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Non-completion of teacher education students. Educational and occupational pathways of persons who withdraw from a teacher education program in Germany

Sebastian Franz *, Steffen Schindler

University of Bamberg, Germany

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ABSTRACT

The study examines non-completion events among over 5,500 teacher education students in Germany and their paths after non-completion. Most students switch programs within teacher education or to a non-teaching program after leaving. Fewer students enter the labor market or vocational training. We use discrete-time survival analyses to study predictors of higher education dropout and study program switch. A match of self-perception and future goals with the teacher education program decreases the likelihood of switching the program or dropping out. Perceived academic performance and the match between performance goals and actual performance are exclusively predictive of the decision to drop out.

1. Introduction

Graduation from teacher education programs is the first step to becoming a teacher in Germany. However, not every student who enrolls in a teacher education program completes it with a degree. Compared to other study programs, dropout rates in teacher education programs are comparatively low. While the average dropout rate of Bachelor students in German higher education is 31 percent, only 21 percent of teacher education students drop out of their program (Heublein et al., 2022). Yet, non-completion in teacher education constitutes a serious concern, since Germany is facing a massive teacher shortage (Klemm, 2020). Leading more students in teacher education programs to graduation is one avenue to counteract this development. However, increasing completion rates at all costs (e.g., through lowering examination standards) might not prove an efficient strategy since it will lead students to graduation who might not be suited for the teaching profession. Instead, the focus should be on students whose characteristics match the academic requirements of teaching but who deliberately leave their study program.

Against this background, it is vital to understand why some students do not complete teacher education programs even though they are associated with well-defined career paths and excellent labor market prospects. In this paper, our focus is on students who – in principle – meet the academic requirements of teacher education programs but choose to leave teacher education to pursue alternative career. Such alternatives include leaving higher education completely (permanent dropout) or moving to another higher education program which includes a change of major and/or degree type (switch).

We aim to identify typical patterns of diversion from teacher education programs. Therefore, we approach this issue in two consecutive steps that reflect our key research interests. First, we want to provide descriptive evidence about choices on subsequent

* Corresponding author at: University of Bamberg, Luitpoldstraße 19, 96047 Bamberg, Germany.
E-mail address: sebastian.franz@uni-bamberg.de (S. Franz).

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career paths of students who left their teacher education program before completion. This will already show which career paths typically appear as attractive alternatives to teacher education. Second, we want to provide explanations for why students revise their initial decision for a teacher education program. Instead of just providing explanations for non-completion, we will link different explanatory factors to the choice of specific subsequent career paths. This will allow us to understand under which conditions certain alternative career paths become more attractive than others. Learning about those factors will also help to identify to what extent individual traits of the students are responsible for non-completion and to what extent study conditions of teacher education programs systematically divert students into alternative career paths. With that, we aim to provide knowledge that can inform policy interventions to make teacher education programs more attractive.

2. Teacher education in Germany

German teacher education programs differ from other higher education study programs: They consist of a theoretically focused phase at a higher education institution followed by a practically focused preparatory phase in a school. While the *Bologna Process* transferred almost all study programs to the Bachelor-Master system in Germany, the teacher education program was only partially converted. Some German federal states still maintain the traditional state examination degree ('Staatsexamen') resulting in the coexistence of bachelor's and master's degrees on the one hand, and the state examination on the other.

Teacher education students usually study one or two majors related to their aspired teaching subjects, such as German, Mathematics, etc. Commonly, teacher education students share courses with students from other study programs in the same fields of study. This implies that the transaction costs of switching from a teacher education program to another study program are very low if students maintain the same combination of their majors. In addition, teacher education students take classes in educational sciences related to pedagogy, sociology, and psychology (Cortina & Thames, 2013). The curriculum of teacher education programs often encompasses internships in schools to get their first practical teaching experience during their studies. While students acquire a wide range of skills related to organization, self-control, improvisation, and field-specific knowledge, the teacher education program leads to a direct and clear profession, namely the job of a teacher.

3. Previous research on non-completion of study programs

Several interpretations and usages of the terms non-completion and dropout exist, and they are often used interchangeably. The different conceptualizations impede the comparison between empirical findings (Heublein, 2014; Larsen et al., 2013). In this study, we use the term non-completion to refer to students who leave their study program without a formal degree (regardless of what they do afterwards). We use the term dropout to indicate a permanent withdrawal from higher education. We use the term switch to refer to transitions to a different study program within higher education without having completed the initial program.

Non-completion of study programs is a widespread phenomenon in German higher education. While no exact figures exist on non-completion rates overall, the share of Bachelor students who do not complete their study program is estimated at 31 percent (Heublein et al., 2022). This corresponds to the average international completion rate of 67 percent (OECD, 2019). Leaving the study program without a degree can have different reasons. These can be categorized according to the degree of voluntariness and the subsequent follow-up activity. Involuntary non-completion can be the result of poor academic performance when students are ex-matriculated because they did not meet the academic requirements. Additionally, financial, and health-related reasons can force the students to withdraw from their study program (Müller & Klein, 2022; Suhlmann et al., 2018). Students may also voluntarily leave their studies if they change their career plans, if they are dissatisfied with their study situation, or if they perceive a poor match between study content and their preferences (Etzel & Nagy, 2016; Porter & Umbach, 2006; Tinto, 1975). Both voluntary and involuntary non-completion can be associated with various follow-up activities.

The focus of this study is on voluntary non-completion of teacher education students and their follow-up activity. First, we focus our literature review on findings about the reasons for voluntary non-completion. Previous research suggests that the basic mechanisms of non-completion in teacher education programs are like those in other study programs (Bohndick, 2020; Franz & Paetsch, 2023). Therefore, we review the insights from studies devoted to non-completion in general. Afterwards, we inspect studies that distinguish between reasons for various follow-up activities, with a focus on the differential causes for permanent dropout from higher education compared to switching study programs. Finally, we turn to the specific findings from research on teacher education about voluntary non-completion.

3.1. Causes for non-completion

Research investigating causes for non-completion often does not explicitly consider whether the decision was voluntary or involuntary. Problems of performance, financial hardship, and lack of study motivation are mentioned to be the biggest drivers for leaving the study program without a degree (Heublein, 2014). Performance issues expressed in repeatedly failed exams and financial hardships can lead to involuntary withdrawal if they leave no scope for continuing their studies. Instead, motivational aspects can most clearly be considered as relating to voluntary non-completion.

