Exploring changes in student teachers’ meaning-oriented learning

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ABSTRACT
This study reports on changes in student teachers’ meaning-oriented learning during teacher education and their perceptions of what enhances this learning. Students with a meaning-oriented learning pattern view learning as an active process of knowledge construction, are capable of regulating their learning, want to understand a topic thoroughly, form their opinions about it and draw their own conclusions. This study is situated in Dutch academic primary teacher education, covering student teachers’ entire study period. Quantitative data on changes in their learning patterns were collected using a pre-test/post-test design (N = 21). The student teachers’ perceptions of what enhanced meaning-oriented learning were explored by conducting semi-structured interviews after their graduation (N = 9). At the group level, changes were limited to an increasing use of deep processing strategies. At the individual level, changes varied from a moderate decrease to a high increase in meaning orientation. Increases appeared to be related particularly to student teachers’ perceptions of opportunities to learn from their own interests and to regulate their own learning; student teachers who reported having experienced such opportunities increased their meaning-oriented learning. The study indicates that student teachers could benefit from explicating and discussing these opportunities.

Theoretical background
Student teacher learning has been investigated from a variety of angles. For example, Fuller and Bown (1975) distinguished different stages in student teachers’ concerns regarding teaching, having many consequences for student teachers’ process of learning to teach in terms of both its focus and supervision or mentoring. Under the influence of developments in cognitive psychology, later research distinguished between phases in teachers’ expertise, indicating that student (and beginning) teachers are real newcomers who rely strongly on rules and still have much to learn, thus suggesting a predominantly deficit model of learning to teach (e.g. Berliner 1988, 2001). Based on learning-theoretical insights from educational psychology, it is nowadays believed that (student)
teachers’ learning does not strictly follow a linear growth process and that it is particularly their ways of learning that influence their professional development as teachers (e.g. Endedijk et al. 2014; Oosterheert 2001). Against this background, it is particularly interesting and complementary to previous research to study student teachers’ learning to become teachers from a learning pattern perspective.

Learning patterns are conceptualisations of student learning as combinations of a learner’s processing and regulation strategies, motivation for and conception of learning (Vanthournout et al. 2014). Processing strategies refer to the cognitive thinking activities and study skills that students apply to process input; regulation strategies refer to the activities used to steer these activities and skills. Motivations for learning reflect students’ personal goals, intentions, motives, expectations, attitudes and concerns with regard to their study. Finally, conceptions of learning can be defined as students’ beliefs with regard to what learning is (Vanthournout et al. 2014). Several terms have been used to denote this extended conceptualisation of student learning, such as learning orientations (Lonka and Lindblom-Ylänne 1996), learning styles (Vermunt 1992), study orientations (Nieminen, Lindblom-Ylänne, and Lonka 2004) and learning patterns (Pintrich 2004; Vermunt and Minnaert 2003). Where Vermunt (1992) originally used the term ‘learning styles’, from 2003 onwards he has used the term ‘learning patterns’.

One of the learning patterns explicitly identified is the so-called meaning-oriented learning pattern (Vermunt and Vermetten 2004; Law 2013; Van Petegem, Donche, and Vanhoof 2005). In studying a topic, students with a meaning-oriented learning pattern tend to use deep processing strategies (relating, structuring and critically processing input) and concrete processing strategies (relating theory to practical experiences and vice versa) and tend to regulate their own learning. They want to understand a topic thoroughly, form their opinion about it and draw their own conclusions. Meaning-oriented learners view learning as an active process of knowledge construction.

To be able to learn throughout their career, it is widely argued that teachers need to demonstrate a meaning-oriented learning pattern (see Oosterheert 2001; Vermunt and Endedijk 2011). Several studies on student teachers’ learning patterns in, for example, the Netherlands (Oosterheert 2001), Belgium (Van Petegem, Donche, and Vanhoof 2005) and Australia (Gordon and Debus 2002), have revealed that only a minority of student teachers are meaning-oriented from the start. To graduate as meaning-oriented learners, most student teachers will have to increase their meaning orientation during teacher education.

