

Promoting Pre-service Teachers' Domain-general Metacognition

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Abstract. The current study explores the possibilities of promoting the prospective teacher's domain-general metacognition in the university study process.

The aim of the study is to investigate which content of reflection is more relevant for effective enhancing teacher education students' domain-general metacognition.

To reach the aim, the structure of metacognition is analysed; metacognition (MC) components are interpreted from the perspective of transformative learning to define the indices for the domain-general metacognition; a set of open-ended sentences is constructed for reflection which includes all components of MC; and the significance of different sentences for providing the students' domain-general metacognition is proved in a mixed-methods study.

Keywords: domain-general/domain-specific metacognition, transformative learning, reflection, teacher education.

Būsimų mokytojų bendrųjų metakognicijų ugdymas

Santrauka. Pristatome tyrime siekiama išsiaiškinti, kaip galima ugdyti būsimų mokytojų bendrąsias metakognicijas universitetinių studijų metu.

Tyrimo tikslas – ištirti, kokia refleksijos forma efektyviau padeda ugdyti bendrąsias studijuojančių būsimų mokytojų metakognicijas. Šiuo tikslu analizuojama metakognicijos (MK) struktūra, jos komponentai interpretuojami transformuojančio mokymosi priegios aprėptyje. Siekiant apibrėžti bendrųjų metakognicijų parametrus, sukurtos visus MK komponentus apimančios sakinių užbaigimo užduotys refleksijai, o pristatome mišrių metodų tyrime įrodoma sakinių užbaigimo užduočių reikšmė ugdant studentų bendrąsias metakognicijas.

Pagrindiniai žodžiai: bendroji / mokslo srities metakognicija, transformuojantis mokymasis, refleksija, mokytojų rengimas.

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Introduction

In today's world, a teacher must be ready for continuous changes, he can do this if the knowledge, skills and competences acquired in the studies not only remain in the future teacher's memory, but "sit" deep into the personality structure, i.e. the learning is transformative (Dirkh et al. 2006).

The question is – how to help the teacher's personality change in teacher education, so that he/she not only knows *what* and knows *how to do*, but also confidently uses his knowledge in practice and flexibly applies it to new, challenging situations.

Metacognition (MC) is considered as an essential component of the teacher's professional competence (Flavell 1979; Hattie 2016; Tanner 2012). The metacognitive teacher takes responsibility for his/her thoughts, actions, and lifelong learning, thus developing self-confidence, self-determination, and direction (Blömeke 2017; Callan and Shim 2019; Dignath and Büttner 2018), and can have a very positive effect on students' outcomes (Perry et al. 2019). Researchers distinguish two types of MC – depending on their attachment to a specific learning content – domain-centred MC and domain-general MC. The domain-general metacognition is supposed to be helpful for the teacher to make more precise decisions required by nonroutinised situations (Hiver et al. 2021).

Thus, there is a need for MC that promotes transformative learning in study process – not only concluding, interpreting, and estimating, but also the internalising and displaying knowledge (Azevedo 2020; Halupa 2017).

In education, a learner's metacognition is provoked in the process of reflection. Various tools for stimulating the students' reflections have been developed for educational purposes (Kaplan and Silver 2018; Siliņa-Jasjukeviča and Briška 2018; Briška and Kalēja-Gasparoviča 2020). There are many varieties of open-ended sentences and questions, but the problem is to what extent they are relevant for promoting students' domain-general metacognition, and how to do this in the most effective way. This should be both deep and reasonable, but at the same time not time-consuming.

The aim of the study is to create and test a tool for self-reflection of teacher education student's learning to investigate which kind of instruction is more relevant for effectively enhancing the teacher education students' domain-general metacognition.

To reach the aim:

1. Components of metacognition are analysed and interpreted from the perspective of transformative learning to define the indices for the domain-general metacognition.
2. The set of open-ended sentences for reflection, which includes all components of MC, is constructed.
3. The significance of particular open-ended sentences in providing the students' domain-general metacognition is proved in a mixed-methods study.

The results of the study will help to improve teachers' education in a transformative direction by effectively promoting the future teacher's domain-general metacognition. The results of the study will contribute to teachers' professionalism, too, by enabling them to transfer their own reflective experiences gained in studies to their school practice.