Research showed that a lack of commitment to and dissatisfaction with the course of studies rather than poor objective academic performance during studies is related to the voluntary decision to leave the study program (Larsen et al., 2013). Personal commitment and dedication to study have been shown to lower the likelihood of leaving the study program (Napoli & Wortman, 1998). The more students are motivated and, consequently, the more effort they put into learning, the more likely they are to complete their study

program with a degree (Bargmann et al., 2022; Heublein et al., 2017). This relation can be explained as learning motivation in higher education is correlated with learning time, attendance in courses, and the planned obtained ECTS points (Suhre et al., 2007). Therefore, personal interests are more vital in the decision-making process to stay or leave the study program than extrinsic motivations, such as expected monetary benefits (Georg, 2009; Rump et al., 2017).

Dissatisfaction with the study program describes another reason for non-completion (Suhre et al., 2007). The dissatisfaction can be related to the quality and the content of teaching, or it can be a function of the self-evaluation of one's academic performance. Furthermore, the perception and satisfaction with social involvement, social support, and the sense of belonging are important factors in the decision to stay or to leave the study program (Allen et al., 2008; Suhlmann et al., 2018). Another source of dissatisfaction is the perceived mismatch between the study program's content and the student's interests (Suhlmann et al., 2018). Such processes can be expected when students begin a program that was not their first choice (Behr et al., 2020).

3.2. Causes for dropout vs. changing study program

While the before-mentioned findings derive from a perspective on non-completion, no conclusions can be drawn on the reasons for different follow-up activities. Only a few studies are dedicated to the question of why some students drop out permanently from higher education while others adjust their original decision for a degree program by changing to another field of study (Meyer et al., 2022).

In general, students switch to study programs that seem more attractive to them in various ways (Hovdhaugen, 2009; Hovdhaugen & Aamodt, 2009). Yet, factors that are related to the current program can influence the decision to rather switch to another program than drop out of higher education completely. Meyer et al. (2022) showed that high-achieving students in Germany are even more likely to switch their study programs than to stay in the same study program. Students with high academic performance during studies might see themselves capable of graduation and, hence, dropout is not an option for them. This can be underpinned by the result that the academic self-concept predicts a switch of major but not dropout (Thies & Falk, 2023). Consequently, poor academic performance is overall seen to be of minor importance for switching study programs compared to dropouts (Astorne-Figari & Speer, 2019; Belloc et al., 2010; Larsen et al., 2013).

Certain motives for the choice of the initial study program are connected to program switches but less so to dropout (Hovdhaugen, 2009; Larsen et al., 2013). When the initial study program is not the first preference, students are very likely to change the course of their studies instead of permanently dropping out of higher education (McMillan, 2005). Likewise, intrinsic (such as interest orientation) and extrinsic (such as career orientation) motives have been found to explain adjusting the initial study choice and remaining in higher education instead of dropping out (Hovdhaugen, 2009).

Studies indicate that students switch study programs to improve their match with the study program. Hence, students switch to programs with requirements that better match their abilities and that are mostly appropriate to their gender and ethnicity (Astorne-Figari & Speer, 2019; Diem, 2016). The mismatch between the student's interests and the study program's content explains why students switch to another program as well (Etzel & Nagy, 2016; Meyer et al., 2022).

3.3. Non-completion in teacher education

The major reasons for non-completion in teacher education programs are like those of other study programs, such as prior academic achievement and academic performance during studies (Franz et al., 2022; Hartl et al., 2022). When it comes to the voluntary decision to drop out based on commitment and the sense of belonging, recent research states no differences between the mechanism of dropout (Bohndick, 2020; Franz & Paetsch, 2023). However, former teacher education students mention unique reasons for their decisions that relate to the peculiarities of the teaching profession (Kim & Corcoran, 2017, 2018; Roberts, 2012).

Several studies find that the actual content of the study program often differs from the expectations of the students, which leads to withdrawal from teacher education programs (Chambers & Roper, 2000; Herfter et al., 2015; Meens & Bakx, 2019). Non-completing teacher education students often attribute their dissatisfaction and decision to leave the study program to factors such as lack of study organization, lack of practical relevance, and incoherently structured courses that do not demonstrate relevance to the teaching profession (Bernholt et al., 2018; Chambers et al., 2010; Herfter et al., 2015; Hobson et al., 2009; Roness & Smith, 2010). Unpleasant teaching experiences during internships might also be a reason for leaving the teacher education program without a degree (Lin et al., 2016; Meens & Bakx, 2019). Furthermore, the perception of having insufficient knowledge of teaching (Basit et al., 2006; Chambers et al., 2002, 2010; Roberts, 2012), as well as a low level of teaching commitment (Lin et al., 2016), leads students to leave teacher education.

Teacher education students also mention the decision to pursue a different career (Chambers et al., 2002, 2010; Hobson et al., 2009) and alienation from the career aspiration of teaching (Herfter et al., 2015; Lin et al., 2016) as reasons for non-completion. Thus, the perception of attractive alternatives relates to withdrawal from teacher education. Rots et al. (2014) point out that a high amount of job opportunities outside of teaching is negatively related to the intention to transition into the teaching profession after graduation. Yet, it remains an open question which alternatives for teacher education students are perceived as attractive, and which factors appear to be important for the decision to switch study programs or drop out.

3.4. Summary

The reviewed studies suggest that mismatches between expectations and actual content of teacher education programs as well as lacking motivations, interests, and commitments on the part of students, and inadequate organization and structure of the study

program provide explanations for voluntary withdrawal. The perception of having an inadequate teaching self-concept and negative experiences during internships are also reasons for leaving the teacher training program. Conversely, the existence of personally more suitable alternatives can also be expected to describe pull factors for some teacher education students who are not grounded in aspiring to the teaching profession.

So far, career pathways after non-completion have been researched very rarely, which is particularly true for teacher education programs. No knowledge exists about what follow-up activity teacher education students choose after they leave their initial study program. Even less is known about predictors for the various possible career pathways that constitute alternatives to the teaching profession (Amitai & Van Houtte, 2022). Hence, we seek to fill that research gap by paying attention to the different career paths of students who withdraw from teacher education programs.