As learning patterns result from the interaction between learners and their learning environment (Marshall and Case 2005), the design of the learning environment is essential in enhancing meaning-oriented learning (e.g. Gordon and Debus 2002). The impact of the learning environment on student learning is mediated by students’ perceptions of the learning environment (Biggs 1999; Vermunt 2005).

The studies in which student teachers’ concerns and teachers’ expertise were addressed (e.g. Fuller and Bown 1975; Berliner 1988, 2001 respectively) are mainly based on student perceptions. Our study on the enhancement of meaning-oriented learning fits in this line; this study investigates student teachers’ perceptions of what enhanced their learning.

More specifically, the following research questions are addressed:

(1) Which changes occur in student teachers’ meaning-oriented learning patterns over the years of teacher education?
(2) Which elements of their learning environment do individual student teachers perceive to enhance meaning-oriented learning?

(3) What are the relations between changes in the meaning-oriented learning pattern and perceived enhancement of meaning-oriented learning?

**Method**

**Context**

The study is situated in the Dutch academic primary teacher education (PTE) context. Dutch regular PTE is a form of higher vocational education. In 2008, academic PTE was introduced alongside regular PTE. In academic PTE, both professional and scientific competencies are developed. Student teachers who meet the academic admission requirements have the opportunity to opt for either academic or regular PTE. At the start of academic PTE, students possess, like student teachers in other teacher education contexts, a limited meaning-oriented learning pattern (Van der Wal-Maris, Geldens, and Beijaard 2012). Their educators explicitly design learning environments aiming at provoking a meaning orientation.

**Participants**

Student teachers enrolled in the academic trajectories of three PTE institutes completed a questionnaire about their learning at the beginning and end of their study. In all, 44 student teachers volunteered at the first measurement point and 24 at the second measurement point (response rates: 95.7% and 96.0%, respectively). The absolute number of student teachers decreased due to discontinuation or change of study and study delay. The questionnaire was fully completed twice by 21 student teachers (all female); 1 student teacher (male) only answered the questions about processing and regulation strategies twice. The student teachers’ average age at the start of PTE was 18.3 years (SD = 1.0). Nine student teachers (three per institute) who completed the questionnaire in full twice were interviewed.

**Design of the study**

In this study, a quantitative and qualitative approach were combined. Changes in student teacher’ learning patterns were measured by the use of a questionnaire. Semi-structured interviews were conducted for acquiring profound knowledge regarding influences from the learning environment.

**Measuring changes**

Changes in the student teachers’ learning patterns were measured using the 100-item version of the Vermunt’s (1994) Inventory of Learning Styles (ILS). The questionnaire consists of 16 scales with 5-point Likert-type scale items. It has been demonstrated to be psychometrically sound in various contexts (e.g. Boyle, Duffy, and Dunleavy 2003; Vermunt and Vermetten 2004). For a more complete description of the instrument, its scales and quality, we refer to Vermunt and Vermetten (2004).
To establish patterns in learning within the context of PTE, we administered the questionnaire among all academic and regular student teachers of the PTE institutes at the start and the end of PTE (n = 676 and n = 199, respectively). Student teachers’ passive informed consent was obtained by informing them of the purpose of the questionnaire and the use of the results. All student teachers were given the opportunity to ask questions about the research. Respondents completed the questionnaires voluntarily.

Based on varimax rotated factor solutions for all scales, a factor which could be interpreted as a meaning-oriented learning pattern was identified for both measurement moments. This consisted of the components ‘deep processing strategies’, ‘concrete processing strategies’, ‘self-regulation strategies’ and ‘constructive conception of learning’. The scale reliability varied from .67 to .85. Per measurement moment, the scores were categorised and labelled both per component and for the meaning-oriented learning pattern as a whole. The scores of the lowest 15% of the respondents were labelled low, the next 20% below average, the next 30% average, the next 20% above average and the topmost 15% high (see Vermunt 1994). The categorisation is presented in Table 1.

Mapping perceived enhancement
To map the perceived enhancement of meaning-oriented learning, semi-structured in-depth interviews (60–90 minutes) were conducted 5–10 months after the student teachers’ graduation. Student teachers who completed the questionnaire twice were invited by email to participate in an individual interview; the content, method and purpose of the interview were explained. At the start of the interviews, student teachers’ active informed consent was obtained.

