

Fostering pre-service teachers' motivation-related practical wisdom through a mentoring procedure

Abstract

This article introduces a procedure aimed at fostering pre-service teachers' reflective thinking and practical wisdom and encouraging them to adopt a theory-based view of promoting learners' motivation while taking into account learners' different motivational profiles. The procedure is based on a study about the promotion of science-related motivation among students with different motivational orientations by employing an inquiry-based science teaching approach and out-of-school learning, as well as supporting learners' basic psychological needs, in order to provide relevant and meaningful conditions for learning. The procedure for pre-service teacher education encompasses lessons intended to familiarize student teachers with theoretical perspectives, authentic case studies of learners with different motivational orientations, support for lesson planning, and reflection on the implemented plans. The described procedure may be used in teacher education during mentoring sessions in practicum periods.

Keywords: pre-service teacher education, practical wisdom, reflection, theory and practice, motivation

Corresponding author: Anni Loukomies, University of Helsinki. Email address: anni.loukomies@helsinki.fi.

Introduction

Much has been written about student teachers' reflection upon, and learning from, practice and the development of teaching and learning in the context of reflective practice. Practical experience is not sufficient to allow student teachers to learn about teaching and adopt more reasoned ways of acting. Like other authors, we argue that practical experience should be shared and that student teachers need to reflect on their practice (Loughran 2006). The iterative building of teacher knowledge is a process of doing and thinking. In many ways, it may be said that experience precedes

understanding, but, by the same token, we believe that understanding is achieved through reflection.

Traditionally, reflection is defined as thinking about what one is thinking or acting upon (Schön 1991). According to Kolb (1984), reflection is needed to transform experience into knowledge that may be used in new situations. In a detailed analysis of John Dewey's work, Rodgers (2002:863) emphasises that

[...] the process of reflection is rigorous and systematic and distinct from other, less structured kinds of thinking. It has its origins in scientific methodology and, as such, includes precise steps: observation and detailed description of an experience, an analysis of the experience that includes generation of explanations and development of theories, and experimentation – a test of theory.

In order to broaden one's understanding of an experience, reflection should happen with others who may share the same object of thinking.

However, it is unclear how student teachers can be helped to become more reflective and to learn from practice knowledge that could be used in new situations (Roskos, Vukelich & Risko 2001). Therefore, we will take another look at student teachers' learning during their teaching practice.

In Finland, there is a strong tradition of combining theoretical views with practice in order to guide student teachers to justify their decisions with arguments based on relevant learning or motivation theories. Since the 1970s, when separate teacher education institutions became part of the traditional university and master's level teacher education programmes were launched, this tradition has been encapsulated by the concept of the *professionally thinking teacher* (Koskenniemi 1971) – the ideal teacher who, in addition to his or her own experience, takes into consideration curriculum aims, learners' needs, previous knowledge and skills, relevant pedagogy and education research outcomes in planning instruction and making decisions in each teaching situation and its concomitant learning situation. An important aim in teacher education is that student teachers should become *professionally thinking teachers*, meaning that student teachers are guided to understand that each decision should be justifiable in the context of relevant theory.

Much like leading theorists in the field of teacher education such as Korthagen (2001), we argue that theories based on scientific research help teachers to perform better in their professional work. Everyday experiences, reflected through the lens of a relevant theory (or set of theories) constitute teachers' *practical wisdom*, their *phronesis*. This type of theory-based practical wisdom, introduced by Lunenberg and Korthagen (2009), is essential for a teacher to make reasoned decisions and

judgements regarding teaching and classroom interaction. According to Lunenberg and Korthagen (ibid), experience shapes action and decision making in certain situations, but profound theoretical knowledge is also necessary for reasoning about decisions in action. The decisions and judgements that teachers make usually happen in complex settings and their consequences may have long-term effects on those involved (Bransford, Darling-Hammond & LePage 2005). Even though these decisions occur in practice, they are always *expressions of value*, drawing from the combination of theoretical understanding and practical experience (Shulman 2007). Shulman (ibid) views the development of the capacity for such judgment as being at the very heart of professional preparation. Therefore, the combination of educational theory with educational practice is an important aim of pre-service teacher education, and it is important to promote reflection on their practice-based experiences among student teachers (Korthagen 2001). Student teachers need scaffolding when learning to combine aspects they have studied in course work with what they encounter during practicum periods. Grossman, Hammerness and McDonald (2009) emphasise this requirement and argue that teacher educators should provide greater assistance to pre-service teachers as they start to familiarize themselves with conceptual and practical tools.