Theoretical background

American developmental psychologist John H. Flavell (1979) was the first to define and study the concept of *metacognition*. He described it as thinking about thinking, and regulating this thinking is thought to underlie all human learning and intelligent behaviour (Flavell 1979; Hiver et al. 2021). Since then, research in this field has been carried out by psychologists, anthropologists, biologists and, of course, educators. All of them have concluded that metacognition itself is a multi-faceted concept. Metacognition refers to the processes used to plan, monitor, and assess one's understanding and performance. Metacognition includes a critical awareness of one's thinking and learning, oneself as a thinker and learner (Chick 2013; Flavell 1987), attentional control, cognitive flexibility, emotional regulation, and anticipatory planning (Miyake et al. 2000).

Usually, the following three aspects are highlighted as important for the understanding of metacognition: one's *metacognitive knowledge*, *metacognitive regulation*, and *metacognitive experience*.

Metacognitive knowledge is related to what a person **knows about** cognitive processes. It includes three types of knowledge: declarative, procedural, and conditional knowledge (Flavell 1987). According to Pintrich (2002), *metacognitive knowledge* includes knowledge of general strategies that might be used for different tasks, knowledge of the conditions under which these strategies might be used, knowledge of the extent to which the strategies are effective, and knowledge of self.

Metacognitive regulation refers to what individuals **do about** learning, how learners monitor and control their cognitive processes. Metacognitive regulation appears in the planning, monitoring, evaluating, and control process of thinking in order to facilitate learning (Stanton et al. 2015). Metacognitive regulation includes meta level (metacognition) and object level (cognition) (Nelson and Narens, 1990). Metacognitive regulation involves the use of certain strategies and knowledge in the process of metacognition. According to neuropsychologist Hartmann, strategic knowledge involves knowing *what* (factual or declarative knowledge), knowing *when and why* (conditional or contextual knowledge) and knowing *how* (procedural or methodological knowledge) (Hartmann 2001).

Metacognitive experience refers to what a person is aware **and feels about**. Metacognitive experiences are characterised as conscious cognitive or affective experiences that occur during the enterprise and concern any aspect of it – how often, how well it is going, satisfaction/dissatisfaction, situational reactions, self-confidence (Flavell 1979; Lin et al. 2005). Feelings and emotions as one's internal response to learning are important expressions of metacognitive experience. As a feedback system, they help to understand one's progress, expectations, comprehension, and connection to new information. As Efklides (2009) points out, being part of the affective loop, metacognitive experience is related to motivation and self-processes; being part of the cognitive loop, they are connected to metacognition knowledge and skills, the latter being declarative and procedural knowledge.

Metacognitive knowledge, regulation, and experiences are regulated by contextual conditions. Lee argues that metacognitive teachers' decisions and practices are regulated by contextual conditions rather than dependent solely on individual thought (Lee 2005). Perry and others acknowledge that the context can either promote or inhibit the development of one's metacognition (Perry et al. 2019). Parsons et al. even argue that the understanding of context is a crucial condition for initial teachers to develop the metacognitive capacity (Parsons et al. 2018).

A persistent issue in research is distinguishing between domain-general and domain-specificity of metacognition. It is argued that specific metacognition must be taught for each task or field separately, whereas general metacognition may be instructed concurrently in different learning situations and thus is expected to transfer to new learning situations (Azavedo 2020; Veenman et al. 2006). If there is the need for teachers to be flexible, adaptive, and capable of transferring metacognitive knowledge and skills to a variety of evolving challenges and in real-world applications (Azavedo 2020), the domain-general metacognition seems to be more adequate for meeting this purpose.

On the contrary, other authors argue that the metacognitive skills are domain-general in nature, and there are no specific skills for certain subject areas (Chick 2013; Perry et al. 2019; Pintrich 2002; Stanton et al. 2015; Stephanou and Mpiontini 2017; Wenden 1998). From this it follows that to initiate the domain-general MC, each study course has to look at what is beyond the boundaries of a certain field and therefore common with other fields. In accordance with social constructivism, these are the person's individuality and context of learning (Helds 2006; Kron 2004). This means that criteria for the domain-general MC are the student's awareness of one's subjective experiences, as well as different socio-cultural contexts. Brookfield (2012) argues that when reflection involves the recognition and critical analysis of one's own assumptions, learning becomes transformative. A person's assumptions are determined by their cultural background, and to be aware of them as one's own, the person must see themselves from the side-lines. As a result, the students can transfer knowledge among varying contexts.