4. Theoretical framework

Conceptually, the voluntary non-completion of a teacher education program is the result of a decision process. More precisely, it is to be considered as a *revision of an initial choice*, namely the choice of pursuing a teacher education program. Following classical rational choice approaches, this can be conceived of as an updated cost-benefit evaluation between different alternatives (Hadjar & Becker, 2004). Rational choice theories predict that a student will leave teacher education if any alternative is associated with a higher perceived utility than the initial program. Two different aspects can feed into such an update. First, the initial decision for the teacher education program might have been based on incomplete or false information, e.g., about the content and requirements of the program or job characteristics of the teaching profession. By participating in the program, new information might have become available. Second, the circumstances framing the cost-benefit evaluations might have changed, e.g., through a shift in personal values and occupational aspirations or external conditions, such as labor market prospects. In the most parsimonious version of a rational choice framework, the decision between educational or vocational alternatives is governed by three basic factors that have to be subjectively assessed: first, the benefits associated with a given alternative, second, the costs associated with that alternative, and third, the probability of accomplishing the tasks associated with that alternative (cf. Erikson & Jonsson, 1996).

The most obvious alternatives to teacher education programs are switching to another study program outside teacher education, starting a vocational training program, or entering the labor market right away. If the costs of remaining in higher education are perceived as too high, students might even decide to leave higher education without having any tangible alternative in mind. In the following, we discuss different factors that we assume to influence the individual evaluations of the three decision components (benefits, costs, success probabilities) in the utility assessment between staying in teacher education and any other alternative.

4.1. Personal fit with the study program

It can be assumed that the relationship between the perceived benefits and costs of staying in a teacher education program is strongly influenced by the perceived personal fit with the characteristics of the study program. The first aspect relates to whether the study program matches the student's interests (intrinsic value, cf. Wigfield & Eccles, 2000) and whether it is in line with the student's value beliefs and self-perception (attainment value, cf. Wigfield & Eccles, 2000). A second aspect relates to whether the expected outcomes of the study program match the students' future goals (utility value, cf. Wigfield & Eccles, 2000). In teacher education programs, in particular, the outcomes are clearly defined by the occupation. Changes in career goals and the perception of the possibility of reaching these goals with the initial choice to become a teacher can easily create a mismatch regarding the utility value of the program.

It becomes apparent that perceived mismatches with those aspects can have different implications. Mismatches regarding intrinsic, attainment, and utility values might cause students to leave the teacher education program. If those mismatches do not concern higher education as such, they might opt for changing to another program. They might drop out of higher education otherwise.

4.2. Influences of the learning environment

If students perceive the learning environment of a teacher education program as pleasant, it should have a positive influence on the perceived benefits of staying in teacher education. If students perceive the setting as unpleasant, it should increase the perceived costs of staying. The following aspects of the learning environment can influence this perception. First, the social integration of the student might play a role (cf. Tinto, 1975). On the one hand, this concerns the involvement and interactions with peers. On the other hand, it relates to the quality of interactions with faculty. Second, aspects related to study conditions can influence whether students perceive the continuation of the program as beneficial or costly. This relates to the quality of instruction or organizational matters. As students in teacher education programs often have to attend classes from other faculties, inefficiencies in organizational matters can lead to frustration and increase the perceived costs of staying.

The design and structure of the degree program and the course can also be an important factor. Students who perceive their study program to have insufficient organization, high-performance pressure, or little practical relevance to their later professional life might tend to leave the study program and reorient themselves.

4.3. Perceived academic performance

If students do not meet the academic performance standards (cf. structural academic integration, Tinto, 1975), it can lead to

non-voluntary non-completion. However, even if students pass exams, the perception of their performance can influence their assessment of success probabilities – more so if they perceive a mismatch between their personal performance goals and their actual performance. If students generalize this mismatch to academic performance standards per se, it will increase the likelihood of dropout. If they link their perceived performance deficiencies to the contents of the teacher education program, switching the study program might provide a higher utility – depending on the evaluation of the other choice factors.

4.4. Individual preconditions

Individual preconditions describe aspects that potentially raise the perceived costs of staying in a study program. They are not idiosyncratic to teacher education programs but describe general factors that might cause students to drop out of higher education. First, it concerns the ability to bear the financial costs associated with studying in higher education. Second, opportunity costs, such as having less time for leisure activities can be perceived as stressors that increase the costs of staying in higher education. Another aspect is non-monetary costs concerning the students' social background. Students from disadvantaged social backgrounds might have to cope with lacking familiarity with the academic system or lacking family support (alienation), which will also increase the perceived costs of staying in higher education.

Table 1 summarizes our expectations of how those factors might influence the utility assessment between staying in the teacher education program and the alternatives of switching the study program or dropping out of higher education.

5. Data and methods

5.1. Sample

We draw on data from the Starting Cohort 5 (SC5) of the German National Education Panel Study (Blossfeld & Roßbach, 2019; NEPS Network, 2023). The SC5 is a nationwide sample of students ($N = 17{,}909$) who enrolled in higher education for the first time in the winter term 2010/11. It contains an over-sampling of students in a teacher education program (Schaeper et al., 2023). Participants are surveyed regularly - almost every half year - with computer-assisted telephone interviews (CATI) or computer-assisted web interviews (CAWI). Within the survey program, respondents are asked to report on their current educational and work history. This makes it possible to examine the respondents' careers on a monthly basis.

In this study, we limit the sample to students who were enrolled in teacher education programs in the first wave. Consequently, the initial sample consists of 5707 teacher education students, 2190 of whom are aiming for a bachelor's degree and 3517 for a state examination (see A1 in the Appendix for a sample description).

For our descriptive analyses of career trajectories of non-completers, we restrict the sample to students who discontinue their initial teacher education program without graduation ($n = 1577$). For documentary purposes, this sub-sample also includes students who switch to another teacher education program and hence do not leave teacher education. For our multivariate analyses, we rely on the full sample of initial teacher education students to elicit why non-completers pursue different career paths.