The interviewees were questioned about how they considered their education had enhanced the use of deep processing strategies, concrete processing strategies and self-regulation strategies respectively, as well as about their conceptions of learning. For each strategy, they were asked to describe which tasks, events and persons they perceived as particularly stimulating the strategy in question and to explain how this was done. After describing specific tasks, events and persons, the interviewer asked them to describe the enhancement of the strategy in general terms. The interviewees were also asked to describe what learning meant to them and the influence of their learning environment on their conception of learning.

Table 1. Categorisation of scale scores at the start and end of PTE (both academic and regular students) on components of the meaning-oriented learning pattern and overall.

<table>
<thead>
<tr>
<th>Component meaning-oriented learning pattern</th>
<th>Period</th>
<th>N</th>
<th>Low</th>
<th>Below average</th>
<th>Average</th>
<th>Above average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep processing strategies</td>
<td>Start</td>
<td>676</td>
<td>&lt; 2.2</td>
<td>2.2–2.5</td>
<td>2.6–2.9</td>
<td>3.0–3.3</td>
<td>&gt; 3.3</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>199</td>
<td>&lt; 2.0</td>
<td>2.0–2.3</td>
<td>2.4–3.0</td>
<td>3.1–3.3</td>
<td>&gt; 3.3</td>
</tr>
<tr>
<td>Concrete processing strategies</td>
<td>Start</td>
<td>676</td>
<td>&lt; 2.8</td>
<td>2.8–3.0</td>
<td>3.2–3.4</td>
<td>3.6–3.8</td>
<td>&gt; 3.8</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>199</td>
<td>&lt; 2.6</td>
<td>2.6–2.8</td>
<td>3.0–3.2</td>
<td>3.4–3.8</td>
<td>&gt; 3.8</td>
</tr>
<tr>
<td>Self-regulation strategies</td>
<td>Start</td>
<td>676</td>
<td>&lt; 2.1</td>
<td>2.1–2.3</td>
<td>2.4–2.8</td>
<td>2.9–3.1</td>
<td>&gt; 3.1</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>199</td>
<td>&lt; 1.6</td>
<td>1.6–1.9</td>
<td>2.0–2.5</td>
<td>2.6–2.9</td>
<td>&gt; 2.9</td>
</tr>
<tr>
<td>Constructive conception of learning</td>
<td>Start</td>
<td>672</td>
<td>&lt; 2.8</td>
<td>2.8–3.0</td>
<td>3.2–3.4</td>
<td>3.6–3.8</td>
<td>&gt; 3.8</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>195</td>
<td>&lt; 2.2</td>
<td>2.2–2.6</td>
<td>2.8–3.2</td>
<td>3.4–3.6</td>
<td>&gt; 3.6</td>
</tr>
<tr>
<td>Overall</td>
<td>Start</td>
<td>672</td>
<td>&lt; 2.5</td>
<td>2.5–2.7</td>
<td>2.8–3.1</td>
<td>3.2–3.4</td>
<td>&gt; 3.4</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>195</td>
<td>&lt; 2.2</td>
<td>2.2–2.5</td>
<td>2.6–2.9</td>
<td>3.0–3.3</td>
<td>&gt; 3.3</td>
</tr>
</tbody>
</table>

*Score for the lowest 15% of the population categorised as low; next 20% below average; next 30% average; next 20% above average; topmost 15%: high.
Relating changes and perceived enhancement
To relate changes in meaning-oriented learning patterns to the participants’ perceptions of what enhanced meaning-oriented learning, we combined the quantitative and qualitative data collected. In an iterative process, the changes, final categorisations, and the interview data were compared.

Data analysis
As changes investigated at the group level might obscure individual changes, changes in student teachers’ meaning-oriented learning patterns were determined both at group level and individual level (see Lindblöm-Ylänne, Parpala, and Postareff (2014). For both measurement moments, the meaning-oriented learning pattern as a whole and per component was categorised. Subsequently, the overall change in student teachers’ meaning-oriented learning patterns was determined. For the interviewees, change per component was also analysed.

