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Finnish Pre-service Teachers' Perceptions of Their Strategic Learning Skills and Collaboration Dispositions

To support the development of pupils' 21st-century skills, teachers themselves must also be competent in these skills and learn them during pre-service teacher education. The aim of this study is to investigate what kind of profiles emerge among Finnish first-year pre-service teachers' (N = 872) in terms of perceptions of their strategic learning skills and collaboration dispositions and what background variables explain membership of the profiles found. Latent profile analysis showed five student profiles corresponding to perceived strategic learning skills and collaboration dispositions. The most robust factor explaining the membership of the profiles was life satisfaction. Pre-service teachers in a profile group of high strategic learning skills and high collaboration dispositions showed the highest anticipated life satisfaction after five years. Obtaining a better understanding of pre-service teachers' skills and dispositions will provide the basis for deeper exploration of how they may acquire these skills and how instruction can better be designed to assist students in developing these skills.

Keywords: pre-service teachers, strategic learning skills, collaboration dispositions, person-oriented approach

Introduction

Working and learning successfully in the digital age calls for the ability to search for, manage and evaluate rapidly increasing information, to create new knowledge and to collaborate productively in teams and networks. This presupposes that learners are proficient in transversal and generic 21st-century skills such as problem solving, critical thinking, collaboration and the use of information and communication technologies (ICT) (Binkley et al. 2012). Research on generic skills has indicated that these skills do not develop separately from subjects (Silva 2009), and they can be learned in the context of subject studies (Virtanen and Tynjälä 2018). It is also known that the content and methods of teacher education programmes can vary a great deal, and that graduates'

level of ability can vary in regard to their preparedness for teaching (Darling-Hammond et al. 2017).

The existing research agrees that teachers play a crucial role in promoting pupils' learning (e.g., Kane et al. 2013). According to Klassen et al. (2018), effective teachers interact with their pupils, share ideas and knowledge and guide their learning. Teachers' cognitive attributes, such as academic skills (e.g., subject-area knowledge and reasoning ability) interact with 'soft' personal characteristics (e.g., beliefs, interpersonal skills, motivation, attitudes and dispositions) and, together with environmental factors (e.g., professional support), they influence teachers' professional practices and pupils' learning outcomes. Subsequently, we agree with Voogt et al. (2013) that it is important to promote pre-service teachers' own 21st-century skills and competencies during their initial teacher education studies so that they will be able to support their pupils in this area.

Many of the generic skills are not new in research or in educational practice, although they appear to be newly important, especially from the viewpoint of teacher education. Decades of research have been conducted to understand the components of skilful learners, particularly emphasising self-regulated learning (Zimmerman and Schunk 2011) in terms of strategic learning skills and metacognition (Winne and Hadwin 2008). In addition, research on productive collaborative learning and dispositions towards collaboration has pointed out its crucial contribution to success in learning (Barron, Pea, and Engle 2013; Wang et al. 2009).

Although 21st-century skills, such as strategic learning skills and collaboration dispositions, are considered important in our global knowledge society (Voogt et al. 2013), empirical research on how pre-service teachers perceive their own strategic learning skills and collaboration dispositions are scarce, especially in teacher education

settings. In this article, we focus on Finnish pre-service teachers and teacher education, which is often introduced as an interesting case due to high PISA results. However, not even Finnish pre-service teachers, in a country that is well-known for its equal education opportunities, form a homogeneous group. Instead, we assume that they can have profiles that may differ from each other and be multi-dimensional combinations of different skills and dispositions. As there is no earlier research about the interplay of pre-service teachers' strategic learning skills together with their collaboration dispositions, we believe that exploratory research applying a person-oriented approach can help us in filling this research gap, namely investigating the profiles of pre-service teachers in terms of their skills and dispositions.

We also explore whether certain background variables can have any impact on how pre-service teachers perceive their skills. In particular, the status variables such as gender, earlier school success, entrance examinations into teacher education and earlier studies or teaching experience are assumed to explain the pre-service teachers belonging to the different skill profiles. General life satisfaction is also selected as a predicting variable in this study, as it is supposed to predict a general engagement in learning (Upadyaya and Salmela-Aro 2017). Especially the subjective, general-level well-being (Välimaa and Danielson 2004) could explain generic skills and dispositions. The cognitive dimension of subjective well-being is commonly known as life satisfaction, referring to an individual's overall evaluation of contentment with his or her life (Diener 1984). This means that those pre-service teachers who are more satisfied with their lives are potentially also more able to be engaged both cognitively and motivationally in their learning, because life satisfaction broadens individuals' thoughts and behaviour, which in turn enhance their personal resources including generic skills and dispositions. This, in turn, may increase life satisfaction in a cyclical manner. In addition, the PCK&S

(pedagogical content knowledge and skills) model (Gess-Newsome 2015) suggests that engagement in learning, perceptions, beliefs, orientations and disposition are filters that can alter teachers' skills and school practices.

Strategic learning skills

Decades of research in self-regulated learning have shown that pupils' strategic learning skills, such as efficient use of cognitive and metacognitive strategies, as well as skills for managing their own learning resources, contribute significantly to the quality of learning (Zimmerman and Schunk 2011; Schunk and Greene 2017). Previous research has determined that a learning strategy is any action or process that facilitates understanding, learning and meaningful encoding of information into the memory (Weinstein, Acee, and Jung 2011). Rehearsal, elaboration and organisation strategies are ways of processing information (Weinstein and Mayer 1986), and metacognitive strategies are deeper-level learning strategies (Dinsmore, Alexander, and Loughlin 2008). The role of metacognitive strategies is to guide pupils in monitoring and directing their learning process and resources available for learning (Schunk 2008).

This study particularly follows Pintrich's self-regulated learning (SRL) model (2000) to understand what strategic learning is and what the core features of a successful learner are (Pintrich 2000). The model highlights that pupils are proactive agents in their own learning by controlling their learning by setting goals and monitoring their cognitive, motivational and behavioural processes. Studies including pre-service or in-service teachers have mainly examined the role of teachers in enhancing SRL among their pupils (Dignath-van Ewijk, and van der Werf 2012) and have only seldom investigated the pre-service teachers' own self-regulation skills (Buzza and Allinotte 2013).

