this moment?
	What impact do you think these factors have on you right now?
	What would you need to be able to still get to self-regulate your learning, despite these factors?
	Would the use of learning strategies be of assistance?
	Is there anything your educational institution can do for you to help you manage these external factors?
	Are there other things your educational institution can do for you to help you progress in studying?

Appendix B

Table 1

Coding scheme semi-structured interviews

Category	Code	Example	Quote
Self-regulated learning	Self-confidence/ self-efficacy	Knowing that there are LS you can use Knowing that you can improve and that there are things you already master	"I had never heard of self-regulated learning or the use of LS before, I now feel more capable and confident to use them to help me."
	Motivation	Learning how to motivate yourself Learning that motivation exists of many themes and subjects	"Motivation can be learned, I never would have imagined that, I thought you just had it, or not."
	Metacognition	Learning about how your brain works	"It is nice to know that my brain is still developing and I'm not 'finished' yet."
	Organisation	Learning how to organise learning, learning-situations and the learning environment	"I now started planning ahead for the second semester, something I haven't done before."
	Personal	Learning that LS can be different for everybody and in every single learning situation Learning to set personal goals	"I kind of hoped you would give us a step-by-step guide on how to learn, but I guess it's different for everybody."
	Ownership	Learning that you can fill your own toolbox to be a self-regulated learner	"Now I can assess the assignment and decide what to do and which LS to use."
Strategy instruction	Instruction	Clarity of the instruction Variation in teaching methods Structure of the sessions	"The instruction was very clear and straight forward." "It was nice to be able to cooperate with my fellow students." "The sessions were well structured.
	Practicality	Practical character of the instruction Link to current assignments	"It was all very straight forward and practical; we could use it straight away in our assignments."

Category	Code	Example	Quote
	Organisation	Frequency of sessions Length of sessions Online/ face-to-face	"The length of the sessions was good." "It's too bad it was online, face-to-face would have had an even bigger impact, at least for me."
	Cooperation	Working with fellow students	"The break-out rooms were very nice, working together gives new insights."
	Mentality	Online challenges	"Lots of students don't even show up online. I really dislike that. I get it that online isn't always the best option, but you should at least show up. It's a disgrace that only 22 of us show up."
Learning strategies (LS)	Consciousness	More aware of the existence of LS Better able to consciously use LS	"I did not know these LS existed, now I find it very helpful to use them in my learning process."
	Toolbox	Concrete tools Practical use	"It's like I have a toolbox, filled with strategies I can use now."
	Mindset	Helps with insecurities Helps with motivation Gives peace of mind	"Knowing which LS there are and which ones I can improve really helps me motivating myself."
	Organisation	Helps getting things done Helps how to get things done Gives structure Helps planning ahead Metacognitive skills	"The LS are very practical and help structure your work" "The LS "looking ahead, monitoring and looking back" are really helpful."
Test-results	Accessibility	Access No access	"It really helped to get the results; it was nice to have access to them." "I didn't really mind not having the results, I know my own pitfalls."
	Focus	Helpful in what to focus on	"Having the results really helped me focus during the sessions." "Not having the results meant I had to focus during all sessions, which was fine for me."

Category	Code	Example	Quote
	Self-knowledge	Confirmation of knowing strong/ weak LS New insights in self	"It was interesting to see that I kind of really already knew what I'm good at and what I'm not good at."
External factors	Mental health	ADHD Insecurity Perfectionism Self-confidence	"My lack of self-confidence in how to tackle certain assignments really limits my ability to self-regulate my learning."
	COVID-19	Curfew Social contacts Online classes Limitations in internship schools Blur boundary school/ home and work/ leisure time	"Not being able to discuss with my classmates and teacher face-to-face has been really stressfull." "Online classes are a dread." "I found it hard that all had to be done at home. This way I lost my routine and the weekend-feeling."
		Procrastination Motivation	"I find it hard to motivate myself to start working on an assignment."
	Communication	Online communication Clarity of communication by educational institution	"Communicating everything online is very tyring."
	Home-situation	Space to learn/ study Noise Moving back in with parents	"I don't have a room for myself to be able to follow classes and do assignments with other students."
	Financial situation	Loss of jobs Moving back in with parents Parents having to pay rent	"My parents now have to chip in to pay for my rent, for I lost my job. I'm grateful, but also stressed."