The interview data were analysed within case and cross case through a process of data reduction, data display, conclusion drawing and verification (Miles and Huberman 1994). For the within-case analysis, all the interview recordings were repeatedly listened to by the first researcher. Next, a detailed summary of the interview data was made per interviewee and per questioned component; representative quotes were annotated. For the cross-case analysis, a matrix was developed to display systematically and together the data for all interviewees. The interviewees represented the rows of the matrix and the components of the meaning-oriented learning pattern represented the columns. A column was added in which personal characteristics as mentioned by the interviewees themselves, significant notes and quotes were recorded. Based on the detailed summaries, the first researcher completed the matrix and a second researcher noted key findings per interviewee and per component. The two researchers compared and discussed the data reduction. In most cases, the data reduction in the matrix and in the key findings corresponded with each other. When there was any doubt, the two researchers jointly studied the relevant parts of the detailed summary and discussed the considerations in interpreting the data until consensus was achieved. In rare instances, the original recordings were listened to again and in some cases this led to modifications in the matrix.

Before relating changes in the meaning-oriented learning pattern to the perceived enhancement of meaning-oriented learning, interviewees with a comparable degree of overall change were clustered.

Results
Overall changes
Overall, there were no significant changes in student teachers’ meaning-oriented learning patterns at the whole group level, but changes did occur at the individual level. Individual changes and final categorisations of the meaning-oriented learning pattern are visualised in Figure 1. Change is plotted on the horizontal axis, distinguishing between a large decrease, moderate decrease, slight decrease, no change, slight increase, moderate increase and large increase. On the vertical axis, the meaning-
oriented learning pattern at the end of PTE (final categorisation) is plotted, distinguishing between low, below average, average, above average and high.

Figure 1 reveals an increase in the categorisation of the meaning-oriented learning pattern for 11 student teachers (I), no change for 3 (II) and a decrease for 7 (III). Also, 11 student teachers started PTE with a meaning-oriented learning pattern ‘above average’ or ‘high’; at the end of PTE, the categorisation had not declined for any of these students and for eight the scores even increased. Four student teachers ended with an average meaning-oriented learning pattern, three as a result of a decrease and one as a result of an increase. For seven student teachers, the final categorisation was below average, for four of them as a result of a decrease and for three as a result of an increase. Based on the degree of overall change, we distinguished four categories of interviewees: interviewees with a) a slight decrease (Robin and Mia), b) no change (Nathalie and Puck), c) a slight/reasonable increase (Anna, Emma, Sophie and Maureen) and d) a large increase (Indy).

Changes in components of the meaning-oriented learning pattern

At the whole-group level, the student teachers significantly increased their use of deep processing strategies (p < .05). There were no significant changes in their use of concrete processing strategies or regulation strategies, or in their conception of learning as knowledge construction (see Table 2).
Table 2. Change per component of the meaning-oriented learning pattern at the whole-group level of academic PTE students.

<table>
<thead>
<tr>
<th>Component</th>
<th>Start</th>
<th>End</th>
<th>t</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep processing strategies</td>
<td>22</td>
<td>2.76</td>
<td>.58</td>
<td>3.05 .67</td>
</tr>
<tr>
<td>Concrete processing strategies</td>
<td>22</td>
<td>3.24</td>
<td>.73</td>
<td>3.25 .56</td>
</tr>
<tr>
<td>Self-regulation strategies</td>
<td>22</td>
<td>2.50</td>
<td>.53</td>
<td>2.44 .61</td>
</tr>
<tr>
<td>Constructive conception of learning</td>
<td>21*</td>
<td>3.35</td>
<td>.76</td>
<td>3.04 .68</td>
</tr>
</tbody>
</table>

*One student did not complete this part of the questionnaire.

Per interviewee, the change and final categorisation for each component of the meaning-oriented learning pattern, overall change and final categorisation are presented in Figure 2.

For seven interviewees, change at the component level pointed in the same direction as the overall change. This was not the case for Mia: she increased her constructive conception of learning.

![Figure 2](image-url)

Figure 2. Overview of interviewees’ individual change and final categorisation for each component of the meaning-oriented learning pattern and overall.
conception of learning, but overall her meaning-oriented learning pattern decreased. For Nathalie there was no change overall, but her concrete processing decreased in favour of deep processing.