Missing values are imputed using multiple imputations by chained equations with predictive mean matching for continuous and logistic regression models for categorical variables. In the imputation model, generated factors were directly imputed, and all variables were imputed conditioned on the last valid observation point. Overall, 20 imputed data sets were generated, and the results of the analysis for each dataset were combined according to Rubin's rules. When the construct was not measured in a certain wave, we used the carry forward approach and replaced the missing value with the last valid value – after data was imputed. All data cleaning, imputation, and analysis were conducted with Stata 18 (StataCorp., 2023).

As we only want to investigate voluntary decisions, we exclude students with poor study achievement (any grades during studies lower than 3.5 on the German grading scale) and students who stated that their study progress was far behind the study regulations.[1] If the grades during studies or the study progress were imputed, we excluded all persons for whom the exclusion criteria were true for at least one imputed data set. By exclusively considering students who seem to discontinue their studies voluntarily after the second wave interview (see Fig. 1), we arrive at a sample consisting of $n = 1953$ individuals for the multivariate analyses.

5.2. Measurements

5.2.1. Dependent variable

We consider the following states of the dependent variable:

Teacher education program: In the descriptive analysis, this category denotes non-completers who switched to a different teacher education program. In the multivariate analysis, this category also comprises students still in their initial teacher education program. Here, it serves as a reference category for students who did not leave teacher education before graduation.

Other study program: Switching to another study program that does not end with a teaching degree. Those students changed the type of degree, which might also go hand in hand with a change of major.

[1] Students who answered the question 'If you think of your previous studies in your current course of study: To what extent does the number of courses you have completed so far (number of lectures/courses attended, number of successfully completed courses/examinations, credits received, etc.) comply with your study regulations? I have completed…)' with 'much less' on a 5-point scale from 'much less' to 'many more'.

Table 1
Summary of expectations.

Dimensions	Expectations
Personal fit with the study program	
Match study program (interests, self-perception)	Low → switch/dropout
Match study program (future goals)	Low → switch/dropout
Influences of the learning environment	
Social integration (peers)	Low → dropout
Social integration (faculty)	Low → dropout
Study conditions: instruction quality	Low → switch/dropout
Study conditions: organization	Low → switch/dropout
Perceived academic performance	
Perceived academic performance	Low → switch/dropout
Individual preconditions	
Perceived financial costs	High → dropout
Perceived opportunity costs	High → dropout
Non-monetary costs: alienation	High → dropout

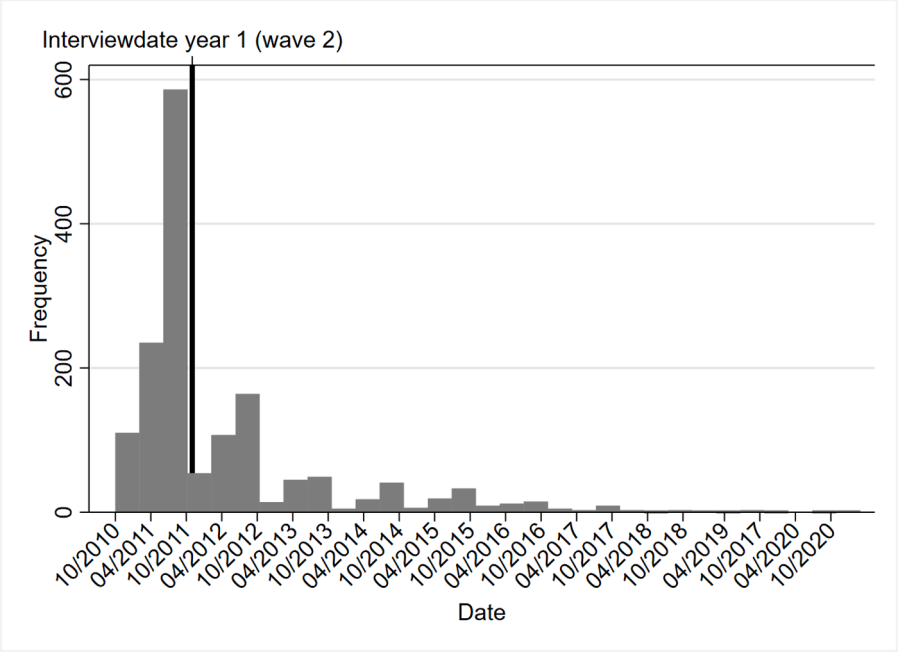

Fig. 1. Frequency distribution of events.

Vocational training: Leaving higher education to start vocational training that is outside the higher education sector. For more nuanced analyses, we classified the occupation of vocational training in high-skilled white-collar, low-skilled white-collar, high-skilled blue-collar, and low-skilled blue-collar based on the International Standard Classification of Occupations, ISCO-88.

Employment: Leaving higher education to enter the labor market. For more detailed analyses, we used the same classification of occupational categories as with vocational training.

Not in Education, Employment or Training (NEET): Leaving higher education and following up with, e.g., an internship, military service, unemployment, gaps, or another event that does not fall into one of the categories above.

People who dropped out of the panel study and for whom no information about graduation or non-completion is available are right-censored. Also, persons who successfully graduated from their study program are right-censored and we do not consider any information about possible higher education episodes afterwards.

5.2.2. Predictors

We use the following variables to measure our theoretical constructs (wording provided in Appendix A2). For constructs that were measured with more than one item, factors were generated based on a one-factor confirmative factor analysis.

Match with the study program contains three subdimensions: interests, enjoyment and identification, and future goals. Fit with interests is measured via the social interest dimension of the 'Interest Inventory Life Span (IILS)' (Wohlkinger et al., 2011), as social interest is one of the key intrinsic motives to start a teacher education program (Osada & Schaeper, 2022; Savage et al., 2021). In the

NEPS, vocational interests are measured in the first and ninth waves. We only consider the first measurement point in the first wave as the vocational interests are assumed to be rather stable in the age range of the participants (Low et al., 2005) and the later measurement point lies outside the period under review. Answers were measured on a five-point scale and internal consistency is not optimal (α =0.59). Nonetheless, the construct has been used several times and the validity has been demonstrated, even with the same sample (e.g., Osada & Schaeper, 2022). We use three items measuring enjoyment and identification, which are part of a scale designed to measure 'Academic Commitment' (Grässmann et al., 1998). It is measured in the second, fourth, sixth, and eighth waves on a 5-point scale with good internal consistency (α =0.83/0.85/0.86/0.87). Future goals are operationalized using one item from the 11th Student Survey at Universities and Universities of Applied Sciences (Ramm et al., 2011). It measures whether the aspired degree is important for achieving one's life goals with a four-point scale. The measurement points were in the second, sixth, and eighth waves, but unfortunately not in the fourth wave.

