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Student Teachers' Study Profiles — Longitudinal Perspective to Research-Based Teacher Education

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Abstract

This study examined student teachers' study profiles and achievement levels from selection through to the bachelor's phase of their teacher education programmes. The latent profile analysis revealed two student teacher study profile subgroups associated with varying study achievement levels from the first three years of the teacher education programme. In a more detailed examination, the results revealed that the main differences occur during the bachelor's phase of the teacher education programme, wherein student teachers are learning to understand the research-based teaching profession and how to conceptualise theories and more independently learn to write their bachelor's theses. A gender comparison between subgroups revealed that male student teachers were more likely to be allocated to the less research-oriented subgroup and female students to the highly research-oriented subgroup. These findings are discussed with regard to how teacher education programmes could better support different learners.

Keywords

Teacher professional development, higher education, teacher education, student teacher selection, study profiles

Introduction

Previous literature has shown that various fields of professions utilise education to acquire the essential knowledge and skills needed in professional fields, such as mathematics, medicine or teacher education, which is also the focus of this study (e.g. Eraut, 1994). Nowadays, many countries in Europe and internationally are developing and shifting the focus towards research-based education to answer changing professional demands (Darling-Hammond et al., 2017; Mikkilä-Erdmann et al., 2024).

Preservice teacher education plays an essential role in the development of competent teachers. A number of studies have highlighted how the development of both teacher competences and teaching quality should be viewed as an ongoing process wherein preservice teacher education plays a key role in enabling teachers to build a solid base with regard to the wide range of skills and competences necessary to perform effectively in the teacher role (Blömeke et al., 2015; Klassen et al., 2018). Moreover, a growing body of literature has shifted the focus in terms of teaching quality by examining the characteristics of preservice teacher candidates when it comes to the selection criteria associated with the dimensions of the competences required in the teaching profession (e.g. Blömeke et al., 2015; Bowles et al., 2014). Such studies have not only identified the vital role of the selection process and recognised the various important phases of preservice teacher education but have also emphasised the need for further information concerning the development of teacher competences both during the preservice stage and after graduation (Bowles et al., 2014; Klassen & Kim, 2019). For instance, Clinton et al. (2019) identified a predictive relationship between the selection criteria (which included social, cognitive and dispositional factors) for teacher education programmes and the programme outcomes, particularly practicum experience. They also posited that the selection criteria established a professional baseline for new graduates to work from throughout their subsequent teaching careers and continuous professional development (Clinton et al., 2019).

Selection and consideration of teacher candidates

When it comes to enrolment in teacher education programmes, many European countries and other countries worldwide have implemented selection systems that consider more than just candidates' grade point average (GPA). However, in Finland, there remains a clear need for the research-based development of selection methods, standardised selection processes and valid criteria concerning enrolment in teacher education programmes (Clinton & Dawson, 2018; Darling-Hammond, 2017; Metsäpelto et al., 2021).

In Finland, unlike in countries where GPA is the main selection criterion, student teachers are selected for initial teacher education through a two-phase selection. Until 2020, candidates participated in the first phase, a multiple-choice test (the VAKAVA exam), which assessed academic study skills. Based on their scores, candidates were invited to the second phase, an aptitude test that varied by university.

Over the past five years, this system has changed, with greater emphasis on the matriculation exam and standardised aptitude tests across all universities. Currently, about 60% of candidates are preselected for the second phase based on weighted matriculation exam scores. Those not meeting this criterion take the VAKAVA exam, and based on these scores, they may be invited to the second-phase aptitude test, which serves as the final selection phase.

It has been argued that recognising and examining different factors known to influence student teachers' initial selection and study success are important with regard to ensuring high-quality teaching. Furthermore, investigating student teachers' characteristics upon selection and actual achievements throughout their teacher education would provide meaningful information that could be leveraged to ensure enhanced learning outcomes among preservice teachers (Blömeke et al., 2015). Hence, the present study examines the association between the selection processes and student teachers' achievements during a teacher educational programme that focuses on allowing students to practise and learn competences, knowledge and pedagogy. More specifically, this study applies a longitudinal research approach to investigate student teachers' achievements from selection through to the bachelor's phase of their teacher education.

Although education systems vary among countries and education processes are, to some extent, linked to the national context, it is suggested that examining the approaches in various countries provides an opportunity to learn how different teacher education programmes manage the process of educating future teachers and identify the kinds of criteria, standards and evaluation processes that are applied to drive student teachers' competence development (Bauer & Prenzel, 2012; Darling-Hammond, 2017). Many countries have implemented selection systems that consider more than just students' GPA when it comes to determining suitability for enrolment in teacher education programmes. In Finland, the validity and reliability of the utilised selection processes are considered essential, as once student teachers have been selected to participate in a teacher education programme, they have a mandate to begin teaching immediately after graduation (Darling-Hammond, 2021; Sahlberg, 2011). Moreover, Finnish teachers have great autonomy in the workplace because Finnish schools are free from standardised evaluations. However, despite the important role played by the applied selection processes within the Finnish system, there remains a need to conduct in-depth studies regarding student teachers' achievements throughout their teacher education due to their varying learning outcomes.