**Changes, perceived enhancement and relation between the two**

**Deep and concrete processing**

At the whole-group level, the student teachers significantly increased their use of deep processing strategies, but no change in concrete processing was identified. In general, interviewees perceived their learning environment as enhancing the use of deep processing strategies directly as well as indirectly. An example of direct enhancement was the requirement to relate and structure input. Examples of indirect enhancement pertained to small group discussions, educators being committed to student learning and peers aiming at real understanding. Most interviewees tended to use concrete processing strategies independently but also felt enhanced in doing so. Examples of the latter were requirements to relate theory to practice, classroom interactions in which practical experiences were exchanged and related to theory and the fostering of reflection on practical experiences.

For the student teachers with a meaning-oriented learning pattern that decreased slightly, Robin and Mia, the use of deep processing strategies was limited. Both gave examples of how they depended on others in using these strategies. They especially perceived the exchange of teaching experiences during classroom sessions as very useful for a thorough understanding of theory. Mia felt that her educators frequently supported connecting theory and practice by providing ideas for practice.

The meaning-oriented learning patterns of Puck and Nathalie did not change. Puck’s use of deep and concrete processing remained unchanged and Nathalie reduced concrete processing in favour of deep processing. She recounted that she believes both kinds of processing strategy to be important, that she personally tends towards concrete processing and felt that academic PTE provoked deep processing. Both Nathalie and Puck experienced many opportunities to learn from personal interests and both perceived this as enhancing deep processing. Puck also provided examples of how the requirement to share knowledge increased her use of deep processing strategies. Furthermore, both students felt that deep processing was enhanced by the support and commitment of their educators. In response to the question of how educators enhanced deep processing, Nathalie said:

_Ehm [...], showing interest and then asking supplementary questions about things, or just challenging you like: ‘OK, and can you figure out how this works?’ or ‘Why did you make that choice?’ Asking questions … the commitment was important._

Nathalie experienced being questioned and experiences in practice schools as evoking a search for deep understanding. According to Puck, the clear focus on relating theory, practice and one’s professional identity worked as a catalyst for both deep and concrete processing.

For Anna, Emma, Sophie and Maureen, interviewees with a slight or moderate increase in meaning-oriented learning pattern, the degree of change in their use of deep processing strategies varied from no change to a large increase. Emma, Anna and Sophie showed little or no increase in their use of deep processing strategies and ended
with low use (Emma) and below average use (Anna and Sophie). Emma and Anna perceived that some academic courses enhanced deep processing, especially the requirement to study theory themselves, followed by small group discussions and questioning each other’s perspectives. Sophie and Anna stated that it was towards the end of their study that they became motivated to search for deep understanding. Anna felt that the assignments became more open and related to students’ personal and professional identities; she started to really search for literature and aim for deep understanding. Maureen greatly increased her use of deep processing strategies. She recounted that once she became used to the open assignments, she felt encouraged to search for deep understanding. She explained the role of open assignments thus:

   In particular, focusing on searching for arguments, structuring, relating, real understanding.

Maureen realised the importance of relating theory to practice, but she had to be encouraged externally to do so; however, when motivated, she processed theory in depth automatically. The four student teachers all slightly increased their use of concrete processing strategies. They perceived concrete processing as being enhanced by frequently discussing experiences in practice schools and through tasks inducing the use of theory in practice.

   Indy, who presented a large increase in her meaning-oriented learning pattern, stated that her use of deep and concrete processing strategies depended on whether she felt herself to be a beginner or becoming an expert. Once she felt she had increased her expertise, she started to analyse theories critically and come up with personal opinions. Indy felt challenged to search for deep understanding through the ongoing study of new perspectives and transfer from theory to practice. She said:

   Through the requirement to collect literature and by studying new literature again and again, your thoughts get structured again and again. But … in most assignments, the learning experience was greatest when you experienced it in practice.

Self-regulation

Among the whole group there were no significant changes in the use of self-regulation strategies. Interviewees hardly reported on the requirement to use self-regulation strategies. They did mention opportunities for self-regulation, for example by being offered open assignments. Two interviewees said that self-regulation was enhanced by a feeling of being encouraged and supported to regulate their own learning. Three interviewees reported a shift in their education from external regulation to opportunities for self-regulation, two interviewees experienced a need to regulate their own learning by a lack of external regulation and two others felt that external regulation hindered their self-regulation.