This theoretical view may contribute to various challenges faced by teachers in their practice. One such problem, according to recent studies and surveys, is learners' low motivation to learn (OECD 2013; Tytler, Osborne, Williams et al 2008; Bennett, Hogarth & Lubben 2003; Osborne, Simon & Collins 2003; Sjøberg, 2000). Some learners may not share teachers' aims for the curriculum or may not be motivated by what they are taught at school, and may engage in learning only for instrumental reasons. This is particularly true in the context of science education (see, for example, Osborne 2008; Osborne et al 2003).

In this article we introduce a procedure aimed at encouraging pre-service teachers to adopt a theory-based perspective of how to promote learners' motivation that also takes into account learners' different motivational profiles. The procedure is based on a study conducted by the first author of this article (Loukomies 2013). The research examined the promotion of science-related motivation among students with different motivational orientations by employing an inquiry-based science teaching approach and out-of-school learning and supporting learners' basic psychological needs in order to provide relevant and meaningful conditions for learning. The procedure described here, based on the original research, may be used in teacher education during mentoring sessions in practicum periods.

Fostering student teachers' motivation-related knowledge

The aim of the procedure for pre-service teacher education, which was designed based on the research conducted by the first author of this article (Loukomies 2013), was to enhance pre-service student teachers' motivation-related practical wisdom, as discussed by Lunenberg and Korthagen (2009). By 'practical wisdom', Lunenberg and Korthagen mean "the sensitivity for and awareness of the essentials of a particular practice situation that shape our perception of this situation, and that help us find possible courses of action" (ibid:227). According to these authors, practical wisdom is connected to theory and experience in a triangular model. In the following two sections of this article, we first introduce the theoretical concepts that formed the focus of this research, and then consider the procedure for implementing them.

The theoretical view which has been introduced to pre-service teachers using the procedure described in this article is related to motivation. Motivation is an important concept in education, because high-quality motivation benefits learners and their learning in various ways. According to research, it yields improved learning outcomes (Niemiec & Ryan 2009; Reeve & Halusic 2009; Guay, Ratelle & Chanal 2008) and better mental well-being (Tuominen-Soini 2012; Vasalampi, Salmela-Aro & Nurmi 2009).

The origins of learners' motivation are diverse, and learners also have different motivational profiles (Schunk, Pintrich & Meece 2007). Although teaching should be differentiated according to learners' individual needs (see National Board of Education, Finland 2011), it usually occurs in the context of (large) groups of learners, which makes it difficult for teachers to focus on each learner individually. Student teachers in particular may find it challenging to differentiate their teaching according to learners' needs.

Edward Deci and Richard Ryan's (Ryan & Deci 2002) self-determination theory of motivation (SDT) was used to conceptualise motivation in the research project reported on in this article. This theory takes into account qualitative differences in motivational orientations, which has important implications when planning lessons aimed at meeting the needs of all student teachers in a group. Learners' differing motivational profiles bring a thought-provoking aspect to the dynamics of a classroom. What works with some learners may not be the optimal approach for others.

The principal idea of autonomous motivation in the context of SDT is that humans are active and growth-oriented; that they seek actualisation of their potential, growth and integration in order to fulfil their basic psychological desire for competence (the need to feel effectual, to have an effect on one's environment, and to attain valued outcomes); autonomy (the desire to be self-initiating and to

have a sense of acting in accordance with one's own sense of self); and relatedness (the desire to feel connected with and to be accepted by significant others) (Ryan & Deci 2002). Rather than being passive subjects pushed around by environmental forces, people move their lives in desired and specific directions. However, as no one lives in a vacuum, the social environment can either facilitate or inhibit these inherent human tendencies (ibid). From this perspective, motivation can be seen as a result of interactions between an individual's *need system* and the environmental factors that interfere with or support the need fulfilment process. More specifically, SDT is interested in individual differences resulting from "the degree to which the needs have been satisfied versus thwarted" (Deci & Ryan 2008:183). Learners' motivation in a particular situation is a function of their immediate social context and inner resources, which in turn will have been influenced by prior interactions with social contexts (Vansteenkiste, Williams & Resnicow 2012; Ryan & Deci 2002).