While teachers are generally considered to be in short supply worldwide as a result of uncertainties concerning what the role should entail in the modern world (Darling-Hammond et al., 2017, pp. 53–55), teacher education has long been a highly popular educational option in Finland. Thousands of candidates apply for admission to Finland's highly selective teacher education programmes annually (Vipunen, 2024). However, there is still considerable pressure to further develop both the selection system and the actual study programmes to ensure the timely graduation of highly qualified teachers (Metsäpelto et al., 2021; Heikkinen et al., 2020, p. 56).

Candidates who gain admission to teacher education programmes will have completed different levels of schooling within the Finnish national education system. At the start of every teacher education programme in Finland, students must confront new learning challenges and adapt to the fact that educational science and research skills will represent core aspects of their academic studies at the university level and also influence the goals that they must achieve on their way to becoming qualified teachers. In fact, student teachers follow a curriculum that requires a great degree of independence and self-regulation when it comes to their learning (Lavonen et al., 2020; Metsäpelto et al., 2021, p. 12; Vilppu et al., 2022). Thus, teacher education and the related academic learning, achievements and grades do not exist in a vacuum; rather, the relevant learning processes are connected to many different contextual aspects, including the social context, popularity of the teaching profession and entry characteristics. Prior longitudinal studies have found that applicants' learning varies in terms of their grades and the motivational aspects that can help them on their way to developing the competences required in the teaching profession (Blömeke & Kaiser, 2017, p. 795).

Furthermore, when compared with the high school level, academic studies at the university level typically require students to increase their personal responsibility for their learning and their capacity to acquire new information in relation to different course contexts and study modules. Based on the findings of previous studies conducted in the higher education context, it is hypothesised that, even among a highly selected group of student teachers, there will be different subgroups based on their achievement levels throughout the teacher education programme (Cassidy, 2012; Lizzio et al., 2002; Vilppu et al., 2019; Voyer & Voyer, 2014).

Research-based teacher educational programmes

Previous studies have revealed a growing understanding that the development of teacher education programmes should be based on research standards, according to which evidence forms the basis for relevant actions (e.g. Darling-Hammond et al., 2017). Previous studies have highlighted the importance of identifying and evaluating promising practices and strategies for developing fruitful models to support student teachers' diverse learning processes (Darling-Hammond, 2017, pp. 306–307). In addition, countries such as Finland and Norway are increasingly utilising research-based principles to assist with the development of teacher

education programmes while simultaneously targeting the establishment of a research-based teaching profession (Jakhelln et al., 2021; Munthe & Rogne, 2015).

Moreover, research-based teacher education programmes, curricula and teaching processes are also influenced by and actively utilising the latest research. In this context, a research-based teaching profession can be understood as requiring teachers to have the ability to utilise research methods and educational theories as part of their general teaching practices and to enhance their professional skills over the course of their careers (Byman et al., 2009; Mikkilä-Erdmann et al., 2019; Westbury et al., 2005, pp. 476–479). Consequently, five-year teacher education programmes for preservice teachers in Finland aim to equip students to utilise, evaluate and integrate educational theories and research as part of their day-to-day teaching practice. Here, student teachers' learning is not solely focused on the substance of specific educational theories; it also aims to foster the skills required to evaluate and appreciate what is being learned and to implement and utilise research-based aspects as part of their teaching practice (Lavonen et al., 2020; Westbury et al., 2005).

In Finland, teacher education and the related curricula include study modules and courses wherein preservice teachers not only learn research skills and how to conduct small-scale research but also come to understand how the teaching profession includes and utilises research-based structures (Heikkilä et al., 2020; Heikkilä, 2022; Puustinen et al., 2018; Tirri, 2014, pp. 603–605). This requires teachers to constantly update their skills, which entails engaging in, being informed by and utilising research. Understanding how theories are connected to teaching practices and mastering research skills are viewed as vital, as the associated skills and competences enable teachers to acquire the tools necessary to develop their professional competences and respond to challenges throughout their careers (Mikkilä-Erdmann et al., 2019).

However, prior studies have shown that students utilise a variety of different learning strategies and processes to achieve academic success (Cassidy, 2011; Vermunt, 1998). This suggests the need for research-based knowledge to be considered when determining how student teachers are selected and the extent to which they achieve the goals of teacher education programmes. Research inquiry and the principles of theory-based learning represent core components of research-based teacher education curricula in countries such as Finland. As part of each curriculum and its associated goals, student teachers are expected to master research skills and utilise them independently, initially during the bachelor's phase of their education. Therefore, the present study applies a longitudinal approach to examine student teachers' achievements after they have been selected to participate in a teacher education programme.