In addition to the fact that SRL skills contribute to successful learning (Pintrich 2000), they are also important for becoming and being a teacher and are necessary skills that contribute towards learning to teach (Darling-Hammond et al. 2005; Gordon, Dembo, and Hocevar 2007). The fundamental idea is that, as the role of teachers is central in guiding their pupils' learning skills, they should also have strong SRL skills that they can model for their pupils (Darling-Hammond et al. 2005). Therefore, it has been claimed that pre-service teacher education programmes should offer more opportunities for SRL skills to develop (Darling-Hammond et al. 2005). In this study, we refer to SRL particularly from the viewpoint of pre-service teachers' perceptions of their own strategic learning skills.

Collaboration dispositions

In addition to individual learning skills, the importance of collaboration skills has been stressed in recent educational policy discussions (OECD 2013). Earlier research has also indicated that collaborative working can have a positive effect on individual learning and knowledge construction (O'Donnell and Hmelo-Silver 2013). Collaborative learning is a situation in which team members jointly, and in a coordinated way, engage in solving problems or challenges (Dillenbourg 1999), optimally resulting in a unique outcome that would not be obtainable without social interaction (Sears and Reagin 2013). Hence, performing well means having not only cognitive skills but also skills for collaborating with peer students. On the other hand, focusing entirely on the group as a 'learning unit' risks ignoring individual students' cognitive, motivational and attitudinal capabilities for collaborating.

Accordingly, previous research has indicated that without adequate skills or external instructional support, the probability of productive learning experiences is not very high in authentic, collaborative learning situations (Farrell and Farrell 2008).

Although students can be taught to collaborate with the aid of explicit instruction (Littleton and Mercer 2013), an affirmative disposition toward collaboration also plays a central role, because willingness to contribute to joint work is considered crucial (Fransen, Weinberger, and Kirschner 2013). Consequently, there exists multiple definitions for 'dispositions'. At a general level, e.g. Schussler (2006) dispositions are seen as relatively stable attitudes or habits. According to recent research, dispositions are related for example to learning theories that guide the instructional choices of the teachers (Altan, Lane, and Dottin 2017; Tiilikainen et al. 2019). Therefore, it is important to recognize dispositions in teachers' thought processes as well as in a teacher education context (see Tiilikainen et al. 2019).

In this empirical study, we approach pre-service teachers' dispositions as one's overall attitude toward collaboration, collaborative problem solving and teamwork, which is in line with the Programme for International Student Assessment (PISA) 2015 framework, which is further based on research by Wang et al. (2009). This approach covers dispositions related to collaborative problem solving through various dimensions of teamwork, including a cooperative mindset, team leadership and negotiation. A cooperative mindset refers to a general attitude towards working as a team and for collaboration, for example in terms of how effective or preferable a mode of working it was perceived to be. Team leadership focuses on dispositions towards guiding other team members and taking a responsibility on the group product. Negotiation disposition can be seen as a central element of teamwork, in which individuals need to negotiate, take others' perspectives into account and adjust their actions according to the accompanying group. In general, dispositions are expected to be associated with students' accomplishments in collaborative activities (OECD 2013), but also with their

development in teaching practices to support learning (Buzza and Allinotte 2013;

Gordon et al. 2007).

The participants of this study are Finnish undergraduate teacher education

students, who have just entered their university studies, and hence, we expect that their

attitudes derive partly from their previous high school learning contexts and practices.

Hence, we are interested in variation among students' perceived generic skills and

dispositions at the beginning of their studies instead of variation between situations

along studies. The aim of this exploratory study was to investigate the following

research questions:

1. What kinds of profiles emerge in terms of Finnish first-year pre-service
   teachers' perceptions of their strategic learning skills and collaboration
   dispositions?

2. What background variables explain pre-service teachers' belonging in the
   profiles found?

Methods

Participants and procedure

The study participants were first-year pre-service teachers from three Finnish

universities ($n_1 = 238$, $n_2 = 265$, $n_3 = 369$). Of the 872 respondents, 23% were male and

77% female, which can be regarded as a typical distribution of male and female pre-

service teachers in Finland (Finnish National Board of Education, 2016). The response

rate was 83%. The average age of the respondents was 21.9 ($SD = 3.2$) years old.

Finnish pre-service teachers graduate in five years with a master's degree in education,

which gives them competencies to teach pupils in a comprehensive school, in grades 1

through 6. Data collection was conducted in the autumns of 2014, 2015 and 2016. Data

were gathered with an online questionnaire as a part of the teacher education courses. Permission to collect the data was received from the head of the department, and participation in this study was voluntary for the pre-service teachers. After the participants volunteered to participate in the study, they were invited to complete all questions in the online questionnaire.

Measures

The questionnaire, combined with the data from the study register, consisted of the following background variables: gender, high school average, entrance exam scores, previous studies, teaching experience and life satisfaction. Current and anticipated life satisfaction after five years were measured with using life-satisfaction indicator on a 10-point Likert-type scale (1 = worst scenario; 10 = best scenario). The life-satisfaction indicator was derived from the Cantril Ladder (Välimaa and Danielson 2004) comprising 10 steps in which the top indicates the best possible life and the bottom step indicates the worst possible life. The pre-service teachers were asked to indicate the ladder step on which they would place their lives at the present time and in five years.

In addition to the background variables, the pre-service teachers were asked to assess their strategic learning skills and collaboration dispositions using a 7-point scale ranging from 1 (*I completely disagree*) to 7 (*I completely agree*). The validated instrument, Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al. 1993), and particularly its learning strategies subscales, were used to measure strategic learning skills. Collaboration disposition was measured using the PISA 2015 background questionnaire, which is based on the instrument employed by Wang et al. (2009).