SDT proposes a distinction between motivational orientations based on an individual's regulatory style, which is related to the quality of motivation (Ryan & Deci 2002). One of the sub-theories of SDT, organismic integration theory (OIT), relates to the internalisation of behaviour and value regulation and, more particularly, to the influence of the fulfilment of basic psychological needs on regulatory style and motivational orientation. Regulation of behaviour may be autonomous (self-determined) or controlled, depending on the degree of internalisation. Internalisation is not viewed in terms of a simple dichotomy of internal versus external, but rather as a continuum (Ryan & Deci 2002).

OIT proposes a taxonomy of regulation types, ranging from non-regulation to intrinsic regulation. Non-regulation, at one end of the continuum, is related to *amotivation*, which Ryan and Deci (2002) define as the state of lacking any intention to act. Controlled and poorly internalised regulations, namely 'external' and 'introjected' regulations, are related to controlled forms of extrinsic motivation, while more autonomous forms of extrinsic motivation encompass 'identified' and 'integrated' regulations. At the other end of the continuum, 'intrinsic' motivation is a prototype of autonomous and self-determined behaviour. Internalisation of behaviour regulation increases and motivation for certain behaviours becomes more autonomous along the continuum (ibid).

'Amotivation' is the most problematic motivational orientation in an educational context. Whether through a perceived lack of competence, or deficiencies in valuing the possible outcomes of an activity, amotivated learners find no reason to engage in a given activity (Ryan & Deci 2002). 'Externally regulated behaviour' aims to satisfy an external demand or socially-constructed contingency, for example, to earn some expected reward or avoid a threatened punishment; the

underlying values of the activity are therefore not internalised (ibid). ‘Introjected regulation’ refers to behaviour that is motivated by internal prompts and pressures connected to an individual’s self-esteem; hence, introjection-based activities are performed either to avoid negative emotions like guilt and shame, or to attain ego enhancement and feelings of worth. Learners with controlled forms of extrinsic motivation experience regulation of their activities external to themselves. They may not be inherently interested in a certain activity, but they engage in it because they value the activity as being important (Deci 1992). Thus, people are unlikely to engage in extrinsically motivated behaviours if they are not instrumental to some desired outcome, such as a reward or the appreciation of significant others who value the activity (Ryan & Deci 2002).

According to SDT, ‘identified regulation’ occurs when regulation has become a part of the self: the individual consciously views the activity as being of personal importance or value and participates in it willingly (Deci & Ryan 2000). Even though the identification of regulation in relation to a certain activity may be separated from an individual’s other beliefs and values, identified regulation is relatively autonomous compared to external and introjected regulations.

Finally, the most self-determined form of extrinsically motivated behaviour is ‘integrated regulation’, which means that an activity has personal importance associated with a valued outcome. This occurs when identifications have been evaluated and brought into congruence with personally endorsed values that already are a part of the self. Integrated extrinsic motivation shares many qualities with intrinsic motivation, but the difference is that intrinsically motivated behaviours are executed for the sake of interest and enjoyment, whereas behaviours controlled by integrated regulation are conducted to attain outcomes that are of personal importance to the individual. However, the behaviour can still be classified as autonomous, as the value of the outcome is well integrated with the self.

‘Intrinsic motivation’ is characterised by intrinsic regulation and self-determined behaviour. Directed by feelings of interest and enjoyment, intrinsically motivated individuals freely engage in a given activity. According to Ryan and Deci (2009:177), “the basis of intrinsic motivation is interest”, and intrinsically motivated behaviours are performed because of the inherent satisfaction of the behaviour per se, not because of any external consequences or reinforcements separable from the activity (Ryan & Deci 2002). A teacher has several possibilities in supporting learners’ autonomous motivation. Reeve and Halusic (2009) suggest that lecturers who support autonomy interact with student teachers in a non-controlling manner while still offering them a sound structure for learning activities. They allow the students to participate in lesson and sequence planning where possible, as

well as providing sufficient time for learning and room for students to express negative feelings, without 'threatening' them with upcoming tests and exams. These aspects were in focus both when the student teachers in this study planned their lessons in conjunction with the mentoring teacher and when the lessons were reflected upon afterwards.

How was knowledge about motivation in a Finnish science classroom acquired?

