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SCHWERPUNKT

Dropping or stopping out of apprenticeships: The role of performance- and integration-related risk factors

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Abstract The dropout rate in vocational education and training (VET) programs is high in Germany. Yet, this study shows that most instances of dropout are not permanent departures from VET. Instead, most trainees later re-enter into a new training program in a different occupation or company (a phenomenon labelled "stopout"). We use Tinto's model of college dropout, which suggests that the importance of performance-related and integration-related risk factors differs for permanent dropouts and stopouts, and their timing. Our analyses are based on longitudinal data from the National Educational Panel Study (NEPS), which provides measures for competencies and socioemotional (also called noncognitive) skills prior to starting VET programs, information to capture factors related to dis/satisfaction with training and longitudinal information on school-to-work transitions. To examine the relative importance of performance- and integration-related factors, we use Shapley decompositions. Our analyses reveal that performance-related risk factors (in terms of low math competence) increase the risk of permanently dropping out, and both cognitive and socioemotional skills predict occupational changes (occupational stopouts). Whether the VET program corresponds to the desired occupation is the most important integration-related factor, and a poor match increases the risk of both permanent dropout and occupational stopout. Moreover, lower satisfaction with training leads to changes in occupations or training companies. Finally, early training dissolutions

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are more strongly linked to integration-related problems, while later ones are more due to performance-related problems.

Keywords Dropout · Stopout · VET · Competences · Noncognitive skills · Socioemotional skills · Prevocational training · Shapley decomposition

Ausbildungsabbruch oder Ausbildungswechsel: Die Rolle von leistungs- und integrationsbezogenen Risikofaktoren

Zusammenfassung Die vorzeitige Beendigung einer Berufsausbildung ist häufig in Deutschland. Diese Studie zeigt jedoch, dass die meisten Abbrüche keine dauerhaften Abgänge aus der Berufsausbildung sind. Stattdessen nehmen die meisten Auszubildenden später wieder eine neue Ausbildung in einem anderen Beruf oder Betrieb auf. Wir verwenden Tintos Modell des Ausbildungsabbruchs, das davon ausgeht, dass die Bedeutung von leistungs- und integrationsbezogenen Risikofaktoren für dauerhafte Ausbildungsabbrüche und Ausbildungswechsel in einen anderen Beruf oder Betrieb sowie deren Zeitpunkt unterschiedlich ist. Unsere Analysen basieren auf Längsschnittdaten aus dem Nationalen Bildungspanel (NEPS), das Indikatoren für Kompetenzen und sozio-emotionale (auch genannt nicht-kognitive) Fähigkeiten vor Beginn der Berufsausbildung, Informationen zur Erfassung von Faktoren im Zusammenhang mit der Unzufriedenheit mit der Ausbildung und Längsschnittdaten zum Übergang von der Schule ins Berufsleben liefert. Um die relative Bedeutung von leistungs- und integrationsbezogenen Faktoren zu untersuchen, verwenden wir Shapley-Dekompositionen. Unsere Analysen zeigen, dass leistungsbezogene Risikofaktoren (im Sinne von geringer Mathematikkompetenz) das Risiko eines dauerhaften Ausbildungsabbruchs erhöhen, und dass sowohl kognitive als auch sozio-emotionale Fähigkeiten Wechsel in einen anderen Ausbildungsberuf vorhersagen. Die Übereinstimmung des Ausbildungsberufs mit dem angestrebten Beruf ist der wichtigste integrationsbezogene Faktor: Eine schlechte Übereinstimmung erhöht das Risiko sowohl eines dauerhaften Abbruchs als auch eines Wechsels in einen anderen Ausbildungsberuf. Außerdem führt eine geringere Zufriedenheit mit der Ausbildung zu einem Wechsel des Ausbildungsberufs oder -betriebs. Schließlich sind frühe Abbrüche und Wechsel stärker mit integrationsbezogenen Problemen verbunden, während spätere eher auf leistungsbezogene Probleme zurückzuführen sind.