Influences of the learning environment are conceptualized with social integration, instructional quality, and organization. Social integration is operationalized using the Social Integration Scale, which contains two subscales and was conducted in the second, fourth, sixth, and eighth waves (Schiefele et al., 2002). One subscale measures contact with other students with three items (α = 0.84/0.82/0.83/0.84), and the other subscale measures interaction with faculty staff with four items on a four-point Likert scale (α = 0.75/0.78/0.80/0.82). We measure instructional quality with two constructs in the second, sixth, and eighth waves: performance pressure and practice orientation of the study program, which have been developed for the NEPS (Schaeper & Weiß, 2016). Both constructs were measured with three items each on a five-point scale. Pressure to perform (α = 0.67/0.70/0.71) and practice orientation (α = 0.83/0.85/0.85) show acceptable to good internal consistency. Organization also includes two constructs: coordination of courses and structure of lectures in the second, sixth, and eighth waves. The former construct was measured with three items, whereas the latter comprised four items, each on a five-point scale. The internal consistency of coordination of courses (α = 0.65/0.67/0.68) and structure of lectures (α = 0.64/0.66/0.67) is comparably low.

Perceived academic performance contains structural academic integration and the perceived mismatch between performance targets and actual performance. Structural academic integration was operationalized using the 'Fulfillment of Achievement Expectation' (Trautwein et al., 2006) via three items on a four-point Likert scale with acceptable internal consistency for each measurement point (α = 0.79/0.74/0.75/0.75). We constructed a measure for the mismatch between performance targets and actual performance as the difference of an item measuring the subjectively perceived likelihood of completing the study program (Esser & Stocké, 2009) subtracted from another item measuring importance of doing well in one's studies.

Individual preconditions comprise perceived financial and opportunity costs as well as parents' educational background. Perceived financial costs are measured on a five-point scale with a question about how well students get by with the money they have at their disposal. Perceived opportunity costs were measured on a five-point scale with an item where students had to indicate to what extent they had to give up important things for their studies. Another factor that can be used to assess non-monetary costs is alienation, which is determined by whether the parents have obtained a higher education degree. This factor serves as an indication of the parent's level of familiarity with the higher education system and the level of support they can provide to their children.

Table 2 presents descriptives of the predictor variables (correlation matrix provided in Append A3).

5.2.3. Control variables

In the discrete-time survival analyses, we control for several factors that have been consistently found to be related to non-completion in higher education (e.g., Heublein, 2014; Larsen et al., 2013): not born in Germany, age (at start of study), and if the students are either enrolled in a Bachelor or State examination program.

5.3. Analytical strategy

To answer our research questions, we first present a descriptive analysis of pathways that persons take directly after non-completion of the initial teacher education program. We present frequency and sequence plots.

In the second step, we apply discrete-time survival analyses to see which explanatory factors are associated with the different career paths after non-completion. This analytical approach is especially suited for this dataset as time-varying variables are used as predictors and the events (non-completion) mostly occur at regular points in time (e.g., Allison, 1982). Furthermore, discrete-time survival analysis can handle right-censored data that occurred in our dataset due to panel attrition. These analyses are based on the full sample of teacher education students, including those who are still in their initial study program. We collapse the various career states of the dependent variable into three categories: staying in teacher education (as a reference), dropping out of higher education, and switching to another study program.

6. Results

6.1. Non-completion events

In the sample (n = 5707), we could identify 1577 persons who reported not having completed their initial teacher education

Table 2
Descriptives of predictors.

	Year 1	Year 2	Year 3	Year 4
Personal fit with the study program				
Match study program: self-perception	0.00	0.14	0.19	0.20
	(0.66)	(0.70)	(0.74)	(0.77)
Match study program: interest	0.00	0.00	0.00	0.00
	(0.23)	(0.23)	(0.23)	(0.23)
Match study program: future goals	3.56	3.58	3.53	3.57
	(0.62)	(0.61)	(0.64)	(0.63)
Influences of the learning environment				
Social integration (peers)	0.00	0.02	0.01	0.03
	(0.53)	(0.53)	(0.54)	(0.56)
Social integration (faculty)	0.00	0.10	0.07	0.13
	(0.37)	(0.39)	(0.41)	(0.47)
Study condition: pressure to perform	0.00	.	0.12	0.19
	(0.47)	(.)	(0.54)	(0.55)
Study condition: practical orientation	0.00	.	0.03	0.14
	(0.99)	(.)	(0.95)	(0.95)
Study condition: coordination of study program	0.00	.	0.24	0.27
	(0.61)	(.)	(0.63)	(0.70)
Study condition: structuredness of lectures	0.01	.	0.04	0.00
	(0.34)	(.)	(0.34)	(0.34)
Perceived academic performance				
Academic integration	0.00	0.13	0.11	0.13
	(0.48)	(0.40)	(0.41)	(0.43)
Mismatch between performance targets and actual performance	0.14	.	0.49	0.55
	(1.00)	(.)	(1.01)	(1.00)
Individual preconditions				
Perceived financial costs	2.21	2.17	2.20	2.13
	(1.00)	(0.97)	(0.97)	(0.94)
Perceived opportunity costs	2.39	2.33	2.35	2.32
	(0.80)	(0.85)	(0.84)	(0.85)
Non-monetary costs: First-generation student	57 %	57 %	56 %	56 %
Non-completion	9 %	3 %	2 %	2 %
N	3948	3273	3169	2832

Mean values; standard deviations in parentheses; percentages for binary variables.

program episode which corresponds with a non-completion rate of 28 %.

Fig. 1 displays the non-completion events by semester ($n = 1556$) .[2] Each semester is denoted by its starting month (e.g., 10/2010 represents the winter term 2010/2011, ranging from October 2010 to March 2011). The y-axis shows the frequencies of events. The figure shows that most non-completion events occur within the first three semesters. This corresponds with the results of other research on non-completion and dropout in higher education in general.