Six sum scales were formulated, and their internal consistency was examined with Cronbach's alpha (α) (see Appendix). There were no missing values among the six

sum scales used to profile the pre-service teachers' perceived strategic learning skills and collaboration dispositions. The strategic learning skills involved the following sum scales, formed on the theoretical basis: (a) cognitive strategies (α = .79, 13 items), referring to information processing and strategies such as rehearsal, elaboration, effort regulation and critical thinking; (b) metacognitive strategies (α = .70, seven items), dealing with use of strategies to help students in regulating their own cognition; and (c) resource management (α = .75, nine items), referring to controlling resources other than cognition; that is, time and study environment.

The collaboration dispositions involved the following sum scales, which were formed by using exploratory factor analysis (EFA): (a) cooperative mindset (α = .75, four items), characterising a general preference for working together as a team; (b) team leadership (α = .76, six items), referring to a willingness to take responsibility for teamwork by sharing ideas and convincing other team members; and (c) negotiation (α = .74, six items), referring to a willingness to listen to others, take other perspectives into account, negotiate and adjust one's own actions to the actions of the collaborating group. Two of the most weakly loading items were removed from the scale.

Analysis strategy

To extract mutually distinctive subpopulations (i.e., profiles) from the data, we first calculated the correlations between the six variables used for profiling, their descriptive statistics and cluster-level (three universities) intraclass correlations. Second, we identified homogeneous profiles through latent profile analysis (LPA) (Muthén and Muthén 1998–2015) by simultaneously including background characteristics that explained latent profile belonging in the same model. LPA allowed us to model unobserved population heterogeneity by defining the number of latent profiles best fitting the data. The means and variances of the latent profile indicators were freely

estimated across profiles (Diallo, Morin, and Lu 2016). In addition to substantive reasoning (Masyn 2013), various statistical criteria were utilised to cull profiles in which within-class differences in pre-service teachers' scores on response variables were small and between-class differences were large. We used the following statistical criteria: log-likelihood (LL), the Akaike information criterion (AIC), the Bayesian information criterion (BIC), entropy, the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMR), and Bootstrapped Likelihood Ratio Test (BLRT). Smaller AIC and BIC values indicate a better fit between the model and the data (Nylund, Asparouhov, and Muthén 2007), while higher values of entropy reflect better distinctions between latent profiles (Kline 2011). The VLMR and BLRT test a k-1 profile model (H0) against a k-profile model with a low p value, suggesting that the estimated model fits the data statistically significantly better than a model with one less profile (Lo, Mendell, and Rubin 2001).

To identify the variables that explain latent profile membership (i.e., to test associations between likely profile belonging and pre-service teacher characteristics), we applied the three-step method available in the Mplus software. In the three-step method, auxiliary variables that explain belonging in profiles are treated as latent class predictors that do not influence the latent profile solution (Asparouhov and Muthén 2014). We used Mplus version 7.4. The estimation method was the maximum likelihood estimator with robust standard errors (Muthén and Muthén 1998–2015).

Results

Correlations and Descriptive Statistics

As seen in Table 1, the results indicated that at the sample level the Finnish pre-service teachers assigned high ratings to strategic learning skills and collaboration dispositions.

Collaboration dispositions were rated somewhat higher (cooperative mindset: $M = 5.20$, $SD = 0.94$; team leadership: $M = 5.34$, $SD = 0.72$; negotiation: $M = 5.95$, $SD = 0.57$) than strategic learning skills (cognitive strategies: $M = 4.97$, $SD = 0.68$; metacognitive strategies: $M = 4.61$, $SD = 0.71$; resource management: $M = 4.44$, $SD = 0.89$). All correlations between the variables used for profiling were positive. Except for the correlations between cognitive and metacognitive strategies ($r = .60$, $p < .001$) and resource management and metacognitive strategies ($r = .62$, $p < .001$), the correlations were small or moderate (Cohen 1988). Intraclass correlations (pre-service teachers nested within three Finnish universities) were non-existent or small (.00–.01), indicating very small between-university variance in the variables used for profiling.

--- INSERT TABLE 1 ---

Latent Profile Model

Table 2 reports the goodness-of-fit statistics for the estimated latent profile models. The log-likelihood (LL) and Akaike information criterion (AIC) values improved when the number of latent profiles increased. While BLRT rejected all the k-1 profiles favouring a k-profile model, the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMR) indicated that no significant improvement in model fit was gained with more than five profiles. The five-profile model had an entropy value of .74, with the average posterior probabilities of group membership for individuals assigned to each profile (i.e., probability of being in each profile) varying between .80 and .87, clearly exceeding the minimum threshold of .70 (Nagin, 2005).

--- INSERT TABLE 2 ---

Moreover, the five-profile model included two theoretically meaningful profiles: one with average values in strategic learning skills (cognitive strategies, metacognitive strategies and resource management) and low values in collaboration dispositions (cooperative mindset, team leadership and negotiation) and the other with low values in strategic learning skills and average values in cooperation. Examination of the BIC index (Figure 1) that has been shown to perform the best of information criterion (Nylund, Asparouhov, and Muthén 2007), showed only a marginal gain in adding the sixth and worsening of the model fit when adding the seventh profile (Masyn 2013). Thus, we chose the five-profile solution as the most interpretable, theoretically justified and statistically best fit for the data.

--- INSERT FIGURE 1 ---

Table 3 presents the profile-specific means and standard deviations along with the eta squared effect sizes quantifying the profile differences in the variables used for profiling pre-service teachers. The mean differences were large (Cohen 1988) across the five profiles on strategic learning skills ($\eta^2_{range} = .44–.74$) and collaboration dispositions ($\eta^2_{range} = .31–.43$).