Schlüsselwörter Ausbildungsabbruch · Ausbildungswechsel · Berufsbildung · Kompetenzen · Nicht-kognitive Fähigkeiten · Sozio-emotionale Fähigkeiten · Berufsvorbereitung · Shapley Dekomposition

1 Introduction

The dropping out of trainees from vocational education and training (VET) programs is often seen as problematic—from an individual perspective because it increases the risk of precarious labor market entry and threatens careers, and from a societal perspective because of the high need for skills and qualifications in modern labor

markets (e.g., Negrini et al. 2015). In Germany and Switzerland—two countries with internationally praised VET systems—about one quarter of training contracts are dissolved prematurely by the training company or the trainees every year (BIBB 2020, p. 146; Negrini et al. 2015). However, training dissolutions do not always mean that young people permanently leave education: many trainees only temporarily "stop out" and re-enter into a new VET or even a university program (e.g., Kotte 2018; Schmid and Stalder 2012; Wydra-Somaggio 2021).

The different factors that lead to stopout, as opposed to permanent dropout, are not well understood, because existing research on dropout rarely differentiates between the two. In doing so, it views "dropouts" as a homogeneous group and ignores the fact that the reasons why trainees do not continue with their training program may differ for stopout and permanent dropout (Rumberger 1987). Performance problems, related to lower levels of competencies or socioemotional skills (like sociability, perseverance, and self-esteem)[1], and structural factors, related to satisfaction with training occupations and conditions, may differently be associated with permanently dropping out and stopping out. Potential differences in the relative importance of performance-related factors compared to structural factors are invisible, if one only considers whether training episodes are completed or prematurely dissolved.

The dropout-stopout differentiation may help us to better understand whether participation in prevocational training programs increases the likelihood of subsequently completing regular VET programs. Every year, nearly a quarter of a million young people enroll in prevocational programs in Germany (National Education Report 2022, p. 167). Prevocational programs are intended to make up for individual shortcomings in cognitive and socioemotional skills, boost motivation, offer career guidance and improve subsequent educational attainment (e.g., Kohlrausch and Solga 2012; Weißeno et al. 2016). The study by Holtmann et al. (2021), using a matching approach for coping with selection into prevocational training programs, shows that participation in such programs indeed improves school leavers' probability of subsequently *entering* regular VET programs. However, it is still unclear whether prevocational programs also reduce the risk of dropping out of subsequent VET programs, and especially the risk of permanent dropout. The few existing studies that look at the effects of prevocational programs do not differentiate between permanent dropout and stopout, and they often have limited opportunities to account for selection into prevocational programs.

These research gaps are partly due to data limitations. Most studies use data at the level of training contracts, which do not include information on whether young people with dissolved training contracts continue to participate in education and training or not. Moreover, these data do not include individual-level characteristics, such as competencies or occupational expectations. Some studies use retrospective individual-level data, which do not include measures for competencies and socioemotional skills *prior* to dropping/stopping out.

[1] Socioemotional skills are used as an umbrella term covering personal resources that are not measured by cognitive ability or competence tests (Lechner et al. 2019). Socioemotional skills are also referred to as noncognitive skills in the literature (Gutman and Schoon 2016).

Against this backdrop, we investigate who drops out permanently and who stops out—that is, restarts training in another occupation and/or company, or enters tertiary education—and why they do so. Research to date on VET dropouts is either completely descriptive or only tests hypotheses for single factors. We enrich this research by applying an overarching theoretical model, that is, Tinto's theoretical model of college dropouts, to VET dropout/stopout processes (Tinto 1975, 1988). The basic idea is that performance- and integration-related risk factors are of differing importance for trainees' stopout or permanent dropout of education. We therefore explore the relative importance of these two different sets of risk factors for the different pathways taken after training dissolution by using the Shapley decomposition approach. We also examine whether participation in prevocational programs lowers the risks of both stopout and permanent dropout, accounting for several factors of intake selection.

In contrast to most existing research, we use *prospective* representative individual-level panel data. We use data from a cohort of grade 9 students, surveyed since 2010 by the German National Educational Panel Study (NEPS). The NEPS data uniquely provide measures for competencies and socioemotional skills prior to starting VET programs. The data also include some information regarding integration-related risk factors and longitudinal information on school-to-work transitions. The caveat with the NEPS data is, however, that they provide no information on performance during VET participation. Hence, trainees' capabilities to meet the VET program's requirements can only be proxied by performance indicators prior to VET entry. To include those proxies is, however, more than existing research has done.