The vertical line in the graph depicts the data point when most of our predictor variables have been measured (2nd wave). This gives rise to a dilemma as approximately 60 percent of the non-completion events occurred before our explanatory variables were recorded. Consequently, we can only examine non-completion events after the first year if we want to make causal attributions.

6.2. Follow-up activity after non-completion

Fig. 2 displays the activities of non-completers right after leaving their initial teacher education program. Within each category, the left-hand bars refer to the full sample, and the right-hand bars to non-completion events after the second wave. Since the overall patterns appear similar across both samples, we do not expect systematic bias through the sample restriction.

As the figure shows, about half of the non-completers remain in teacher education and just change to a different teacher education program. About 15/19 percent switch to a non-teaching study program, but only a minority of them remain in the same field (2/4 percent). The rest (13/15 percent) continue in a different field. About 16/19 percent of the non-completers transition into employment, only about three percent start vocational training, and about one-tenth choose some kind of bridging activity, e.g., an internship. This descriptive analysis highlights the variety of career alternatives for teacher education students, suggesting that options like other study programs, employment, and vocational training are considered attractive paths.

A closer inspection (cf. A4 in the appendix) reveals that the few non-completers who start vocational training predominantly choose training programs in white-collar professions, both in high and low-skilled occupations. Training programs for blue-collar occupations are less popular. A similar picture emerges when considering non-completers who transition into employment. Here, however, low-skilled occupations are more widespread. This appears plausible as most of the non-completers can be assumed not to

[2] For 21 events no date was available.

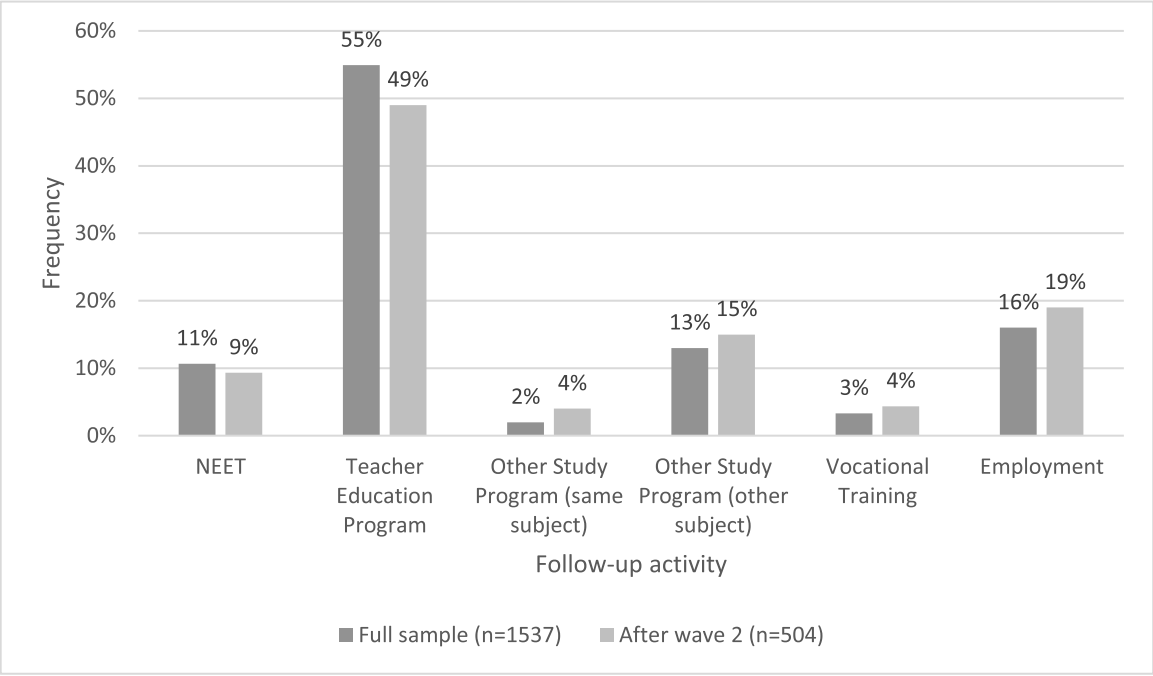

Fig. 2. Follow-up activity one month after the non-completion event.

hold any vocational qualification.

While Fig. 2 only shows the direct follow-up activity one month after non-completion, we also visualized the whole career trajectories in Fig. 3. We display two plots depicting career sequences after non-completion, with the first plot illustrating individual sequences per month, and the second plot demonstrating the grouping of individuals who possess sequences in a similar order. Looking at the career sequences rather than only the first follow-up activity has the advantage that we can evaluate the stability of the latter. The sequence plot shows, ordered by the first chosen career alternative, what activity the persons pursue for each month after non-completion up to the person's last valid observation.

The graphical representation of the sequences indicates that the subsequent activity is predominantly not permanent, but that frequent changes of state still occur afterwards. Two observations about teacher education programs stand out. First, only a small proportion of people re-enter teacher education after a NEET, employment, or non-teaching study program episode. Second, most teacher education students who switched to another teacher education program followed up with an employment episode and, hence, most likely graduated from teaching (see Fig. 3). In the survival analysis model, we therefore count people who switch to another teacher education program as retention. Furthermore, we can observe some patterns regarding the career alternatives outside teacher education. First, most of the non-completers who switch to another study program appear to remain there for a longer period, many of which with a subsequent employment episode. The same is true for students who transition to vocational training. This suggests that those two options appear to be attractive for former teacher education students who presumably have a clear career alternative in mind. In contrast, the careers of those who transition into employment directly appear particularly unstable. Together with students who transition into NEET, this might suggest a pattern of external reorientation of students who were unhappy with teacher education or higher education as such but didn't have a viable alternative at hand at the time of dropout.

In summary, our descriptive analysis reveal that teacher education students often view switching to another study program, entering the workforce, and enrolling in vocational training as appealing options. The stability in their career trajectories after non-completion tends to be more prevalent when they select a definite alternative career path at an early stage.