A research project related to learners' motivation to study science was conducted between 2008 and 2013, following the principles of the design-based research approach (DBRC 2003). The design process is grounded in theory (Edelson 2002; 2006), which means that the theory-based conjectures embodied in the design are laid out in advance (Sandoval 2013). Such explication enables testable predictions to be made, the results of which may lead both to refinements of a particular design and revisions of the broader theoretical perspective (Sandoval 2004; 2013). In this research project, the theoretical conjectures arose from the literature about motivation. In addition to the demand for a background theory, DBR must also take teachers' needs and school practices into serious consideration (Juuti & Lavonen 2006), as this generates artefacts that help teachers and learners to act in a way that leads to optimal learning. These artefacts can also be widely used in settings other than the original one. The DBR approach is also a combination of theory and practice, as there is a dual commitment to improving educational practices and furthering our understanding of the processes of learning and teaching (Sandoval 2013).

This design-based research process yielded a teaching sequence for science education enriched with features intended to enhance learners' study motivation. The teaching sequence, combining out-of-school learning environments with classroom activities, follows the principles of inquiry-based science teaching (IBST), which emphasises learners' participation and the authenticity of the phenomena they explore (Minner, Levy & Century 2010). The research also yielded broader knowledge about means of motivating learners with different motivation profiles and operationalisations of the theory concerning basic psychological needs. These results are briefly described in the following paragraphs.

The study helped to contribute to the understanding of individual differences in interest and motivational development in the context of science learning. There appeared to be differently motivated learners among the participants, some of them not being motivated to learn science at all, and some having intrinsic motivation towards learning about the topic. It is also notable that

some participants did not fit neatly into a single motivational orientation category, but simultaneously exhibited features characteristic of two or more of the categories. Lee, McInerney, Liem & Ortiga (2010) argue that different motivational orientations can coexist and should be dichotomised as two separate goals, rather than examining them as being on the continuum of a single motivational force, as the SDT proposes (see Ryan & Deci 2002). Moreover, it is evident that differently regulated orientations may coexist within the same individual, although only one is usually prominent.

The most important evidence emerged from the qualitative data of this project, which show that learners with different prominent motivational orientations (even with the limitation discussed above) found different aspects of the designed teaching sequence appealing. These aspects were compatible with the characteristics that guide the behaviour of an individual with a given motivational orientation across situations and domains, as assumed by the SDT. For example, amotivated learners were initially very critical towards studying science, did not feel themselves competent in this area, and were deeply sceptical about the possible relevance to their lives of studying science. They did not seem to recognise the connection between science studies and their own lives. These learners noted that their competence and feelings of social relatedness were successfully supported. On the other hand, they did not refer to those aspects intended to enhance their need for autonomy. Externally regulated learners, in turn, found the supportive atmosphere of the group important and thus improved their competence and fulfilled their need for relatedness. Externally regulated learners did not experience much autonomy, but also did not appear to long for it. The more self-determined learners' actions were before the implementation, the more they valued the designed teaching sequence with respect to the autonomy they experienced and the value of the activity per se. Learners with internalised regulation appreciated the autonomy offered to them and considered it essential for their motivation. To sum up, an individual's motivational profile can be described as a lens through which he sees an activity and the possibilities it offers him to fulfil his needs.

The results of the study indicate that individual differences in the motivational profiles of the learners within a group are related to their experience of how a particular course may fulfil their psychological needs. A course in any subject should be organised in such a way that it not only takes into account learners' prior knowledge, but also their differing motivational profiles. As the basic psychological needs of learners within a given class or group may vary, it is important to organise rich teaching settings to enable all learners to experience teaching in a way that is compatible with their personal needs, so that every learner may discover at least one reason to be actively involved

and enjoy the teaching. Finding a link between curriculum-based content and learners' lives is worth considering, because this may increase learners' perceptions of the relevance of their studies and so benefit all learners, regardless of their motivational orientation. The way in which teachers interact with learners is important in aiming to promote learners' autonomous motivation.

Implications of the research for pre-service teacher education

There are three practice periods in the primary teacher education programme at the University of Helsinki. The first of these takes place in the first year of study and lasts three weeks (or three study credits according to the European Credit Transfer and Accumulation System (ECTS) (European Commission 2015), with one week allocated for planning. The focus is on teaching mother tongue and drama. The second practice period takes place in the third year, with the focus on five different school subjects, such as science, mathematics, history or visual arts. This period lasts six weeks (nine ECTS credits), one of which is again allocated for planning. A pair of student teachers teach a total of fifty lessons during this period. The fourth-year (master's level) practicum period (eight ECTS credits) usually takes place in a field school.