Research aims

The present study sought to identify Finnish student teachers' varying development in terms of their achievements in relation to the main study modules during the first three years of the

bachelor's phase of their teacher education. The study also sought to examine the association between selection processes and student teachers' development during the first three years of their bachelor's level education. To accomplish this, the study was designed to answer the following research questions:

- What subgroups can be identified based on their achievements in relation to the four main study modules and the study credits gained during the bachelor's phase of their teacher education?
- How do student teachers differ from each other based on their achievements during the bachelor's phase of their teacher education?
- How are gender and age groups distributed within the subgroups?

Methodology

Participants

A total of two student teacher cohorts (N = 158) consisting of students who were accepted into the teacher education programme at the University of Turku in 2010 and 2013 were enrolled in this study. Longitudinal datasets were drawn from cohorts. The following inclusion criteria were utilised: participants were accepted through a joint selection process into the teacher education programme; the start years of the participants' studies ensured the collection of the necessary three-year data for longitudinal research; and the sample cohort was consistent, representing one university's teacher education programme, due to variations in the second-phase aptitude test before the 2020 reform.

The university's selection process comprised two phases: a multiple-choice test and a series of aptitude tests. The Department of Teacher Education at the University of Turku also conducted group interviews as part of its two-phase selection process. In addition, among the aptitude tests, applicants to the University of Turku had to complete a mathematics and natural sciences examination designed to measure their basic mathematical and science skills. Prior studies and annual statistics have shown that the intake of Finnish teacher education varied between approximately 700 and 800 applicants during the 2010s. These statistics cover all Finnish universities with teacher education departments (Mankki, 2019, p. 14; Vipunen, 2024). Hence, the student teacher cohorts involved in this study represent a subset of all annual applicants to Finnish teacher education programmes.

Among the applicants, 79% were female (n = 124), and 21% (n = 34) were male. Their mean age during the selection phase was 22 years (range: 19–44 years). During the second phase of the selection process, the applicants' mean score on the matriculation examination was 3.9. In other words, the average score of the applicants who sought admission to the teacher education programme represented the third highest grade available (or magna cum laude approbator). In terms of the Finnish matriculation examination, the accepted scale for written

subject grades ranges from the lowest approbator to the highest laudator. The matriculation examination is taken at the end of upper secondary school.

At the time the present study was conducted, applicants had to pass a two-stage entrance examination prior to being accepted into the popular teacher education programme. More specifically, after graduating from upper secondary school, all the applicants had to complete a multiple-choice test (the VAKAVA exam). In contrast to the matriculation examination, the VAKAVA exam focused on assessing applicants' academic learning skills in an educational context. The applicants' mean score for the multiple-choice test was 10.41 (standard deviation [SD] = 2.18), whereas their scaled scores varied between 5.75 and 15. To progress to the second phase of the selection process, the applicants had to achieve a score of 5 or higher for the multiple-choice test. The second phase involved a group interview in which the mean score was 10.56 (SD = 2.18), in addition to a mathematics and natural sciences test in which the mean score was 10.52 (SD = 2.05). To pass these second-phase aptitude tests, the applicants had to achieve a score of 5 or higher (their scores varied between 5 and 15).

The selected student teachers' five-year study programme consisted of four main study modules: basic studies, subject didactics, bachelor's studies and master's (or advanced) studies. During the teacher education programme, the student teachers' potential grades ranged from one to five (1 = passable, 2 = satisfactory, 3 = good, 4 = excellent, 5 = distinction). As shown in Table 1, the student teachers' average grades were above 3 for all of the study modules. To follow the teacher education curriculum and schedule, the student teachers had to complete the first three years of a bachelor's degree (consisting of 180 study credits) and then two years of a master's degree (consisting of 120 study credits). Based on the mean values of the completed study credits, the majority of the student teachers in the two cohorts followed the curriculum during the first three years, although some variation was noted in certain cases (see Table 1).