An important way to provoke the student's metacognition in the learning process is reflection – looking back on their actions, feelings, and thoughts in order to notice, process and analyse one's experiences. But not all reflection is metacognitive. It depends on the content and form of reflection. Regarding the MC structure and its relationship to transformative learning, there is a question about the content of reflection in the study process. There is an issue for the teacher trainer, how to select the questions for designing the reflection form to initiate all aspects of MC and to promote students' growth in the next step of thinking, not only on the performance, but on the personal experiences and meanings of one's activities, feelings, and learning in different contexts, as well (I learned, felt, understand, plan, etc.).

There are a variety of reflection methods, including think aloud protocols, observations, monitoring judgements, error-detection tasks, and self-report questionnaires, which are the most prevalent, as well as being the most efficient and economical ones (Peteranetz 2018).

As MC experiences are individual and subjective, reflection must touch the student's actual feelings and personal preferences. In accordance with Blummer and Kenton (2015), the sentences containing the pronoun 'I' provoke a response to learning and promote one's deeper thought processes and evaluation of the experience gained.

For MC to be domain-general and transformative, the reflection must include more general questions in addition to field-specific ones in each study course, as well as those relating to individuality, life, and cultural context. The field-specific issues will follow in each sentence by students' initiative.

To include the context in the student's reflection, the evaluative judgements should be included in the instruction.

Methods

A mixed-methods study was carried out to understand which instruction of reflection helps to initiate the student's domain-general MC in the most efficient and economical way.

To find out the answer:

- A reflection form was created and placed in GoogleForms.
- Data were collected by distributing a survey to students.
- The obtained data was coded by interpreting the students' statements in MC categories.
- The number of codes in each statement was counted.

Then it was compared:

- Which statements help to reflect professional knowledge and skills (domain-specific MC) better?
- Which statements help to reflect personal feelings, attitudes, values (domain-general MC)?
- Which of the proposed statements do the students recognize as the most important for their learning?

For a template for reflection, the self-report questionnaire with open-ended sentences oriented to different aspects of metacognition was created.

To involve MC, open-ended sentences began with words which focussed on the student's feelings and cognitive processes. To finish the sentence, students had to observe themselves from the side-lines, not only seeing the action, but also themselves as the doer, as well as the situation (context) in which the action or learning has taken place.

To fix **MC knowledge**, cognitive processes were named in the sentence introduction ('I learned...', 'I did not understand...'). The student can say this about professional knowledge or about learning, thinking processes or values.

As **MC regulations** relate to the activity when the students are aware of the planning, realisation, monitoring, regulating and evaluating the aims, steps, strategies, and results of their either practical or theoretical external/internal activity and/or learning, the reflection issues were begun with terms of doing and planning: 'I can do well', 'I will use in future', 'I want to learn'.

MC experience manifests as student's affective experiences, feelings, situational reactions as satisfaction/dissatisfaction, self-confidence (Lin et al. 2005). That is why the phrases 'I was surprised by', 'now I am sure' were included in reflection. A surprise was chosen from a variety of emotions because it is a reaction to something unprecedented, namely something different from the person's previous notions and assumptions (which is important for transformative learning).

The student's evaluations, beliefs, conceptions that indicate the presence of the awareness of **MC context** depend on the mutual interaction of the student's cultural background, life experience, and actual learning situation. To initiate a student's estimates and judgements, as the general expression 'It was important for me' was chosen (Figure 1).

Please, finish the sentences!

I learned...

I was surprised by...

Now I am sure that...

I can do well...

I did not understand...

It was important for me...

I will use it in future...

I want to learn...

Mark the three sentences that helped to reflect on the experience gained!

Figure 1. Reflection instruction

Data were obtained at the end of the training phase (cycle of lectures in language or art didactics), students were asked to reflect on their learning by completing eight sentences, and then reflect on which sentences were the most significant ones. In the remote study process, a questionnaire was completed electronically by students. The sample consisted of 66 Primary school teacher education programme students at the University of Latvia – one group of first-year students (20 students), two groups of third-year students (19 and 25 students).