Based on the results of the original research by the first author (Loukomies 2013), a procedure was constructed for mentoring pre-service teachers during the second practice period. The procedure emphasises *theory-based practical wisdom*, guiding student teachers to justify their decisions through argument in the context of learners' motivational orientations and basic psychological needs, as proposed by self-determination theory (SDT). It consists of a brief interactive lecture, during which the motivational phenomena are conceptualised; a group task, during which learners' different motivational profiles and their basic psychological needs are examined; and a session during which the pre-service teachers' lesson plans are examined based on their potential to promote motivation. Finally, the student teachers present their lessons, after which the lessons are reflected upon collaboratively with the mentoring teacher. In addition, the sequence plan designed by the student teachers and according to which they intend to teach, is formatively evaluated and modified as needed during the entire practicum period. After the practicum, the whole is reflected upon retrospectively in a final session. The procedure is described in Table 1.

Table 1: Activities in the mentoring procedure

Activity	Aim of the activity
Examining the student teachers' motivation-	The mentoring teacher obtains a view of the

related preconceptions	student teachers' motivation-related knowledge structure.
Conceptualising motivation	The mentoring teacher and student teachers share a common language with which to consider motivational phenomena. The student teachers familiarise themselves with different ways of being motivated (motivational orientations) and the basic psychological needs that orient people's behaviour.
Case task related to motivation	The student teachers combine motivational science concepts with their everyday life experiences.
Lesson planning and reflection on the plans	In their lesson plans, the student teachers implement the theory-based aspects intended to enhance learners' motivation to learn, for example, support for basic psychological needs.
Implementation of the lesson plans	The student teachers put the motivational science principles into practice.
Reflecting on the lessons	Shared understanding and new knowledge about putting motivational principles into practice are generated.

In more detail, the procedure unfolds as follows: The interactive lesson concerning motivation begins with a conversation during which the pre-service teachers examine their preconceptions about what motivation is, and which means and instructional methods they consider beneficial for learners' motivation. This is followed by an introduction to motivational psychology. The field is approached from different perspectives, and the history and roots of different motivation theories

are also considered. After a general introduction, emphasis is placed on the self-determination theory (SDT) and one of its sub-theories, the organismic integration theory (OIT), as they relate to learners' basic psychological needs.

Organismic integration theory proposes the concept of internalisation of behaviour regulation, the degree of which may vary according to motivational orientation (Ryan & Deci 2002). In other words, learners with less internalised forms of behavioural regulation exhibit external and controlled forms of motivation, whereas learners with well-internalised forms of regulation exhibit more autonomous forms of motivation. More concrete examples of this aspect arising from the data obtained in the original research are introduced to the pre-service teachers during this lecture. Besides motivational orientations, the idea that the fulfilment of basic psychological needs supports high-quality motivation is important in the SDT. The original research suggests some instructional methods to promote the fulfilment of learners' basic psychological needs. These methods are introduced to the pre-service teachers. Finally, theory-based suggestions about how a teacher may promote learners' autonomous motivation (as introduced in the opening section of this article) are discussed.

The lesson about promoting learners' autonomous motivation focuses on satisfying their basic psychological needs for competence, autonomy and relatedness (Reeve & Halusic 2009; Ryan & Deci 2002) and appropriate teaching methods or learning activities that support these needs. Learners' needs are analysed in the context of primary school topics and learning activities appropriate to the primary school level. The following topics are discussed:

- autonomy-supporting activities or support for choices;
- learner-centred teaching/learning methods, such as science inquiry or process writing, where learners have choices with regard to study methods;
- the use of information and communication technology (ICT) and choices in the selection of an ICT tool; in addition, content may be selected using a web browser;
- co-planning of learning activities;
- enhancing learners' feelings of competency;
- the selection of constructive evaluation methods, such as self- and group evaluation, which help learners to recognise their competencies;
- promoting learners' perception that a given activity or the use of ICT has personal value or utility;

- support for learners' social relatedness through the selection of collaborative learning activities and co-planning, which promotes the perception that learners can trust each other and that they belong to a larger group who finds a given topic or activity valuable and important.