Table 1

Student Teachers' (N = 158) Descriptive Characteristics and Achievement Variables

Variable	N	Mean value or %	SD	Min–Max
Men (%)	34	22		
Women (%)	124	79		
Age (years)	158	22		19–44
≤ 20 (%)	64	40.5		
> 20 (%)	94	59.5		
Matriculation examination: Applicants' written subjects (mean scores)	154	3.92	0.84	1.6–6
Aptitude test: Multiple choice test	158	10.41	2.18	5.75–15
Aptitude test: Group interview	158	10.56	2.18	5–15
Aptitude test: Mathematics and natural sciences test	158	10.52	2.05	5.50–15
Basic studies (25 credits)	141	3.06	0.66	2–5
Subject didactics (60 credits)	136	3.10	0.60	2–5
Bachelor's studies (35 credits)	137	3.42	0.51	2–5
Bachelor's thesis grade	138	3.38	0.80	1–5
Study credits (years from 1–3 until bachelor's level)	158	176	41.09	22–312

Note. N = number of cases, SD = standard deviation, Min–Max = minimum–maximum values

Measures

The student teachers' study profiles comprised longitudinal datasets that included different variables derived from their selection and achievement data over the course of their programme of study. To examine the student teachers' achievements, the study included five achievement variables from the basic phase of their teacher education through to the bachelor's phase: the grades for their basic studies, the grades for their subject didactics, the grades for their bachelor's studies, the grades for their bachelor's theses and the credits from the first three years of the teacher education programme. Due to the student teachers' varying grades and scores, their achievement levels and learning outcomes were also found to vary.

In addition, the following four selection-phase variables were used to demonstrate the possible association between the applicants' achievements during the selection process and the identified subgroups: the average matriculation examination scores for the different written

subjects, the first-phase selection scores for the multiple-choice test, the second-phase selection scores for the group interview and the scores for the mathematics and natural sciences test.

The possible associations among the student teachers' gender and age and the identified subgroups were also analysed. The student teachers' gender was coded (1 = men, 2 = women). Moreover, as examining how the young applicants performed with regard to the teacher education selection process (Heikkinen et al., 2020, pp. 44–46) was one of the aims of this study, a variable was created that comprised applicants aged 20 years or under who continued their studies directly after graduating from upper secondary school (1 = yes, 0 = no).

Analysis

To answer the three research questions that informed this study, a latent profile analysis (LPA) was performed to identify the latent student teacher subgroups associated with the variables described above. In contrast to traditional cluster analysis, an LPA is a model-based method intended to explain heterogeneous data and identify the latent subgroups within the data based on the examined variables (e.g. Tein et al., 2013). The LPA involved the following steps:

Step 1: We identified the student teacher subgroups based on the variables associated with teacher education, including the student teachers' achievements at the basic studies level, subject didactics, degrees gained at the bachelor's level and study credits achieved. The selected variables chosen for the LPA represented the main study modules and learning objectives included in the teacher education programme over the three-year period, thereby providing a comprehensive description of study achievements and targeting content preparing for the teaching profession. Prior to further analysis, we examined and confirmed the fit statistics for the different latent classes identified.

Step 2: We examined the associations among the student teachers' selection phase achievements and the identified subgroups. Here, the selection-phase variables included the student teachers' grades for the written subjects during the matriculation examination, the scores for the multiple-choice test and the scores for the two aptitude tests (group interview and mathematics and natural sciences test). Additionally, we performed an analysis of the student teachers' genders and ages to examine the possible associations between these two variables and the identified subgroups.

The first-stage descriptive analysis was performed using IBM's Statistical Package for the Social Sciences 26 statistical programme. MPLUS 8.4. programme and an LPA were used to identify the possible student teacher subgroups, with the focus being on the bachelor's phase measurement points within the longitudinal dataset. The LPA analysis type was conducted with a mixture command. Five of the 11 variables used in the study contained missing data; the percentages of missing cases varied between 3.2% and 13.9%. The missing data were coded (-99) and handled with full information maximum likelihood, where missing data are

assumed to be random. Furthermore, the associations among the identified subgroups and the background variables were also examined using the MPLUS programme (AUXILIARY option-using methods BCH and DCAT). The relevant percentages were included in the analysis of the categorical variables, although they were excluded from the analysis of the continuous variables.

To allow for further analysis, the decision criteria for choosing a suitable model and determining the number of latent student teacher subgroups were developed. Models with different latent classes were examined with regard to several fit statistics and values, as shown in Table 2. The analysis revealed that when the classes were added in stages two to four, the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) values decreased up to stage three. In terms of decreasing AIC and BIC values among the models from 2 to 3, the statistics appeared to show an improvement in the models (Tein et al., 2013). In addition, the Vuong–Lo–Mendell–Rubin likelihood ratio (VLMR) test was used to compare the models and identify a suitable number of classes. In the VLMR test, significant p-values indicated that the estimated model fit the data well when compared with a model with fewer classes (Nylund et al., 2007). Yet, as shown in Table 2, the VLMR test p-values were nonsignificant for all of the models from two to four, showing no clear support for several classes, especially in the three- and four-class solutions.