We continue with a brief introduction to the German VET context, followed by a review of the literature and theoretical considerations. We then provide information on the data and our analytical strategy to test our hypotheses. We subsequently present and discuss the results of our analyses.

2 The German institutional context

The German school system provides different levels of school-leaving certificates which structure the options that school leavers have after leaving the general school system. Those holding the *Abitur* (the German university entrance qualification) can choose between entering a university or a VET program. Those holding an intermediate secondary school certificate (*Realschulabschluss, MSA*) can enter the VET system or continue schooling to pursue the *Abitur* at vocational schools. Low-achieving school leavers (i.e., those holding only a lower secondary school certificate *Hauptschulabschluss* or leaving school without a school certificate) can enroll in the VET system.

The German VET system consists of three sectors: the dual system of company-based training combined with school-based education (apprenticeships); the school-based sector (e.g., which provides training for nurses and kindergarten teachers); and the prevocational training sector (for details, see Protsch and Solga 2016). Both dual and school-based VET programs usually last three years and lead to nationally recognized, occupation-specific VET certificates. These regular VET programs are

stratified horizontally by occupation and vertically by educational requirements and later career prospects (Protsch and Solga 2016; Solga and Konietzka 1999). In contrast to the dual and school-based programs, the various prevocational programs do not result in VET certificates, but are rather designed to prepare low-achieving school leavers for regular VET programs. Most of these programs only last one year. In 2012 (the year when most NEPS students in our cohort left school), about 27% of new enrollments in the VET system were in prevocational programs (National Education Report 2014, p. 98).

In 2018, 26.5% of training contracts were prematurely dissolved (BIBB 2020, p. 146)—about two thirds of them in the first 12 months of training (one third during the first 4 months, i.e., often within the probationary period), another quarter in the second year, and the remaining 9% in the last training year (Uhly 2015, p. 9).

Rates of training dissolutions differ greatly by trainees' school-leaving certificate: 39% for school leavers with at most a lower secondary certificate, 25% for those with an intermediate certificate and only 15% for those with an *Abitur* (BIBB 2020, p. 146). An individual-level cross-sectional study conducted by the Federal Institute for Vocational Education and Training (BIBB) in 2002 showed that about 50% of VET dropouts entered another VET program (in another company or occupation), and an additional 13% continued in (higher) education (Schöngen 2003). Kotte (2018) reported similar results for apprenticeship entrants in 2005. Wydra-Somaggio's (2021) study, based on register data of (company-based) apprentices (between 1999 and 2002) for the German federal state Saarland, showed that about 70% of contract dissolutions are stopouts, with 61% of the stopouts connected with entering a new training program for a different occupation.

3 Previous research

Most studies on dropping out of upper-secondary education—the level at which Germany's regular *vocational* education programs are classified internationally—focus on young people who do not complete *general* upper secondary education. The reason for this is that most education systems do not include company-based vocational programs. We will shortly review their relevant findings for our study. Moreover, as existing research only rarely differentiates between permanent dropouts and stopouts, our literature review mainly includes research findings on this heterogenous group of (unspecified) training "dropouts."

Research on *general* education dropouts has revealed different domains of predictive factors for youth dropout risk: individual characteristics (e.g., performance indicators, socioemotional skills, socio-demographic characteristics like gender or family background) and institutional characteristics related to schools and communities (see the reviews by Gubbels et al. 2019; Rumberger and Lim 2008). Individual factors that have been shown to be very influential are poor school performance (grades, competencies), low educational aspirations, social behavioral problems and bad school experiences (e.g., Aarkrog et al. 2018; Bradley and Lenton 2007; Rumberger 1987; Rumberger and Lim 2008). These factors also partly mediate the impact of family background on dropout risks. Concerning institutional factors, international

research has mainly focused on schools (not companies) as the learning environment in upper secondary education. Here, school/class climate and student-teacher relationships are found to be the most influential factors (Gubbels et al. 2019).

Research on dropouts from *vocational* education has put less emphasis on individuals' competencies or socioemotional skills and school contexts (see Woll et al. 2015). One reason for this is that most research on VET dropouts in Germany relies on the *Berufsbildungsstatistik* (data from statistical agencies), which contain an identifier for training contracts but not for individuals. Thus, the unit of analysis is training contracts and the measurement of VET dropouts is "premature training contract dissolution" (initiated by the training company or the trainee). Some studies use the retrospective (individual-level) BIBB Transition Studies 2006 and 2011 (BIBB-Übergangsstudien), which do not allow for the inclusion of explanatory factors measured before dropping out (like socioemotional skills or satisfaction with the VET program).