After familiarising the student teachers with motivational psychology and motivational orientations, there is a discussion about the fact that learners do not usually fit neatly into a single motivational category, but rather exhibit individual motivational profiles, which may encompass features of two or more motivational orientations, and that the fulfilment of basic psychological needs depends on learners' motivational orientation. In order to strengthen these ideas, case studies based on real learners are presented to the student teachers following the approach of Goldblatt and Smith (2005), who argue for the use of authentic case studies as a basis for teacher education. As these case studies are based on real persons and are not modified in any way to render them more coherent, the student teachers become familiar with the idea that even though motivational theories may offer them a beneficial conceptual framework when considering learners' motivation, in practice learners seldom conform to a clear theory-based categorisation of motivational orientations, but rather have individual motivational profiles. The case studies are discussed and their motivational orientations tracked, after which the student teachers discuss the most appropriate means of promoting learner motivation in each case. Student teachers may propose strategies to respond to problems, as suggested by Darling-Hammond, Hammerness, Grossman et al (2005). This is a particularly important phase, which allows the student teachers to carefully practise the required skills outside of a real teaching situation.

Finally, together with the mentor teacher, the pre-service teachers consider their lesson plans from the point of view of learners' motivational orientations and the potential of the lesson plans to support the fulfilment of learners' basic psychological needs. They discuss which aspects of the lessons promote the fulfilment of basic psychological needs, and which need(s) in particular, as well as the possibility that some activities may be modified to be more supportive of autonomous motivation.

After the student teachers' lesson plans have been implemented, there is a group discussion during which the mentor and student teachers reflect on the lessons in terms of features supporting or thwarting the fulfilment of learners' basic psychological needs. Lessons may be videotaped for this purpose or the discussion may be based on the mentor teacher's notes and student teachers' personal retrospective views about their lessons. The student teachers' interactions with learners

during the lessons are also considered in terms of whether they supported autonomous motivation. The most important feature of these sessions is that the reflection is conducted in a detailed way. This follows the suggestions of Lunenberg and Korthagen (2009:235) that “the more specific the analysis of a small part of a lesson is, the more a student teacher is supported in developing practical wisdom, as he or she is then supported in developing sensitivity to the particulars of educational situations”.

In summary, an important research-based message for the student teachers is that a learner should not be categorised into one motivational orientation, but rather, a teacher should try to ascertain a learner’s motivational profile and then decide which means would be best suited to this particular learner. Furthermore, as many features as possible that support the fulfilment of basic needs should be included in lesson plans, because learners with different motivational profiles appreciate support for different needs, and lessons should encompass aspects that support each learner’s existing motivational resources. A connection between the topic to be taught and learners’ lives should not be underestimated, because, according to the original research, strengthening learners’ perceptions of the relevance of their studies to their lived experience is especially important for learners (and teachers) struggling with very poor existing motivational resources.

Suggestions for encouraging pre-service teachers to adopt a theoretical view when planning their teaching

Theory-based practical wisdom is important for teachers to be more aware of the many decisions they must make during the course of a lesson (Lunenberg & Korthagen 2009). Practical wisdom, theory and experience are interdependent. Besides the experience gained during the practicum periods, it is important to emphasise the theoretical aspect and connect it in a relevant way to the concrete phenomena that pre-service teachers encounter during their practicum periods. As Lunenberg and Korthagen (2009:232) argue, “in order to develop practical wisdom, the presentation of theory should not only be focused on presenting a knowledge base for better understanding of classroom realities, but also for stimulating awareness in student teachers of relevant aspects of concrete situations”.

Practical wisdom, theory and experience form an interconnected triangle, as explained at the start of this article. We also linked the concept of practical wisdom to Koskenniemi’s (1971) model of the ‘professionally thinking teacher’, which was introduced in Finland in the 1970s. Besides encouraging

student teachers to adopt a theoretical approach as a part of their practical wisdom, it is important to offer them experiences on which to build.

The theoretical approach that has been introduced here relates to the strengthening of learners' autonomous motivation. In order to equip student teachers to achieve this, it is necessary to offer them support for *their own* autonomous motivation as well. As described above, autonomous motivation may be promoted both by facilitating the fulfilment of basic psychological needs (Ryan & Deci 2002) and through certain aspects of a teacher's interaction with learners (Reeve & Halusic 2009). These means were employed throughout the procedure described in this article. In order to allow the student teachers to experience autonomy, they were allowed to select the cases they wanted to scrutinise. They were also allowed to plan their lessons quite freely, according to the structure that was introduced to them at the beginning of the practicum period, and were able to choose the lessons they wanted to be videotaped. In order to support the student teachers' need for a feeling of competence, there was discussion of their prior knowledge about motivation; their expressed thoughts and opinions were appreciated and the feedback given to them in the reflection sessions was kept constructive. The student teachers' need for a feeling of social relatedness was supported by letting them work in pairs or in small groups when conducting the tasks related to the learner case studies, lesson planning, teaching and reflecting on their teaching.