The fit statistics concerning the latent student teacher subgroups also included the entropy values. As presented in Table 2, for the latent classes from two to four, all of the values were close to one, which proved that the latent classes were clearly different from each other (range: .901–.926). In contrast to traditional cluster analysis, an LPA also reveals the probability of belonging to a specific latent group. As the data in Table 2 show, the class probability values in all classes were close to 1. The entropy and class probability criteria enabled us to select classes from two to four. The number of cases and percentages in the different latent classes were also included in the LPA, which revealed that each latent group had a sufficient number of cases. Stanley et al. (2017, p. 90) emphasised the usefulness of different latent classes and specified that latent subgroups should not contain less than 5% of cases.

As can be seen in Table 2, in the two-class solutions, there were 93 cases (57%) and 65 cases (43%), whereas in the three- and four-class solutions, the LPA revealed that the classes contained less than 5% of the cases. Previous studies concerning learning in an academic context have indicated a solution involving several latent classes (Vermunt, 1998; Vilppu et al., 2019). However, our LPA was conducted on student teachers' achievements by using their grades for different study modules, not a specific theme with validated research measurements. Thus, there were insufficient reasons to justify the exact number of latent classes. Prior studies have shown that LPA analyses can be utilised with very different sample sizes, beginning with over 100 cases and ending with thousands of cases (Spurk et al., 2020). Some researchers have suggested that a suitable LPA sample size is 500 or more cases, although following the characteristics of each research study and paying attention to the utilised items/indicators,

classes and fit statistics have also been recommended (Ferguson et al., 2020; Spurk et al., 2020; Tein et al., 2013).

Researchers have previously highlighted the possibility of there being no exact answers or "golden rules" when it comes to the question of latent classes and suitable fit statistics (Marsh et al., 2009, p. 215). Hence, the final decision in this regard should be made after examining a combination of fit statistics, prior research findings and theoretical concepts (Marsh et al., 2009, p. 195).

To summarise the final decision in our LPA analysis, the BIC values and the distribution of cases across classes were crucial. As seen in Table 2, the BIC values decreased up to the three-class solution. However, in the three- and four-class solutions, there were classes that contained less than 5% of the cases. Additionally, to check the robustness of the results, the model was alternatively tested by changing the parameterisation to allow for group solutions with different variances. The two-class model with different variances showed similarities in structure and fit statistics compared to the model with equal group variances. The models with three- and four-class solutions did not work.

On that basis, we continued with the LPA, which yielded two student teacher subgroups. To describe the differences between the identified student teacher subgroups and the student teachers' differing levels of achievement in detail, the analysis included a t-test comparison involving two profile groups and each selected variable's study module grades and study credits. When multiple comparisons were conducted, the t-test p-values were calculated using the Bonferroni correction.

Table 2

Fit Statistics for the Student Teacher Subgroups' Study Profiles in One to Four Classes

Number of classes	Number of cases in the classes (%)	BIC	AIC	Loglikelihood	Entropy	VLMR test *p*-value	Class probabilities
1	158(100)	2060.585	2029.959	-1004.980			1.000
2	93(57) / 65(43)	1857.105	1808.103	-888.052	0.901	0.2706	0.955/0.982
3	4(3) / 85(54) / 67(43)	1679.817	1612.440	-784.220	0.927	0.7770	1.000/0.948/0.982
4	63(40) / 5(4) / 4(3) / 84(53)	1684.983	1599.230	-771.615	0.926	0.4957	0.971/0.970/1.000/0.935

Note. In terms of the number of cases in the classes, the unacceptable value for each subgroup is < 5%.
BIC = Bayesian information criterion (the model with the lowest value offers the best fit); AIC = Akaike information criterion (the model with the lowest value offers the best fit). A higher entropy value up to a value of one indicates better classification, while < 0.80 is not acceptable. VLMR = Vuong–Lo–Mendell–Rubin likelihood ratio. A significant p-value indicates that the estimated model fits the data well when compared with the fewer class model. With regard to the class probabilities, the higher the value up to a value of one, the better the probability that the cases are correctly classified into the classes.

Research ethics

From the start of the data collection process and the initial disclosure of information, we followed all applicable laws and standards, including the Personal Data Act and the guidelines and local rules set by the University of Turku. Prior to beginning their higher education studies, all of the students were asked by the university administration to give permission for the use of their register data for scientific research purposes. Moreover, the European Union's General Data Protection Regulation came into force in the spring of 2018. As a consequence, we also applied the following guidelines and principles: First, an application for permission to conduct the study and approval of the research design was submitted to the university so that we could access the selection-phase register and study register data concerning students who had given permission to participate in scientific research studies. Second, once permission was granted and access to the two different registers was provided, the data were combined into one longitudinal dataset. During this phase, any sensitive information was pseudonymised – only research codes were used during the subsequent analyses. The research data were stored in electric files with limited access, which were administered by the university's information technology services. Additionally, the data were recorded in the university research data inventory, where all research data processed on behalf of the university must be described. As the present research involved personal data, a privacy statement was used. It should be noted, however, that all of the participants in this study were adults and that no sensitive information (e.g. data concerning health) was gathered. Thus, a separate Finnish ethics review was not required.