--- INSERT TABLE 3 ---

As shown in Figure 2, the five clusters were named *Low in all* ($n = 87$, 10.9% of the sample), *Average in strategies, low in collaboration* ($n = 173$, 26.8%), *Low in strategies, average in collaboration* ($n = 166$, 17.3%), *Average in all* ($n = 328$, 31.5%) and *High in all* ($n = 118$, 13.4%). The pre-service teachers in the *Low in all* latent

profile exhibited low strategic learning skills (cognitive strategies, metacognitive strategies, resource management) and low collaboration dispositions (cooperative mindset, team leadership, and negotiation), while pre-service teachers in the *Average in strategies, low in collaboration* profile were characterised by close to mean values in strategic learning skills and low values in collaboration dispositions. The pre-service teachers in the *Low in strategies, average in collaboration* profile reported low strategic learning skills in combination with average values in collaboration dispositions. The *Average in all* profile consisted of individuals with average values, and the *High in all* profile included individuals with high values in all the variables used in profiling.

--- INSERT FIGURE 2 ---

Variables Explaining Latent Profile Membership

Table 4 shows the variables that explain latent profile membership with the reference category being the *High in all* profile. There was a trend toward the pre-service teachers in the *Low in all* profile having lower entrance exam scores and less previous studies than pre-service teachers in the *High in all* profile. Moreover, they had lower high school averages, less teaching experience, and less anticipated life satisfaction after five years in comparison to pre-service teachers in the *High in all* profile. The odds ratios (ORs) indicated, for example, that a one year increase in teacher experience was related to 0.63 times greater odds of belonging to the *Low in all* profile compared with the *High in all* profile when controlling for other variables in the model. The pre-service teachers in the *Average in strategies, low in collaboration* profile, in turn, tended to have increased probability of less teaching experience and previous studies, along with poorer anticipated life satisfaction after five years in comparison with pre-service teachers in the *High in all* profile.

--- INSERT TABLE 4 ---

The pre-service teachers in the *Low in strategies, average in collaboration* profile were characterised by a tendency to have lower entrance exam scores, lower high school averages and less previous university studies. They also reported having lower anticipated life satisfaction after five years than pre-service teachers in the *High in all* profile. Finally, in comparison with the *High in all* profile, the *Average in all* profile was defined by an increased probability of less previous university studies. This profile was more likely to be populated by males than the *High in all* profile.

Discussion

The present study examined, first, what kind of profiles emerge among Finnish first-year pre-service teachers regarding their strategic learning skills and collaboration dispositions, and second, what background variables explain membership of the profiles. Latent profile analysis (LPA) found five student profiles corresponding to perceived strategic learning skills and collaboration dispositions with the most robust factor explaining the membership in the profiles being life satisfaction.

There were two particularly interesting and theoretically meaningful profiles that in a way are opposite to/mirror each other. The first profile (*Average in strategies, low in collaboration, 26.8 %)* represents a group of pre-service teachers that view themselves as skilful in strategic learning, but do not in general have a high preference for working in a team, to take the responsibility for teamwork nor to listen to others, negotiate and adjust own actions to the actions of the collaborating group. These pre-service teachers' co-operative mindset was as low as those in the *Low in all* profile, and team leadership and negotiation were the second lowest among the profiles. Moreover,

they had fewer previous university studies and teaching experiences than pre-service teachers belonging to the *High in all* profile. Particularly, compared to *High in all* profile pre-service teachers, their expected life satisfaction was low.

It can be assumed that although relatively stable in nature, collaboration dispositions are influenced by strategic skills as well as the studying and working environment. Due to lack of previous university education and teacher experience, these pre-service teachers lacked prior opportunities to practice collaboration with peers and teacher colleagues. It is noteworthy that their expected life satisfaction was low, which may contribute to lack of agency and low engagement in active learning in general (Järvelä and Renninger 2014), and probably for that reason, strategic skills were at the moderate level. Given that teachers' work is increasingly collaborative (Vangrieken et al. 2015), this is a group of students who may benefit from in-service teacher education, which prioritizes teamwork and collaboration. This group of students would also be worth following up to monitor the development of their collaboration dispositions to find out whether Finnish teacher education improves not only skills, but also their willingness to collaborate.

The opposite group, as a second profile type, includes pre-service teachers who do view their strategic learning skills as low, but have a stronger preference for collaboration (*Low in strategies, average in collaboration, 17.3 %)*. One explanation can be in developing learning cultures prior to higher education studies (Hakkarainen et al. 1998). While some Finnish high schools have been more active in promoting collaborative learning practices, other schools may have stressed more individual learning strategies. These pre-service teachers reported particularly high levels of co-operative mindset and team leadership. Compared to pre-service teachers in the *High in all* profile, they had lower high school average and university entrance exam scores, less

previous university education and low expected life satisfaction. They had the same level of teaching experience as pre-service teachers in the *High in all* profile and, thus, similar opportunities for involvement in collaboration with in-service teachers

The most robust factor explaining pre-service teachers belonging in profiles was their evaluated life satisfaction after five years. The results indicated that the Finnish pre-service teachers in all the other profiles were less likely to be satisfied with their life situation after five years than pre-service teachers in the *High in all* profile. Earlier research has indicated that life satisfaction positively predicts young adults' engagement in university education or work (Upadyaya and Salmela-Aro 2017). This indicates that getting to know how to learn and to develop one's own learning skills can contribute to individuals' well-being and general life satisfaction (McLaughlin 2008).

This study provides evidence for the heterogeneity of pre-service teachers in their individual strategic skills and collaboration dispositions. In a practical sense, the findings imply a need to highlight differing profiles of future teachers and search for more fine-grained and adaptive pre-service learning environments. For example, pre-service teachers in the *Low in all* profile of this study might need more consistent support in many of the skills areas, whereas some pre-service teachers might perceive some skills as strong, but some others as not so strong. In future, support for both individual and collaboration skills need to be integrated with each other in a fluent way.

Conclusions

Although this research has focused on Finnish pre-service teachers' perceived 21st-century skills, it can be assumed that similar investigations would be relevant in a more global context. There is a international consensus that teacher education should be developed to better meet the future changes in education and for working life, and

therefore 21st century skills have been highlighted in recent curriculum revisions (e.g. Urbani et al. 2017). However, the way in which teacher education is organized varies, not only between different cultural contexts but also within countries (Darling-Hammond et al. 2017). Interpretations of 'quality teachers' can be to some extent similar across cultures (UNESCO 2014), but it is important to be sensitive to national and local as well as cultural and historical contexts of teacher education in the potential cross-national studies.