The student teachers' experience was also enriched through contextualisation. Learning occurred in real-life situations and authentic case studies were used to contextualise the theory. According to Bransford, Brown & Cocking (2000), this should enhance the quality of the student teachers' learning. The student teachers' motivational profiles were not examined at the beginning of the practicum periods, nor were their experiences recorded afterwards. It might be useful to do so in future in order to develop further procedures for supporting student teachers in developing their practical wisdom.

References

- Bennett, J., Hogarth, S. & Lubben, F. 2003. A systematic review of the effects of context-based and Science-Technology-Society (STS) approaches in the teaching of secondary science. Version 1.1. In: *Research Evidence in Education Library*. London: EPPI Centre, Social Science Research Unit, Institute of Education.
- Bransford, J., Darling-Hammond, L. & LePage, P. 2005. Introduction. In: L. Darling-Hammond, J. Bransford, P. LePage, K. Hammerness & H. Duffy (Eds). *Preparing teachers for a changing*

world: What teachers should learn and be able to do. San Francisco, CA: John Wiley & Sons. 1-39.

Bransford, J.D., Brown, A.L. & Cocking, R.C. (Eds). 2000. *How people learn: Mind, brain, experience and school.* Washington, DC: National Academy Press.

Darling-Hammond, L., Hammerness, K., Grossman, P., Rust, F. & Shulman, L. 2005. The design of teacher education programs. In: L. Darling-Hammond, J. Bransford, P. LePage, K. Hammerness & H. Duffy (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do.* San Francisco, CA: Wiley & Sons Ltd. 390-441.

Deci, E.L. & Ryan, R.M. 2000. The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4):227-268.

Deci, E.L. & Ryan, R.M. 2008. Self-determination theory: A macrotheory of human motivation, development and health. *Canadian Psychology*, 49(3):182-185.

Deci, E.L. 1992. The relation of interest to the motivation of behaviour: A self-determination theory perspective. In: K.A. Renninger, S. Hidi & A. Krapp (Eds). *The role of interest in learning and development.* Mahwah, NJ: Lawrence Erlbaum Associates. 43-69.

Design-Based Research Collective. 2003. Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1):5-8.

Edelson, D.C. 2002. Design research: What we learn when we engage in design. *The Journal of the Learning Sciences*, 11(1):105-121.

Edelson, D.C. 2006. Balancing innovation and risk: assessing design research proposals. In: J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds). *Educational design research.* London: Routledge. 100-106.

European Commission. 2015. *European Credit Transfer and Accumulation System.* Retrieved from http://ec.europa.eu/education/tools/ects_en.htm (accessed 14 December 2014).

Goldblatt, P.F. & Smith, D. (Eds). 2005. *Cases for teacher development: Preparing for the classroom.* Thousand Oaks, CA: Sage.

Grossman, P., Hammerness, K. & McDonald, M. 2009. Redefining teaching, re-imagining teacher education. *Teachers and teaching: Theory and practice*, 15(2):273-290.

Guay, F., Ratelle, C. & Chanal, J. 2008. Optimal learning in optimal contexts: the role of self-determination in education. *Canadian Psychology*, 49(3):233-240.

- Juuti, K. & Lavonen, J. 2006. Design-based research in science education: One step towards methodology. *NorDiNa: Nordic Studies in Science Education*, 2(2):54-68.
- Kolb, D.A. 1984. *Experiential learning experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.
- Korthagen, F.A.J. 2001. Teacher education: a problematic enterprise. In: F.A.J. Korthagen (Ed). *Linking practice and theory: The pedagogy of realistic teacher education*. Mahwah, NJ: Lawrence Erlbaum Associates. 1-19.
- Koskenniemi, M. 1971. *Elemente der Unterrichtstheorie*. Munich: Ehrenwirth.
- Lee, J.Q., McInerney, D.M., Liem, G.A.D. & Ortiga, Y.P. 2010. The relationship between future goals and achievement goal orientations: An intrinsic-extrinsic motivation perspective. *Contemporary Educational Psychology*, 35(4):264-279.
- Loughran, J. 2006. Being a teacher educator: A focus on pedagogy. In: J. Loughran (Ed). *Developing a pedagogy of teacher education: Understanding teaching and learning about teaching*. Abingdon: Routledge. 13-29.
- Loukomies, A. 2013. *Enhancing Students' Motivation towards School Science with an Inquiry-Based Site Visit Teaching Sequence: A Design-Based Research Approach*. Research Report 349. Helsinki: Department of Teacher education, University of Helsinki.
- Lunenberg, M. & Korthagen, F.A.J. 2009. Experience, theory and practical wisdom in teaching and teacher education. *Teachers and teaching: Theory and practice*, 15(2):225-240.
- Minner, D.D., Levy, A.J. & Century, J. 2010. Inquiry-based science instruction – what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, 47(4):474-496.
- National Board of Education, Finland. 2011. *Amendments and additions to the National Core Curriculum for Basic Education*. Helsinki: National Board of Education.
- Niemiec, C.P. & Ryan, R.M. 2009. Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education*, 7(2):133-144.
- OECD (Organisation for Economic Co-operation and Development). 2013. *PISA 2012 results: Ready to learn: Students' engagement, drive and self-beliefs*. Vol III. Pisa: Publishing. Retrieved from