Results

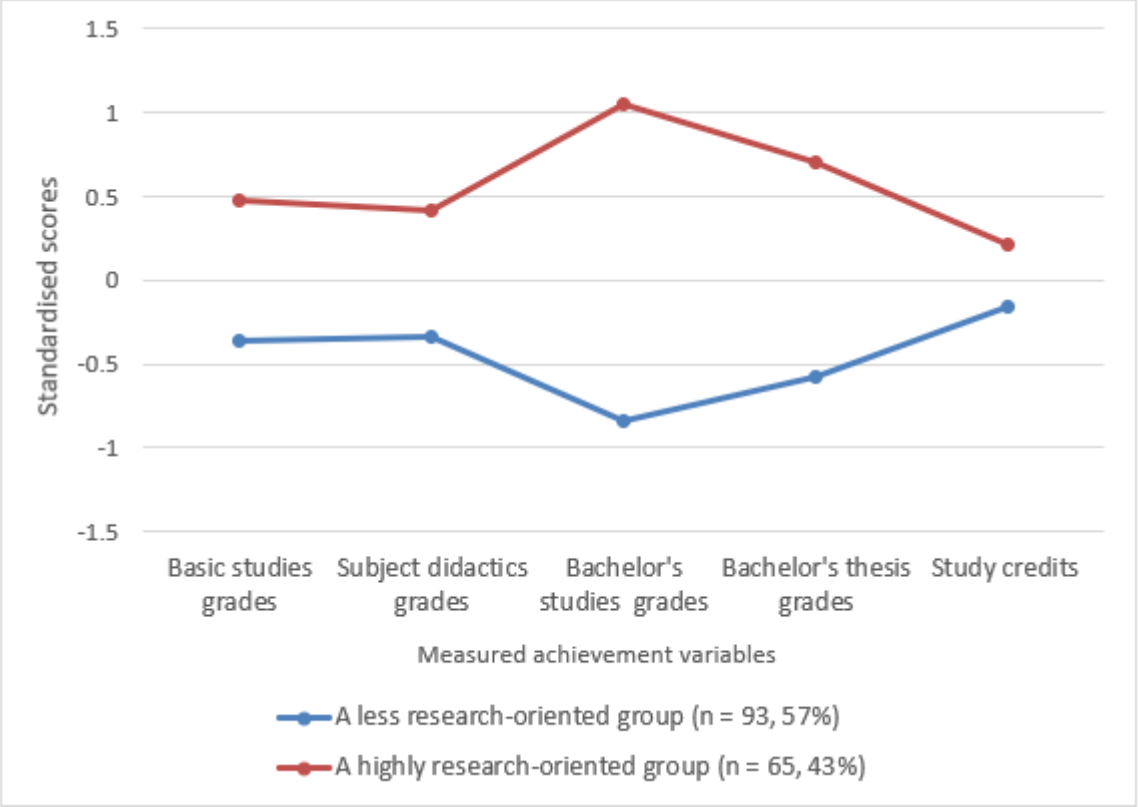
Our first research aim concerned identifying student teachers with varying levels of achievement during the first three years of their study programme, with the focus being on the four main study modules and the study credits gained prior to the bachelor's phase.

Identified student teacher subgroups

The LPA yielded two student teacher subgroups that showed differences in their achievement levels from the basic studies phase through to the bachelor's phase: Group 1 (n = 65, 43%), which represented a highly research-oriented group, and Group 2 (n = 93, 57%), which represented a less research-oriented group. As shown in Figure 1, the identified differences developed over time and between the two groups. In fact, the group differences began to increase immediately after selection and became prominent during the bachelor's phase.

Figure 1

Student Teachers' Study Profiles Based on Five Achievement Variables from Initial Selection Through to the Bachelor's Phase



To understand and clarify the meanings of the different factors involved, such as the study modules included in the determination of the identified student teacher subgroups, we examined each achievement factor separately on the basis of the t-tests and effect sizes (Cohen, 1988).

Table 3

T-Test Comparison of the Student Teachers' Study Profiles

	A less research-oriented group		A highly research-oriented group				95% confidence interval		
Achievement variable measures	M	SD	M	SD	t	*p*	Lower	Upper	*d*
Basic studies grade	-0.36	0.79	0.49	1.04	-5.33	<.001	-1.29	-0.59	-0.94
Subject didactics grade	-0.35	0.85	0.43	1.01	-4.80	<.001	-1.19	-0.49	-0.84
Bachelor's studies grade	-0.84	0.40	1.05	0.23	-34.99	<.001	-6.40	-4.90	-5.65
Bachelor's thesis grade	-0.58	0.73	0.71	0.80	-9.89	.001	-2.07	-1.29	-1.68
Study credits	-0.18	0.95	0.26	1.01	-2.79	.001	-0.77	-0.13	0.45

Note. CI = confidence interval, M = mean, SD = standard deviation, t = t-test ratio used to describe the difference between the two groups, Cohen's d with Hedges' correction = effect size, at least 0.2 = small effect, 0.5 or more = intermediate effect, 0.8 or more = large effect. The p-values are calculated based on the Bonferroni correction. Statistical power in the comparisons between the subgroups was high ((1-β) > 0.98), except for the variable "study credits" ((1-β) = 0.79).