Results

The content analysis of data was done to mark the manifestations of different aspects of metacognition in student's reflections according to the theoretical framework and criteria analysed above. In expressions, the meaning units describing the student's awareness of professional knowledge and skills, individual experiences, feelings, and evaluations and substantiations were coded. They were searched for in all statements, even though initially each topic was targeted at a different category. Then the codes were generalised by distributing them into two categories related to domain-specific and domain-general metacognition. The coding was proceeded and discussed by two experts.

MC knowledge means to be aware of one's knowledge and skills and appears in statements which include the use of professional terminology. In teacher education, the domain-specific metacognition refers to the recognition and analysis of the organisation of content and methods for school student's education. The categories of pedagogical process (domain-specific) were not mentioned in the open-ended sentences; so, it was the student's choice which of them to include in the reflection. Typical examples are shown below:

I know that it is necessary to respect school students' needs.
I learned the visual art types.
I can organise work with text.

This type of statements predominated in most cases. The respondents showed the ability to use professional terminology but did not show how deeply internalised knowledge is to be used in other situations. They can be interpreted as declarative knowledge (Efklides 2009; Flavell 1987; Hartmann, 2001, Suchanova 2006). From these expressions, it is not possible to judge if it is the use of formal, profession-related phrases or nomination of noticed details and changes in experience what would confirm the domain-general MC.

In students' responses, **MC regulation** was marked if the planning, monitoring, evaluating of the process, activities, and learning was mentioned (Stanton et al. 2015). MC regulation related, in students' responses, to practical activities (painting, writing a lesson plan etc.) and to learning activities (writing notes, comprehension, involvement, teamwork, listening etc.). If the students' reflection on their activities was related only to the course content, it was categorised as the domain-specific MC. For example:

I know that it is necessary to respect school students' needs.
I want to acquire knowledge and skills in lesson planning.
In practice I will use what I have learned during lectures. How to start a lesson, how to build an hour for each activity performed by a child is based on how to create worksheets, how to build feedback at the end of the lesson.

If the respondents demonstrate the awareness of their learning and reasoning processes, it is marked as the domain-general MC regulation. For example:

I could not write down all the ideas and thus also pass through myself.
I will use practical ideas I gained in lectures to develop children's reading skills in my family. It was important for me that the teacher shared real life experiences, my colleagues shared real life experiences and it gave me more understanding to really plan a meaningful lesson for the students.
I was amazed at how many new things it is possible to learn during three lectures, to repeat it all several times, still being able to do independent and group work, discussing everything and making sure of what I have learned.

MC **experiences** were marked if they included a description of one's emotional experiences and feelings. All of them were categorised as domain-general because there we see the involvement of personality – awareness of one's experience and judging about its causes (Dirkh et al. 2006). There are examples of typical expressions:

I want to be more confident.
I have ideas and creativity, but sometimes I'm not sure I do the right thing.
It was important for me to learn to understand what I see and feel.
I really like to express myself creatively.

It can be seen here that the respondents' MC affects the student personally; it goes beyond the professional field.

Expressions which contain evaluation criteria chosen by the student or which could be interpreted as a point of view, were categorised as the **context** aspect of MC. Reasoning and/or justification, on the one hand, means the personally significant choices that are worth paying attention to, but on the other hand, it contains the broader view of a person's experience and cultural background, and their attitude to a given context.

I learned that meaningful learning is about values, not just meeting the needs of students.
I learned that language permeates our entire lives, that we use language all the time.
It was important for me to understand the topic of the lecture and show my knowledge.
I want to learn to think openly, to be ready for any turn.

For example, the first expression can be interpreted as a point of view of a school student's meaningful learning; the second – as the context of the language; the third – as the respondent's studies; and the fourth – as the context of a challenging life. In these expressions, the criteria of evaluation differs as well. They are either the development of a child, human communication, self-esteem, or open-mindedness. The third example was interpreted as the domain-specific MC, whereas evaluation takes place in the context of professional education.

If the respondent has tried to substantiate or explain their opinion in more detail, it indicates a deeper reflection of their experiences and a search for meaning.