<http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-iii.htm> (accessed on 14 December 2014). DOI:/10.1787/9789264201170-en.

Osborne, J., Simon, S. & Collins, S. 2003. Attitude towards science: a review of the literature and its implications. *International Journal of Science Education*, 25(9):1049-1079.

Osborne, J.F. 2008. Engaging young people with science: does science education need a new vision? *School Science Review*, 89(328):67-74.

Reeve, J. & Halusic, M. 2009. How K-12 teachers can put self-determination theory principles into practice. *Theory and Research in Education*, 7(2):145-154.

Rodgers, C. 2002. Defining reflection: Another look at John Dewey and reflective thinking. *Teachers College Record*, 104(4):842-866.

Roskos, K., Vukelich, C. & Risko, V. 2001. Reflection and learning to teach reading: A critical review of literacy and general teacher education studies. *Journal of Literacy Research*, 33(4):595-635.

Ryan, R.M. & Deci, E.L. 2002. An overview of self-determination theory: An organismic-dialectical perspective. In: E.L. Deci & R.M. Ryan (Eds). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press. 3-33.

Ryan, R.M. & Deci, E.L. 2009. Promoting self-determined school engagement. In: K. Wentzel & A. Wigfield (Eds). *Handbook of motivation at school*. London and New York: Routledge. XX.

Sandoval, W. 2004. Developing learning theory by refining conjectures embodied in educational designs. *Educational Psychologist*, 39(4):213-223.

Sandoval, W. 2013. Conjecture mapping: An approach to systematic educational design research. *Journal of the Learning Sciences*, 23(1):1-19.

Schön, D. 1991. *The reflective practitioner: How professionals think in action*. London: Avebury.

Schunk, D.H., Pintrich, P.R. & Meece, J.L. 2007. *Motivation in education: Theory, research, and applications*. 3rd Edition. Upper Saddle River, NJ: Pearson Education.

Shulman, L. 2007. Practical wisdom in the service of professional practice. *Educational Researcher*, 36(9):560-563.

Sjøberg, S. 2000. Interesting all children in 'science for all'. In: R. Millar, J. Leach & J. Osborne (Eds). *Improving science education: The contribution of research*. Birmingham: Open University Press. 165-186.

Tuominen-Soini, H. 2012. *Student motivation and well-being: Achievement goal orientation profiles, temporal stability, and academic and socio-emotional outcomes*. PhD thesis. Helsinki: University of Helsinki. Retrieved from <http://urn.fi/URN:ISBN:978-952-10-8201-6> (accessed 14 December 2014).

Tytler, R., Osborne, J., Williams, G., Tytler, K. & Cripps Clark, J. 2008. *Opening up pathways: Engagement in STEM across the primary-secondary school transition*. Canberra, ACT: Australian Department of Education, Employment and Workplace Relations.

Vansteenkiste, M., Williams, G.C. & Resnicow, K. 2012. Toward systematic integration between self-determination theory and motivational interviewing as examples of top-down and bottom-up intervention development: Autonomy or volition as a fundamental theoretical principle. *International Journal of Behavioral Nutrition and Physical Activity*, 9(23). Retrieved from <http://www.ijbnpa.org/content/9/1/23> (accessed 14 December 2014).

Vasalampi, K., Salmela-Aro, K. & Nurmi, J.-E. 2009. Adolescents' self-concordance, school engagement, and burnout predict their educational trajectories. *European Psychologist*, 14(4):332-341.