A detailed examination of the student teacher subgroups revealed statistically significant differences with regard to the five study modules and credits (see Table 3). Statistically significant differences concerning the study modules and credits included in the subgroups, the effect sizes were found to large effect in all four study modules (d = -0.84– -5.65) excluding credits to a small extent (d = 0.45). According to the results, the bachelor's phase proved to be the main study module in which differences between the subgroups could be observed based on both the statistical significance and the large effect size (t [122.81] = -34.99, $p \leqslant .001$, d = -5.65). Thus, our results suggest that the main differences occur during this phase of the teacher education programme, wherein student teachers are learning to understand the research-based teaching profession and how to conceptualise theories and apply research skills in practice. Despite this, student teachers' potential and motivation with regard to the

teacher education programme are examined during the selection phase. In addition, student teachers' academic achievements in high school could form a solid base for mastering more advanced university studies, including research studies. Therefore, our analysis also included the applicants' background and selection phase data.

Examining differences in student teacher subgroups

To identify any possible differences in the associations among the student teachers' selection-phase achievements and background characteristics and the two identified subgroups, our second research aim involved examining the possible associations between their selection-phase achievements in terms of the two-phase entrance exams and the subgroups. The analysis revealed that the association between the student teachers' mean score for the matriculation examination and the subgroups was nonsignificant (χ^2 [1, n = 158] = 2.776, p = .096). In addition, similar nonsignificant associations were found with regard to the other variables involved in the two-phase selection process, including the mean multiple-choice test score (χ^2 [1, n = 158] = 2.270, p = .132), group interview score (χ^2 [1, n = 158] = 1.669, p = .196) and mathematics and natural sciences test score (χ^2 [1, n = 158] = .219, p = .640). Our results indicate that highly selected applicants represent a relatively coherent group when it comes to their two-phase selection scores.

A comparison between the student teachers' ages and the identified subgroups revealed no statistically significant differences between the younger student teachers and their levels of achievement (χ^2 [1, n = 158] = 0.865, p = .352). In fact, 64% of the younger student teachers who continued their studies directly after high school were allocated to the less research-orientated subgroup and 36% to the highly research-oriented group. Regarding the older students, a comparison revealed that 55% were allocated to the less research-oriented subgroup and 45% to the highly research-oriented subgroup.

Interestingly, the results revealed gender differences between the two subgroups. Male student teachers were more likely to be allocated to the less research-orientated subgroup (82%) than to the highly research-orientated subgroup (18%). In contrast, female student teachers were more equally divided between the less research-orientated subgroup (52%) and the highly research-orientated subgroup (48%). These gender differences between the two subgroups proved to be statistically significant (χ^2 [1, n = 158] = 13.037, p < .001).

Discussion

The present study sought to examine student teachers' study profiles based on their subgroup allocation and achievement levels from the initial selection through to the bachelor's phase of their teacher education programme. To accomplish this, the study utilised longitudinal datasets concerning two cohorts of highly selected student teachers and investigated their progress during the first three years of the teacher education programme. In line with our

hypothesis, the main results revealed two distinct subgroups among the student teachers over the course of the first three years of their education, including their research studies.

Given the utilised variables, the results indicated that the differences between the achievement levels of the two subgroups occurred during the teacher education programme and that there was no significant association between the student teachers' achievement levels during the selection phase (e.g. their scores for the matriculation examination) and their differing achievement levels during the programme.

With regard to student teachers' achievement levels during the teacher education programme, the LPA revealed variations between the two subgroups. Overall, our detailed examination of the different factors indicated that the main differences between the identified subgroups were particularly prominent during the bachelor's phase, as supported by the intermediate effect size. In this case, the bachelor's phase of the programme included courses wherein the student teachers focused on building an understanding of research skills and the principles of research-based teacher education, linking theories to practice and determining how to utilise the related skills as part of their continuous professional development. When compared with the basic study modules and courses, the bachelor's phase is more demanding, requiring student teachers to engage in more independent study to achieve the desired learning outcomes. However, despite this common goal on the part of teacher education programmes in Finland, it is suggested that preservice teachers could perceive the meanings and benefits of research studies differently, resulting in differences when it comes to their achievement levels (Brew & Saunders, 2020; Heikkilä, 2022; Heikkilä et al., 2020; Munthe & Rogne, 2015; Puustinen et al., 2018). Therefore, simply participating in the courses and practice teaching sessions is no longer sufficient, as the student teachers' active and self-regulated role with regard to mastering their learning process is becoming increasingly critical.