6.3. Discrete-time survival analysis

The second research question targets at the factors that are predictive of alternative career paths after non-completion. We draw on discrete-time survival analysis to investigate the importance of our theoretically derived predictors for the decisions between the following alternatives: staying in teacher education (reference category), switching to a non-teaching study program, or dropping out from higher education. Table 3 shows the results of the discrete-time survival analysis based on the 20 imputed data sets.

We argued that perceived benefits and costs of the teacher education program influence whether students stay in teacher education or decide on an alternative outside or inside higher education. Moreover, we assumed that the subjective match of the study program with personal interests, self-perception, and future goals plays an important role in that decision. The results of the discrete-time analysis show that enjoyment of and identification with the study program is negatively associated both with dropout (OR=0.52;

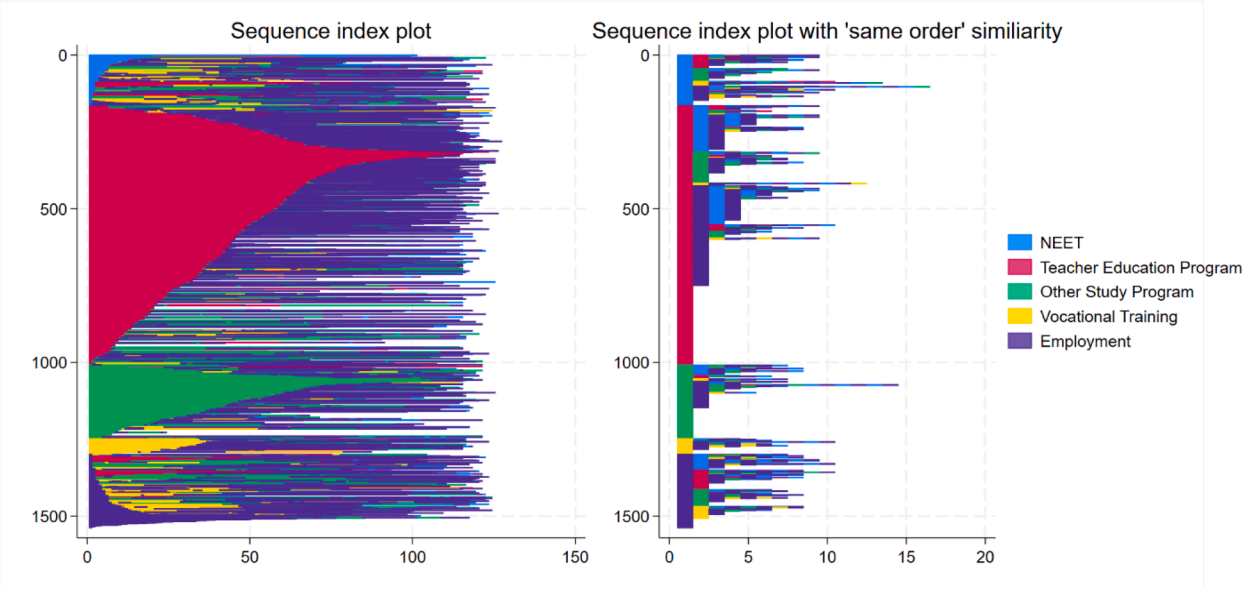

Fig. 3. Sequence plots of educational and occupational pathways after non-completion.

Table 3
Discrete-time survival analysis with competing risks; imputed data ($m = 20$); restricted sample (voluntary dropout).

	Dropout			Switch		
	OR	SE	p-value	OR	SE	p-value
Personal fit with the study program						
Match study program: self-perception	**0.52**	**.08**	**0.000**	**0.54**	**.09**	**0.000**
Match study program: interest	1.39	.50	0.362	0.49	.18	0.053
Match study program: future goals	**0.67**	**.09**	**0.004**	**0.59**	**.09**	**0.000**
Influences of the learning environment						
Social integration (peers)	0.90	.17	0.557	0.86	.18	0.496
Social integration (faculty)	1.37	.35	0.229	1.45	.45	0.232
Study condition: pressure to perform	0.68	.15	0.080	0.80	.20	0.387
Study condition: practical orientation	1.03	.11	0.815	1.01	.13	0.921
Study condition: coordination of study program	1.02	.17	0.924	1.11	.23	0.609
Study condition: structuredness of lectures	1.16	.36	0.629	1.06	.36	0.855
Perceived academic performance						
Academic integration	**0.35**	**.08**	**0.000**	0.61	.16	0.062
Mismatch between performance targets and actual performance	**1.34**	**.13**	**0.005**	1.14	.11	0.206
Individual preconditions						
Perceived financial costs	1.10	.11	0.338	1.09	.13	0.466
Perceived opportunity costs	0.93	.13	0.593	0.94	.14	0.669
Non-monetary costs: First-generation student	1.08	.18	0.637	1.02	.19	0.915
Control variables						
Female (vs. male)	**1.65**	**.30**	**0.007**	**1.55**	**.33**	**0.037**
Not born in Germany	0.95	.37	0.905	1.01	.48	0.981
Age at study start (09/2009)	1.11	.02	0.000	0.94	.04	0.201
Bachelor (vs. state examination)	0.98	.16	0.885	0.79	.16	0.236
Year 1	**0.01**	**.01**	**0.000**	0.29	.30	0.225
Year 2	**0.00**	**.00**	**0.000**	**0.08**	**.09**	**0.017**
Year 3	**0.00**	**.00**	**0.000**	**0.07**	**.07**	**0.008**
Year 4	**0.00**	**.00**	**0.000**	**0.07**	**.08**	**0.014**
Number of persons			1593			
Number of observations			13,222			
Adjusted R^2			.1115			

OR=odds ratios; SE=standard errors; bold values are significant ($p \leq .05$).

SE=0.08; $p \leq .001$) and switching to another program (*OR*=0.54; *SE*=0.09; $p \leq .001$). A match with social interests appears to increase the chances of dropout, but the coefficient is not statistically significant (*OR*=1.39; *SE*=0.50; p=.362). On the other hand, it lowers the chances of switching programs, while the coefficient is only marginally statistically significant (*OR*=0.49; *SE*=0.18; p=.053). The more the teacher education program matches with the future goals, the lower the chances of dropping out (*OR*=0.67; *SE*=0.09; $p \leq .01$) or

switching programs (*OR*=0.59; *SE*=0.09; $p \leq .001$).