In the next phase of our research, our three-year follow-up study will aim to obtain a better understanding of how Finnish pre-service teachers progress in these areas throughout their teacher education studies. For example, we would like to know whether they change between the different profile groups during their studies. Additionally, interventions are needed to provide pre-service teachers with theoretically justified and pedagogically relevant examples of challenging study projects that presuppose skills related to productive collaboration and successful strategic regulation of learning.

References

Altan, S., J. F. Lane, and E. Dottin (2017). "Using habits of mind, intelligent behaviours, and educational theories to create a conceptual framework for developing effective teaching dispositions." *Journal of Teacher Education* 70 (2): 169–183. doi.org/10.1177/0022487117736024

Asparouhov, T., and B. Muthén. 2014. "Auxiliary variables in mixture modeling: Three-step approaches using Mplus." *Structural Equation Modeling: A Multidisciplinary Journal* 8: 1–13.

Barron, B., R. D. Pea, and & R. Engle. 2013. "Advancing understanding of collaborative learning with data derived from video records." In *International handbook of collaborative learning,* edited by C. Hmelo-Silver, A. O'Donnell, C. Chinn, and C. Chan, 203–219. New York, NY: Taylor & Francis.

Binkley, M., O. Erstad, J. Herman, S. Raizen, M. Ripley, M. Miller-Ricci, and M. Rumble. 2012. "Defining twenty-first-century skills." In *Assessment and teaching of 21st-century skills*, edited by P. Griffin, B. McGaw, and E. Care, 17–66. New York, NY: Springer.

Buzza, D., and T. Allinotte. 2013. "Pre-service Teachers' Self-Regulated Learning and their Developing Concepts of SRL." *Brock Education* 23 (1): 58-76.

Cohen, J. 1988. *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Darling-Hammond, L., D., Burns, C. Campbell, L. Goodwin, K. Hammerness, E.-L. Low, A. McIntyre, M. Sato, and K. Zeichner. 2017. *Empowered educators: How high performing systems shape teaching quality around the world*. San Francisco, CA: Jossey-Bass.

Darling-Hammond, L., K. Hammerness, P. Grossman, F. Rust, and L. Shulman. 2005. "The design of teacher education programmes." In *Preparing teachers for a*

changing world: What teachers should and be able to do, edited by L. Darling-Hammond, and J. Bransford, 390–441. San Francisco, CA: Jossey-Bass.

Diallo, T. M. O., A. J. S. Morin, and H. Lu. 2016. "Impact of Misspecifications of the Latent Variance–Covariance and Residual Matrices on the Class Enumeration Accuracy of Growth Mixture Models." *Structural Equation Modeling: A Multidisciplinary Journal,* 23 (4): 507–531.

Diener, E. 1984. "Subjective well-being." *Psychological Bulletin,* 95: 542-575.

Dignath-van Ewijk, C., and G. van der Werf. 2012. "What teachers think about self-regulated learning: Investigating teacher beliefs and teacher behavior of enhancing students' self-regulation." *Education Research International*. doi:10.1155/2012/741713.

Dillenbourg, P. 1999. "Introduction: What do you mean by collaborative learning?" In *Collaborative learning: Cognitive and computational approaches,* edited by P. Dillenbourg, 1–19. Oxford, England: Pergamon.

Dinsmore, D. L., P. A. Alexander, and S. M. Loughlin. 2008. "Focusing the Conceptual Lens on Metacognition, Self-Regulation and Self-Regulated Learning." *Educational Psychology Review,* 20: 391–409.

Farrell, B. J., and H. M. Farrell. 2008. "Student satisfaction with cooperative learning in an accounting curriculum." *Journal of University Teaching & Learning Practice,* 5 (2): 39–54.

Finnish National Board of Education. 2016) *Luokanopettajakoulutus, kaikki yliopistot* [Teacher training, all universities]. Accessed November 23 2017. http://vipunen.fi/.

Fransen, J., A. Weinberger, and P. A. Kirschner. 2013. "Team effectiveness and team development in CSCL." *Educational Psychologist,* 48 (1): 9–24.

Gess-Newsome, J. 2015. "A model of teacher professional knowledge and skill including PCK: Results of the thinking from the PCK summit." In *Re-examining pedagogical content knowledge in science education,* edited by A. Berry, P. Friedrichsen, and J. Loughran 28-42. New York, NY: Routledge.

Gordon, S. C., Dembo, M. H., and Hocevar, D. 2007. "Do teachers' own learning behaviors influence their classroom goal orientation and control ideology?" *Teaching and Teacher Education*, 23: 36-46.

Hakkarainen, K., S., Järvelä, L. Lipponen, and E. Lehtinen. 1998. "Culture of collaboration in computer-supported learning: Finnish perspectives." *Journal of Interactive Learning Research,* 9: 271-288.

Järvelä, S., and K. A. Renninger. 2014. "Designing for learning: Interest, motivation, and engagement." In *Cambridge Handbook of the Learning Sciences*, *Second Edition,* edited by D. K. Sawyer, 668-685. New York: Cambridge University Press.

Kane, T. J., D. F., McCaffrey, T. Miller, and D. O. Staiger. 2013. *Have we identified effective teachers? Validating measures of effective teaching using random assignment.* Seattle, WA: Bill & Melinda Gates Foundation.

Klassen, R. M., T. Durksen, W. T. A. Al Hashmi, L. Kim, K. Longden, R.-L. Metsäpelto, A.-M. Poikkeus, and J. Gyori. 2018. "National Context and Teacher Characteristics: Exploring the Critical Non-Cognitive Attributes of Novice Teachers in Four Countries." *Teaching and Teacher Education*, 72: 64–74.

Kline, R. B. 2011. *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: Guilford Press.

Littleton, K., and N. Mercer. 2013. *Interthinking: Putting talk to work*. Abingdon, England: Routledge.