In line with previous findings, our results revealed a short-term positive association between the student teachers' bachelor's phase achievement levels and their higher orientation towards research studies. When it comes to achieving research-based educational aims, prior studies have highlighted the increased usefulness and importance of addressing research and research-related concepts with student teachers (Brew & Saunders, 2020; Byman et al., 2009; Puustinen et al., 2018).

Moreover, our results indicated that the student teachers allocated to the less research-orientated subgroup would particularly benefit from support designed to strengthen their achievement in relation to research studies. Heikkilä et al. (2020) highlighted how fostering an understanding of the meaning of research studies as part of the curriculum can result in student teachers developing an expanded understanding of the usefulness of research skills and, consequently, can support their professional growth.

The results also revealed gender differences between the two subgroups, with the female students being more commonly allocated to the highly research-orientated subgroup and the male students being allocated to the less research-orientated subgroup. Generally speaking, gender is not a focus of the Finnish education selection system; it concentrates on applicants' cognitive and noncognitive factors (Klassen et al., 2018; Metsäpelto et al., 2021). Additionally, based on the selection-phase entrance exam results, all the student teachers who participated in this study exhibited sufficient potential and quality to be selected for the teacher education programme.

Limitations and future research directions

Certain processes or factors were not captured in the selection-phase analyses. For example, we could not determine whether differences already existed between male and female students or whether the teacher education programme involved some elements that male students found particularly difficult (Voyer & Voyer, 2014). Furthermore, it must be acknowledged that the selected cohorts represent a limited number of student teachers when compared with the intakes of all Finnish universities that offer teacher education programmes (Vipunen, 2024).

Selected cohorts and applicants represented one university's teacher education programme at a time when the two-phase selection process had not yet been renewed and standardised. Hence, generalisability and comparison between universities are more complex due to variations in the selection phase. In addition, there was no missing information on the variables used – or it was not regular. However, an exception to this is made by gender in basic studies and subject didactics, which can be considered a limitation of the research. Concerning statistical comparisons, due to the sample size, the results of the power analysis were not high in all cases. Hence, in terms of potential new factors, future studies could benefit from including more representative samples of applicants by covering several Finnish universities and teacher education programmes, including the current renewed two-phase selection system. More research is also needed before and after renewed selection to determine how successful the changes have been and whether we are on track to select and educate student teachers as future professionals.

Researchers have previously modelled and revealed several factors that could affect student teachers' learning outcomes and achievements during their teacher education programmes (Klassen et al., 2018; Vilppu et al., 2022). Based on this expanded research design, additional measurements need to be covered by different universities' teacher education programmes (Jakhelln et al., 2021). For example, rather than solely focusing on achievement in terms of grades, new measurements (e.g. examining different learning strategies or students' perceptions of their learning environments) could provide valuable knowledge concerning the causes of the differences among student teachers when it comes to their study profiles (which were conceptualised as subgroups in the present study). If student teachers are left to

experience difficulties in terms of understanding the role and meaning of research studies during their teacher education programmes, it could prove detrimental to their learning outcomes. Thus, further research is required concerning student-related factors and how student teachers perceive their studies, particularly research studies. In addition, gender differences that might inform our results require further investigation, as does the issue of how widespread gender differences in achievement levels exist in teacher education programmes.

Conclusion

The present study examined student teachers' levels of achievement during their teacher education programmes using a longitudinal research design. It also explored student teachers' allocation to different subgroups based on their study profiles from initial selection through to the bachelor's phase of the programme and investigated the association between research skills development and the teacher education programme's curriculum. The results indicate that there are opportunities with regard to research training and skills development within the curriculum that need to be further explored to enhance the teacher education programme and ensure the graduation of teachers who have mastered the targeted learning outcomes.

It is important to increase our understanding of how teacher education programmes can support different learners and the kinds of learners who are selected for such programmes. Furthermore, the results of this study demonstrate the significance of exploring the selection criteria for teacher education programmes in an effort to ensure greater success and to provide teacher educators with valuable information concerning the needs of student teachers. We are aware that student teachers' performances can vary during the full five-year master's level teacher education programme; although this is similar to other higher education study programmes (e.g. medical education), it is very important to identify and support low-performing students as early as possible (Vilppu et al., 2019). Therefore, longitudinal approaches and multiple methods must be included in the new research framework. Additionally, evaluations and feedback from selected student teachers could provide useful information when it comes to developing education programmes and curricula in a way that facilitates student teachers to achieve the best possible results, graduate in a timely fashion and acquire the necessary teaching competences during their academic studies.

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