The interviewees with a slightly decreasing meaning-oriented learning pattern experienced little need for regulating their learning. Mia said the following about the external regulation of her learning:

   Everything is quite determined. You know the goal and how to accomplish it. Actually, it was quite like you followed the institute’s pre-determined route.

Robin experienced a gradual shift from external regulation to self-regulation and felt that teachers and peers were very supportive in building up her self-confidence.
The interviewees whose meaning-oriented learning pattern was high from the start highly regulated their own learning, both at the start and at the end of their study. They felt that educators stimulated them to do so or at least provided opportunities. Puck also perceived self-regulation as being enhanced by the demand to reflect (e.g. on her teaching competencies) and by the clear focus in her education. Nathalie felt that self-regulation was strengthened by the gradual reduction of scaffolding of student learning while educators continued to be engaged.

Apart from Anna, the students with slight/moderate increase in meaning-oriented learning patterns increased their use of self-regulation strategies. Emma perceived that educators increasingly scaffolded self-regulation on request and Sophie experienced opportunities for self-regulation and for adjusting learning to her own interests. Concerning these opportunities Sophie said:

At some point, a teacher says: ‘I think about this and this, does that interest you too? Or would you like to learn more?’

Sophie perceived that increasing interest in her study led to increased self-regulation. She attributed this change in interest to the supervisor of her bachelor thesis, who she viewed as very committed, helpful and intelligent. Maureen stated that in her learning environment, the need to make one’s own choices in learning content within existing frameworks was customary.

Looking back, Indy realised that she felt like a beginner when she started something new (e.g. a course). At those moments, she acted as a help seeker and relied strongly on teachers and peers. Indy perceived that over the years of education, the shift from external regulation to self-regulation was enhanced. There was a gradual transition from concrete and externally structured assignments to more open assignments and an increasing requirement to regulate one’s own learning while being scaffolded.

Constructive conception of learning

At the whole-group level there was no significant change in students’ conceptions of learning as knowledge construction. When questioned about their conceptions of learning, all interviewees stated that learning requires one’s active involvement and that they were challenged to engage. Three interviewees indicated that their learning environment was strongly focused on knowledge construction.

The student teachers with a slightly decreasing meaning-oriented learning pattern felt that active involvement in their own learning was stimulated. For Robin and Mia, the final categorisation of their conception of learning as construction of knowledge was below average and on average respectively; they both considered learning especially as ‘doing’. Robin said her learning was optimal when she was able to apply theory to practice.

Puck, one of the highly meaning-oriented student teachers from the start, was convinced that the essence of learning lies in constructing knowledge by relating theory, practice and one’s professional identity. She stated:

[The institute] opted for relating theory, performance in practice and professional identity, as these three underlie who you are and how you act in a classroom situation.

Nathalie emphasised that, to her, real learning is ‘result oriented, active knowledge construction that equips you to change things for the better’. This view was supported
by the obviousness of critical processing theory, as expressed in her learning environment, and by opportunities to relate theory to practice.

In terms of the students whose meaning-oriented learning pattern as a whole slightly/moderately increased, Anna and Emma slightly increased their view of learning as knowledge construction; Sophie did not. All three ended with a constructive view of learning that was below average. Maureen viewed learning as knowledge construction from the start of PTE. According to Anna, real and lasting learning occurs when learning activities aim to form a personal opinion and as such change one’s thoughts or being. She indicated that the combination of academic and professional education created such opportunities. For Emma, real learning needs active involvement. She was aware that she still had to develop this and said:

For me, real learning is doing [. . .] However, sometimes I still find it difficult because I am not really accustomed to it. I was used to simply opening the book and starting to memorise.

Sophie felt that real learning is about actively processing knowledge and that motivation triggers this. Maureen indicated that real learning occurs when one is intrinsically motivated, regulates one’s own learning and constructs one’s own knowledge. In her opinion, seminars (teaching units dealing with an educational dilemma) especially matched her conception of learning.

Indy, whose meaning-oriented learning pattern increased greatly, developed a constructive view of learning. She stated that becoming a professional includes constructing one’s own knowledge and insights and felt that this view was highly shaped by her education.