Lo, Y., N. R. Mendell, and D. B. Rubin. 2001. "Testing the number of components in a normal mixture." *Biometrika,* 88 (3): 767–778.

Masyn, K. E. 2013. "Latent Class Analysis and Finite Mixture Modeling." In *The Oxford Handbook of Quantitative Methods in Psychology: Vol. 2: Statistical Analysis,* edited by T. D. Little, 551–611. Psychology, Psychological Methods and Measurement.

McLaughlin, C. 2008. "Emotional well-being and its relationship to schools and classrooms: a critical reflection." *British Journal of Guidance and Counselling,* 36 (4): 353–366.

Muthén, L. K., and B. O. Muthén. 1998–2015. *Mplus user's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.

Nagin, D. 2005. *Group-based modeling of development*. Cambridge, MA: Harvard University Press.

Nylund, K. L., T. Asparouhov, and B. O. Muthén, B. O. 2007. "Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study." *Structural Equation Modeling,* 14 (4): 535–569.

O'Donnell, A. M., and C. E. Hmelo-Silver. 2013. "What is collaborative learning?: An overview." In *International handbook of collaborative learning*, edited by C. E. Hmelo-Silver, C. A. Chinn, C. K. K. Chan, and A. M. O'Donnell, 1–15. New York: Taylor and Francis.

OECD [The Organization for Economic Cooperation and Development]. 2013. *Draft PISA 2015 collaborative problem solving framework*. Accessed January 15 2018. http://www.oecd.org/pisa/pisaproducts/pisa2015draftframeworks.htm

Pintrich, P. R. 2000. "Role of goal orientation in self-regulated learning." In *Handbook of self-regulation*, edited by M. Boekarts, P. Pintrich, and M. Zeidner, 452–494. San Diego, CA: Academic Press.

Pintrich, P. R., D. A. Smith, T. Garcia, and W. J. McKeachie. 1993. "Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Education and Psychological Measurement,* 53 (3): 801–814.

Schunk, D. H. 2008. "Metacognition, self-regulation, and self-regulated learning: Research recommendations." *Educational Psychology Review,* 20 (4): 463–467.

Schunk, D. H., and J. A. Greene, J. A. 2017. "Historical, contemporary, and future perspectives on self-regulated learning and performance." In *Handbook of Self-Regulation of Learning and Performance (2ⁿᵈ ed.)*, edited by D. Schunk, and J. Greene, 1–15. New York, NY: Routledge.

Schussler, D. L. 2006. "Defining dispositions: Wading through murky waters." *The Teacher Educator*, 41 (4): 251-268.

Sears, D. A., and J. M. Reagin. 2013. "Individual versus collaborative problem solving: Divergent outcomes depending on task complexity." *Instructional Science,* 41: 1153–1172.

Silva, E. 2009. "Measuring skills for 21st-century learning." *Phi Delta Kappan*, 90 (9): 630–634.

Tiilikainen, M., A. Toom, J. Lepola, and J. Husu. 2019. "Reconstructing choice, reason and disposition in teachers' practical theories of teaching (PTs)." *Teaching and Teacher Education*, 79: 124-136.

UNESCO. 2014. *EFA Global Monitoring Report. Teaching and learning: Achieving quality for all*. Paris: UNESCO Publishing.

Upadyaya, K., and K. Salmela-Aro. 2017. "Developmental dynamics between young adults' life satisfaction and engagement with studies and work." *Longitudinal and Life Course Studies,* 8 (1): 20–34.

Urbani, J., S. Roshandel, R. Michaels, and E. Truesdell. 2017. "Developing and Modeling 21st-Century Skills with Preservice Teachers." Teacher Education Quarterly, 44 (4): 27-50.

Vangrieken, K., F. Dochy, E. Raes, and E. Kyndt. 2015. "Teacher collaboration: A systematic review." *Educational Research Review,* 15: 17-40.

Virtanen, A., and P. Tynjälä. 2018. "Factors explaining the learning of generic skills: a study of university students' experiences." *Teaching in Higher Education*, DOI: 10.1080/13562517.2018.1515195

Voogt, J., O. Erstad, C. Dede, and P. Mishra. 2013. "Challenges to learning and schooling in the digital networked world of the twenty-first century." *Journal of Computer Assisted Learning,* 29: 403–413.

Välimaa, R., and Danielson, M. 2004. "Health and Well-Being." In *Health Policy for Children and Adolescents, No. 4: Young People's Health in Context. Health Behaviour in School-Aged Children (HBSC) Study: International Report of the 2001/02 Survey*, edited by C. Currie, 55–61. Copenhagen, Denmark: World Health Organisation.

Wang, L., C. MacCann, X Zhuang, L. O. Lydia, and D. R. Roberts. 2009. "Assessing teamwork and collaboration in high school students: A multimethod approach." *Canadian Journal of School Psychology,* 24 (2): 108–124.

Weinstein, C., and R. Mayer. 1986. "The Teaching of Learning Strategies." In *Handbook of Research on Teaching*, edited by M. Wittrock, 315–327. New York: Macmillan.

Weinstein, C. E., T. W. Acee, and J. Jung. 2011. "Self-regulation and learning strategies." *New Directions for Teaching and Learning,* 126: 45–53.

Winne, P. H., and A. F. Hadwin. 2008. "The weave of motivation and self-regulated learning." In *Motivation and self-regulated learning: Theory, research, and applications*, edited by D. H. Schunk, and B. J. Zimmerman, 297–314. Mahwah, NJ: LEA.

Zimmerman, B. J., and D. H. Schunk. 2011. "Self-regulated learning and performance: An introduction and an overview." In *Handbook of self-regulation of learning and performance*, edited by B. J. Zimmerman, and D. H. Schunk, 1–12. New York, NY: Routledge.