We also hypothesized that the study conditions in teacher education programs might be a factor diverting students into other study programs or out of higher education. Yet, none of our indicators supports our claim – neither in substantive terms nor regarding statistical significance.

We further expected that the perceived performance could explain why students leave teacher education programs. The results of the discrete-time analysis show a negative association between structural academic integration and the chances of dropping out (*OR*=0.35; *SE*=0.08; $p \leq .001$) or switching the study program (*OR*=0.61; *SE*=0.16; $p = .062$). A mismatch between performance goals and actual performance increases the chances of dropping out (*OR*=1.34; *SE*=0.13; $p \leq .01$) or switching the study program (*OR*=1.14; *SE*=0.11; $p = .206$), while the latter fails to reach an acceptable level of statistical significance.

Finally, we hypothesized that monetary and opportunity costs are associated with dropout from higher education. However, our indicators do not lend any support to that expectation.

7. Discussion

The purpose of this study was twofold. First, we aimed to provide descriptive evidence about the career pathways of teacher education students after their decision not to complete their initial teacher education program. We could show that about half of these students re-enroll in another teacher education program and most of them can be expected to complete it. From a policy perspective, this must be considered as a reorientation within teacher education, meaning that those students do not "get lost" to teacher education programs. We leave it to further research to explore the implications of these internal reorientations and whether they come along with critical issues, such as shortages in certain domains of teacher education. More concerning for teacher education is the other half that leaves teacher education for good and with destinations in other higher education programs or outside higher education. We could show that among those, it is quite popular to change to a different study program. Only a few non-completers transition into vocational training. However, both career paths appear to lead to stable further trajectories, so we can consider them as the "main competitors" to teacher education. The rest of the non-completers enter either employment or NEET. Both transitions are associated with unstable subsequent career paths and suggest that those students leave teacher education without a clear alternative in mind. We could also show that among students who left teacher education, it is quite uncommon to re-enter teacher education again at a later point in time. This suggests that the decision to leave a teacher education program is rather definite in the majority of cases.

Our second contribution was to explore the factors that account for the decisions to give up teacher education programs for a different career path. We explicitly excluded students who can be assumed to leave teacher education involuntarily and focused on explanations of voluntary non-completion. We suggested four bundles of explanatory factors: the personal fit with the study program, influences of the learning environment, perceived academic performance, and individual preconditions. Our empirical analyses showed support for our expectations regarding the personal fit with the study program and the perceived academic performance. From a policy perspective, these findings are rather unsatisfactory since the underlying explanations are related to personal factors and not to structural properties of teacher education that would be accessible to straightforward policy interventions. Instead, our results reflect social mechanisms that apply to non-completion in general and are not idiosyncratic to teacher education (Bohndick, 2020; Franz & Paetsch, 2023). We could not find any indication that the influences of the learning environment in teacher education programs do make a difference. Even though the perception of the quality of instruction and organizational matters becomes more negatives over time, it does not appear to contribute to an explanation of non-completion patterns.

8. Limitation and future research

This study is not completely free from limitations and these need to be addressed. First, panel attrition is a problem since it leads to non-completion events where no information on the follow-up activity is available (Zinn et al., 2018).

Second, the measurement points of our predictor variables pose a problem to our study. Most measures were recorded in the second wave of the panel, which corresponds to the third semester in higher education. Yet, most non-completion events happened during the first year and we had to exclude them from our analysis. Furthermore, some measures were not conducted regularly and had to be replaced with the last information we had. This might have led to an undercapturing of temporal changes in the values of our predictor variables and possibly to an underestimation of their effects. Future studies on non-completion should therefore measure important constructs right from the start and repeat measurements of time-varying constructs regularly.

Third, one can question to what extent our empirical indicators capture the theoretical constructs to a satisfactory degree. Although some measures, e.g., for social integration, have been used before, some doubts still exist about whether they correspond well with the theoretical constructs they are supposed to reflect (Dahm et al., 2016; Tarazona & Rosenbusch, 2019). Some indicators also show low internal consistency, which suggests that those measures need to be revised for future research. While our study focuses on specific fit characteristics such as interest, self-conception, and future goals, we acknowledge that there are additional factors that can influence the fit between students and the teacher education program. A better recording of person-environment fit, such as the fit between needs-supplies, demands-abilities and interest-major, could perhaps provide an even greater explanatory contribution (e.g., Etzel & Nagy, 2016; Li et al., 2013).

Fourth, no information on the individual evaluations of the potential alternatives to teacher education was available. Since the data only comprises individual evaluations of the properties of the study program they were enrolled in, we could not model the pull factors of the alternatives. Future studies that seek to model educational decisions should make an effort to collect data on alternative-specific evaluations of the costs and benefits associated with a given choice alternative.

At last, fifth, our data was rather limited on measures that are specific to teacher education programs. All available variables in the data were designed to cover properties of higher education in general and did not consider the specific characteristics of teacher education programs. For example, it would have been desirable to have information on the perception of school internships, how the students see their aptitude for teaching, or relatable measures. Unfortunately, such constructs were only included in the panel study at a later point in time when most of the non-completion events already had occurred.

9. Conclusion and practical implications

While we already knew from previous research that non-completion rates in teacher education programs are lower than in other study programs, our study corroborates the impression that non-completion is not the most pressing issue in teacher education programs – at least not during the phase that takes place at universities. Things might look different during the transition to and during the subsequent phase ('Referendariat'), but this has not been at the center of this study (cf. Franz et al., 2023; Gülen et al., 2023). Hence, policy interventions targeting non-completion in teacher education programs might only have limited scope in counteracting the recent teacher shortages in Germany. What is more, since – among those who do leave teacher education programs – the reasons seem to be largely connected to individual factors rather than structural conditions of the programs, effective policy measures might be difficult to implement. Within those limits, our findings would only suggest one potential avenue for policy intervention, which is aiming to enhance students' self-assessment of their academic performance, conveying the message that they have the potential to secure good job opportunities, even with average grades.

CRediT authorship contribution statement

Sebastian Franz: Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Steffen Schindler:** Writing – review & editing, Writing – original draft, Conceptualization.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijer.2024.102463.

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