**Discussion**

For the group of student teachers, the increase in their meaning-oriented learning patterns was limited to an increase in their use of deep processing strategies. The use of concrete processing strategies was high from the start; a ceiling effect could therefore be an explanation for no further increase. Students’ use of self-regulation strategies was limited at the start of PTE and did not increase. These findings differ from those of a study among Flemish student teachers (Donche and Van Petegem 2009). A significant increase in the use of self-regulation strategies was identified in their study. A no increase in self-regulation might be a reason for concern. It is questionable whether the student teachers, once graduated, will then be able to regulate their continued learning. We suggest not only offering opportunities for self-regulation, but also making these explicit, modelling the use of self-regulation strategies, scaffolding self-regulation and regularly reflecting on students’ regulation of learning. Another reason for concern might be that no increase was found in students’ conception of learning in terms of knowledge construction. If one starts working as a teacher in an environment that does not enhance the search for deep understanding, it is questionable if one will continue to use deep processing strategies. No increase might also present difficulties for another reason: it is likely that teachers’ learning conceptions will influence their teaching. Students who are educated by teachers who lack a constructive view of learning will not be stimulated to construct their own knowledge.
At the individual level, our analyses are both striking and promising. For all student teachers whose initial meaning-oriented learning pattern was categorised as above average or high, this pattern remained ‘strong’ or became even stronger. For half of the student teachers with an initial meaning-oriented learning pattern below average, this pattern became stronger.

In the enhancement of meaning-oriented learning, the focus was primarily on the use of deep and concrete processing strategies. An explicit requirement to use self-regulation strategies was rarely reported. Within the same learning environment, some interviewees experienced opportunities for regulating their own learning, while others felt hindered. These findings indicate that the enhancement of self-regulation might also result in an increase in students’ use of self-regulation strategies.

The quantitative data suggest no increase in a constructive conception of learning, but the interviews nuanced this finding. Most interviewees stated that learning requires active involvement and that they were stimulated to actively engage.

This study attempts to identify elements of student teachers’ learning environments that enhance their meaning-oriented learning. Relating individuals’ changes in meaning-oriented learning patterns and their perceptions of their learning environment reveals that in the same learning environment, a student teacher saw opportunities to fit her learning to suit her own interests, whereas other student teachers did not experience such opportunities. In contrast to the former, the latter did not increase their use of deep processing strategies. Interviewees whose use of deep processing strategies increased during their last year also felt that opportunities to learn from their own interests had increased during that year. A largely comparable picture emerges for the use of self-regulation strategies: two interviewees with a slight decrease in their meaning-oriented learning pattern experienced that their learning was highly externally regulated, but another interviewee, enrolled in the same learning environment, experienced many opportunities for regulating her own learning.

Our research reveals that not all student teachers are affected by the learning environment to the same extent or in the same way (cf. Postareff, Parpala, and Lindblom-Ylänne 2015). The study indicates that student teachers’ perceptions of opportunities to fit learning to suit their own interests seem crucial for meaning-oriented learning. We therefore recommend that educators explicate and discuss these opportunities with their students.

Limitations and suggestions for future research

We used a pre-test/post-test design to investigate changes in meaning-oriented learning patterns. Such a design does not provide a clear indication of the origin or complexity of the students’ learning trajectories (Schmitz 2006). In a follow-up study we will also focus on student teachers’ development of a meaning-oriented learning pattern in intermediate years. Furthermore, this study enrolled a limited number of participants. Comprehensive research on this topic is needed to provide further validation of the findings.

Conclusion

Our study reveals that student teachers who participated in an academic learning trajectory showed changes in their meaning-oriented learning patterns during their
course of study. At the whole-group level, change was limited to an increasing use of deep processing strategies. Student teachers’ use of concrete processing strategies remained high, while their use of self-regulation strategies remained low. Overall, students especially perceived the enhancement of deep and concrete processing. At the individual level, changes varied. The data suggest a relation between the direction and degree of change of student teachers’ meaning-oriented learning patterns and their perceptions of opportunities to fit their learning to suit their own interests and of possibilities to regulate their own learning.

**Disclosure statement**

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