Appendix
Results of the Factor Analysis: Three Sum Scales Describing the Strategic Learning Skills and Three Describing the Collaboration Dispositions

Sum scales for strategic learning skills	Cronbach's alpha (α)
Cognitive strategies	.79

- When I study for a class, I pull together information from different sources, such as lectures, reading, and discussions.
- I try to relate ideas in this subject to those in other courses whenever possible.
- When reading for a class, I try to relate the material to what I already know.
- I try to understand the material in a class by making connections between the readings and the concepts in the lectures.
- I try to apply ideas from course reading in other class activities, such as lectures and discussions.
- When I study the reading for a course, I outline the material to help me organize my thoughts.
- When I study for a course, I go through the readings and my class notes and try to find the most important ideas.
- I make simple charts, diagrams, or tables to help me organize course material.
- When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.
- I often find myself questioning things I hear or read in a course to decide whether I find them convincing.
- When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.
- I treat the course material as a starting point and try to develop my own ideas about it.
- Whenever I read or hear an assertion or conclusion, I think about possible alternatives.

Metacognitive strategies	.75

- When I become confused about something I'm reading for this class, I go back and try to figure it out.
- If course materials are difficult to understand, I change the way I read the material.
- During class time, I often miss important points because I'm thinking about other things.
- Before I study new course material thoroughly, I often skim it to see how it is organized.
- I ask myself questions to make sure I understand the material I have been studying.
- When studying for this course, I try to determine which concepts I don't understand well.
- I often find that I have been reading for class, but I don't know what it was about.

- When I study for a class, I set goals for myself in order to direct my activities in each study period.
- If I get confused taking notes in class, I make sure I sort it out afterward.

Resource management   .70
- I make good use of my study time for a course.
- I make sure I keep up with the weekly readings and assignments for a course.
- I often find that I don't spend very much time on a course because of other activities.
- I work hard to do well in my studies even if I don't like what we are doing.
- I often feel so lazy or bored when I study for a class that I quit before I finish what I planned to do.
- Even when the course materials are dull and uninteresting, I manage to keep working until I finish.
- When course work is difficult, I give up or study only the easy parts.

Sum scales for collaboration dispositions   Cronbach's alpha (α)

Cooperative mindset   .75
- I prefer working as part of a team to working alone.
- I find that teams make better decisions than individuals.
- I find that teamwork increases my own efficiency.
- I enjoy cooperating with peers.

Team leadership
- I like to be in charge of groups or projects.
- I enjoy sharing ideas.   .76
- I convince others to see things my way.
- I enjoy exchanging ideas.
- I like convincing peers.
- I enjoy bringing a team together.

Negotiation   .74
- I am a good listener.
- I enjoy seeing my classmates be successful.
- I take into account what others are interested in.
- I enjoy considering different perspectives.
- I am open to all sorts of opinions.
- I am flexible when working with a team.

Table 1. Bivariate Correlations, Means, and Standard Deviations of the Variables Used for
Profiling

	1	2	3	4	5	6
1. Cognitive strategies						
2. Metacognitive strategie	.60***					
3. Resource management	.43***	.62***				
4. Cooperative mindset	.18***	.17***	.12**			
5. Team leadership	.38***	.29***	.18***	.43***		
6. Negotiation	.40***	.34***	.28***	.44***	.46***	
M	4.97	4.61	4.44	5.20	5.34	5.95
SD	0.68	0.71	0.89	0.94	0.72	0.57

Note. M = Mean, SD = Standard deviation, ***$p < .001$, **$p < .01$, two-tailed

Table 2.   Goodness-of-Fit Statistics and Group Sizes for the Estimated Latent Profiles

No. profiles	No. free parameters	LL	AIC	BIC	Entropy	*p*VLMR	*p*BLRT	Group sizes
1	12	-5854.373	11732.746	11789.995	-	-	-	872
2	25	-5348.582	10747.164	10866.434	.76	< .001	< .001	467, 405
3	38	-5216.381	10508.762	10690.052	.75	0.1757	< .001	361, 358, 153
4	51	-5134.029	10370.057	10613.367	.74	0.0165	< .001	238, 332, 160, 142
5	64	-5057.012	10242.025	10547.355	.74	0.0186	< .001	95, 151, 234, 117, 275
6	77	-5008.890	10171.779	10539.130	.76	0.3970	< .001	126, 88, 42, 230, 295, 91
7	90	-4977.671	10135.342	10564.713	.77	0.1572	< .001	206, 77, 36, 112, 275, 95, 71

Note. LL = Log-likelihood. AIC = Akaike information criterion. BIC = Bayesian information criterion. *p*VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test. BLRT = Bootstrapped Likelihood Ratio Test

Table 3. Means and Standard Deviations for Profiles and Variable-Specific Effect Sizes

Profiles of pre-service teachers strategic learning skills and collaboration dispositions

Variable	*Low in all*	*Average in strategies, low in collaboration*	*Low in strategies, average in collaboration*	*Average in all*	*High in all*	η^2
Cognitive strategies	4.02 (0.52)	4.87 (0.47)	4.47 (0.40)	5.30 (0.40)	5.82 (0.39)	.60
Metacognitive strategies	3.55 (0.43)	4.56 (0.40)	4.00 (0.36)	4.90 (0.32)	5.70 (0.36)	.74
Resource management	3.47 (0.97)	4.36 (0.70)	3.91 (0.64)	4.63 (0.59)	5.60 (0.52)	.44
Cooperative mindset	4.48[a] (1.01)	4.56[a] (0.78)	5.65[bc] (0.68)	5.63[bd] (0.65)	5.52[cd] (0.96)	.31
Team leadership	4.57 (0.72)	4.85 (0.58)	5.58[a] (0.48)	5.72[a] (0.48)	5.73[a] (0.60)	.40
Negotiation	5.31 (0.72)	5.57 (0.46)	6.08 (0.39)	6.26[a] (0.33)	6.37[a] (0.43)	.43

Note. Profile comparisons in variables used for profiling students were conducted with One Way Analysis of Variance using the Sidak post hoc test. Profiles sharing a superscript in the same row for a variable, are not different at $p < .05$.