I want to learn and always hear the wishes and needs of each child, so that each child can learn with his or her personal interest.
I want to learn more about literature and read more books that I don't do as much daily. I will definitely read to my child in the future.

The use of explanatory auxiliary sentences such as 'because', 'as', 'for', 'in order to', and 'so that' can be argued to be a reliable sign of the domain-general metacognitive experience, too. It means that a respondent has devoted more time to contemplation looking for the personal sense of the learning. Such responses are a sign of a person's transformation as a result of metacognitive thinking.

The results were compiled statistically in Excell to indicate which open-ended sentences were more conducive to student's domain-general metacognition.

Then the students' justifications about their priority issues of reflection to realise the dominant perspectives which impacted their metacognition were summarised.

Domain-specific variants appeared in practically all statements. In each sentence, teachers mentioned the categories relevant to the particular study course. As in this study, they were language or visual arts methodologies; the terminology of language, art, and culture was used as well as psychology and pedagogy. Their quantities were not further compared as there were virtually no differences.

In turn, the number of domain-general answers was significantly different for different questions (Figure 2).

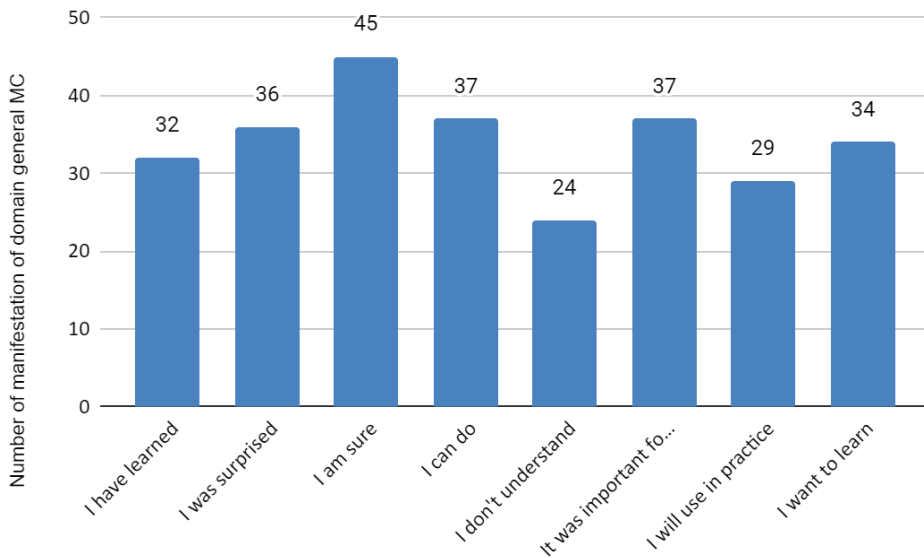


Figure 2. Manifestations of the domain-general MC in each of eight issues of students' reflections

The diagram shows that most of the domain-general related MC responses were found in the sentences 'I was surprised' (36), 'Now I am sure' (45), 'it was important' (37), and 'I want to learn' (34). Two of them are directly related to student's emotional experiences – surprise and sense of self-confidence. 'I want to learn' refers to planning for the future, formulating my interests and needs. 'It was important for me' makes an assessment. As no criteria are indicated at the beginning of the sentence, the student adds their own ones, which originate from their individual life experience and cultural context.

The open-ended sentence 'I didn't understand' is the least encouraging the student's domain-general MC (24). This may be because no one wants to show their ignorance. It should be noted that this is the only sentence in which the form of denial was used.

In the survey, respondents were asked to indicate the three incomplete sentences that best foster reflection on their learning. The students' priorities are summarised in Figure 3 and compared with manifestations of the domain-general MC indicated by the content analysis.