Table 4. Variables Explaining Latent Profile Memberships

Variable	Low in all			Average in strategies, low in collaboration			Low in strategies, average in collaboration			Average in all		
	Est.	*S.E.*	*OR*	Est.	*S.E.*	*OR*	Est.	*S.E.*	*OR*	Est.	*S.E.*	*OR*
Gender	-0.58	0.58	0.56	-0.79	0.52	0.45	-0.71	0.53	0.49	-0.92	0.50	0.40†
High school average	-0.45	0.19	0.64*	-0.04	0.16	0.96	-0.40	0.17	0.67*	-0.06	0.17	0.94
Entrance exam scores	-0.03	0.02	0.97†	-0.02	0.01	0.98	-0.02	0.01	0.98†	-0.01	0.01	0.99
Previous studies	-0.86	0.51	0.42†	-0.67	0.39	0.51†	-1.27	0.45	0.28**	-0.86	0.38	0.42*
Teaching experience	-0.47	0.23	0.63*	-0.47	0.19	0.63*	-0.22	0.17	0.80	-0.23	0.17	0.79
Current life satisfaction	-0.27	0.20	0.76	-0.08	0.19	0.92	0.09	0.20	1.09	-0.07	0.20	0.93
Life satisfaction after five years	-1.16	0.33	0.31**	-1.07	0.32	0.34**	-1.14	0.31	0.32***	-0.37	0.31	0.69

Note. The reference profile is *High in all*. Est. = Estimate; *S.E.* = standard error; *OR* = odds ratio; Gender (1 = female). ***$p < .001$, **$p < .01$, *$p < .05$, †$p < .09$, two-tailed. The coefficient values are unstandardized.
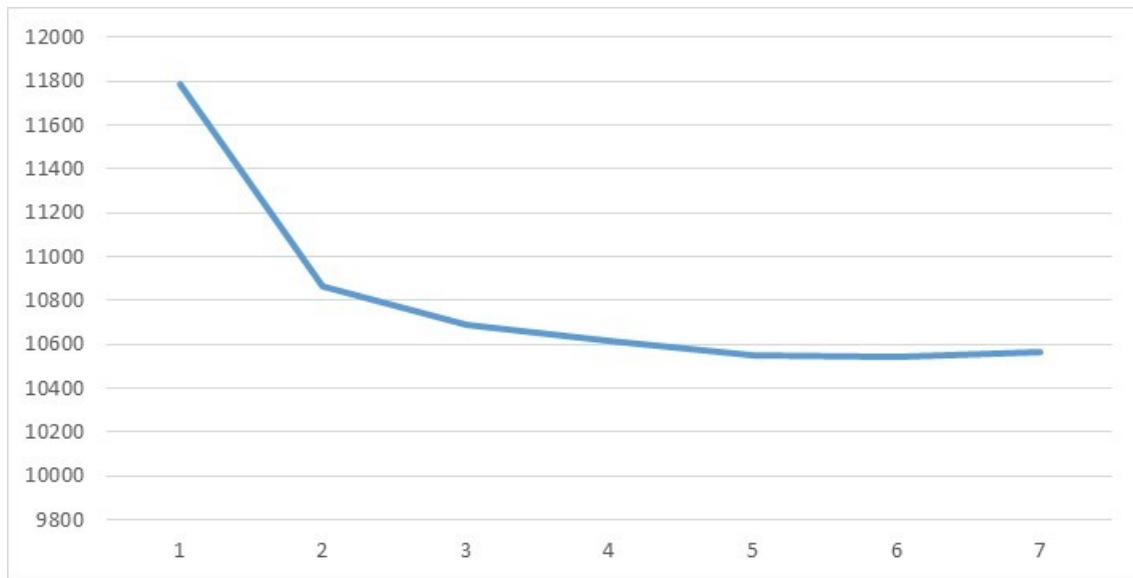
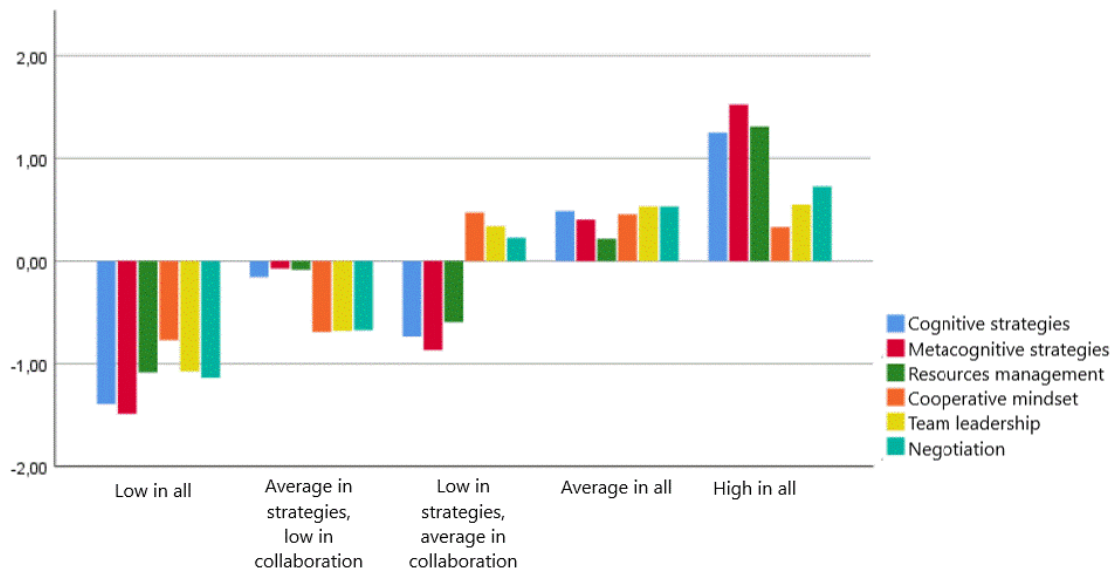Figure 1. Screen Plot for Bayesian Information Criterion for 1 to 7 Profiles

Figure 2. Profiles of pre-service teachers' cognitive strategies, metacognitive strategies, resource management, cooperative mindset, team leadership, and negotiation. Variable means are standardized ($M = 0$, $SD = 1$)