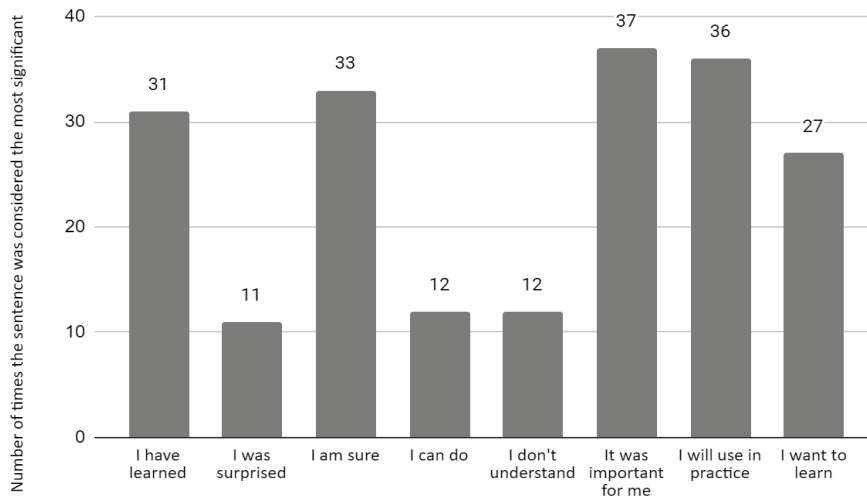


Figure 3. How many times each item was recognised as more important in students' opinion

The students' opinion on the significance of the reflection content differs from Figure 2, which shows how the domain-general MC manifests in students' responses. The two sentences of about equally high significance in both cases are 'It was important' (37 and 37 from 66 responses), namely, the sentence oriented to the awareness of MC context, and 'Now I am sure' (45 and 33) which reflects the possibility of experiencing pride and self-esteem.

Other student priority choices are more related to MC knowledge and regulation – 'I learned', 'I will use it in practice', 'I want to learn'. Significantly, students find it more important to put knowledge into practice, but the idea of further learning is less important. In contrast, Figure 1 shows that the domain-general MC is more about reflecting on what I want to learn than about what I will use in practice. This shows that students are more focussed on acquiring professional knowledge and skills that are useful in certain situations at school, and not so much on the awareness of one's personality or the sense of learning. This could mean that prospective teachers see their profession pragmatically, mostly as a craft, where they perform routine things properly, applying their knowledge and skills, rather than living an interesting life, with continuous growth, meeting challenges, and flexible adaptation to diverse situations.

The biggest difference between students' evaluations and the results of the content analysis is in the sentences 'I was surprised' and 'I can do it well'. The data show a high

level of domain-general MC there, but the respondents themselves do not mark these open-ended sentences as important to them.

According to the theory, the domain-general MC helps to internalise knowledge and experience, and then use them in other unforeseen situations (Chick 2013; Perry et al. 2019; Stephanou and Mpiontini 2017). Whereas students underestimate important components of the domain-general MC, there is a risk that they will not use them purposefully in learning and professional activities. There is the possibility of making a teacher's education more transformative by completing the reflection of emotional experiences and emphasising the students' strengths.

Discussion and Conclusions

The domain-specific MC relates to the awareness of one's professional knowledge and skills. In the domain-general MC, an individual's feelings, emotions, personal significance of the experience are involved as well as life contexts beyond professional activities. These are statements in which students describe their feelings and cognitive processes, or express judgements based on their own perceptions, which are undoubtedly influenced by their experience and life context.

The domain-specific MC is detected in all students' reflections after the completion of a certain study cycle. It seems that it is a common and understandable form of reflection for students and widespread in students' previous educational experience.

Students' domain-general MC is more frequently noticeable in open-ended sentences, which call for reflection on the action taken and the learning experience gained, not so much on the knowledge. It was best facilitated by the open-ended sentences 'I am sure ...', 'I can do ...', 'It was important for me ...' and 'I was surprised ...', but less important were 'I learned...', 'I didn't understand ...'.

In the students' evaluation, the most important reflection issues were those related to the evaluation of professional experience – knowledge and skills. It can be concluded that reflecting the feelings, emotions, personal experiences, and cultural background are not considered significant.

It can be assumed that without the fostering of the general-domain MC in the reflection process, transformative learning cannot be convincingly implemented in teacher education practice. This assumption is worth testing in a longitudinal study.

Deep and transformative reflection can be indicated by particular words and grammatical constructions. It is a debatable issue whether a text which lacks such constructions or lexicon indicates superficial or only domain-oriented metacognition. It is possible that the ability to reflect deeply on the gained experience depends on the student's language skills, or they can differ in different situations in which reflection occurs. It follows that further research would investigate how the student's domain-general MC reflection is affected by their personality and/or language skills.

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