Research on *individual* risk factors for dropping out of VET programs is still limited. Eegdeman et al. (2018) reported no association between dropping out in the first years and competencies (measured by cognitive formative entry tests) or personality traits (measured by the Big Five, see McCrae and John 1992) for the Netherlands. The study by Volodina et al. (2015) examined dropout *intentions* (not actual dropouts) in two occupational fields (technicians and industrial clerks). They also found that competence in mathematics or physics did not influence early dropout intentions but, in contrast to Eegdeman et al. (2018), that four of the five personality traits (the exception being "Openness to Experience") predicted early dropout intentions. Similarly, the study by Nießen et al. (2020) found that "Agreeableness" increases, and "Conscientiousness" reduces, the risk of dropout. However, for each of these studies, the effect sizes were rather small (although statistically significant).

An important individual characteristic in studies of VET dropout is trainees' school-leaving certificate. Several studies found higher rates for trainees with lower school-leaving certificates (e.g., Beicht and Walden 2013; Kropp et al. 2014; Laporte and Mueller 2013; Uhly 2015) and poorer school grades (Beicht and Walden 2013; Michaelis and Richter 2022) in Canada and Germany. Moreover, the influence of lower school-leaving certificates remains substantial after accounting for several other factors, like training occupation, company size, gender (e.g., Rohrbach-Schmidt and Uhly 2015) and socio-economic background (e.g., Beicht and Walden 2013). Possible explanations for the high association between dropout risk and level of school-leaving certificate include the possibility that low-achieving school leavers are less likely to enter training in their desired occupations, or that they possess lower levels of cognitive and/or socioemotional skills, which means they may struggle to meet the training requirements. However, research has not yet uncovered whether these two mechanisms (integration/satisfaction or performance-related problems) are underlying causes for the strong predictive power of school-leaving certificates.

In this respect, research on the impact of prior prevocational program participation on VET dropout risk is of interest because prevocational programs are intended to remedy individuals' deficits in competencies, socioemotional skills and occupational orientation (Menze and Holtmann 2019). If these intentions are fulfilled, participation in prevocational programs should reduce dropout risk (after account-

ing for selection into these programs). Research addressing this question is still very limited and inconsistent. Some studies find that prevocational program participation is associated with higher (not lower) dropout risk (Beicht and Ulrich 2008; Beicht and Walden 2013; Michaelis and Richter 2022; Uhly 2015). These studies do not account for competencies or socioemotional skills, however (except Michaelis and Richter (2022), who include some socioemotional skill measures). In contrast, other researchers report almost equal dropout rates for participants and nonparticipants (National Education Report 2016, p. 290).

Institutional factors have received large amounts of attention in VET dropout research. Studies for Scandinavian countries and Australia suggest that both teaching quality and work environments are influential for training dissolutions (e.g., Bäckman et al. 2015; Jäppinen 2009; Stromback and Mahendran 2010). The latter, namely company-level factors, have received much more attention than vocational schools, especially in German research (e.g., Schöngen 2003)—most probably because of the strong company-based VET sector, in which attendance at vocational schools only amounts to about 20% of the training time. Companies' training capacities (defined as training quality, quality of trainers and collective representative bodies like works councils or trainee representatives) were studied as factors for early contract dissolution (e.g., Rohrbach-Schmidt and Uhly 2015; Uhly 2015). German and Swiss studies using multidimensional concepts of the perception of training quality (including input- and process-quality factors) revealed that trainees' perception of training quality highly correlates with trainees' dropout intentions (Krötz and Deutscher 2021) and with the numbers of dropouts at the company level (Negrini et al. 2015).[2] Some studies examined the impact of companies' training capacity proxied by specific company characteristics, such as company size, industry and companies' training motivation/strategies. This research shows remarkable differences in dropout rates—for example, smaller companies have higher rates than larger companies (e.g., Rohrbach-Schmidt and Uhly 2015; Uhly 2015).

Furthermore, dropout rates vary considerably between training occupations—for example, between 5% and 50% in 2013 (Uhly 2015, p. 44). Potential explanations for this variation across occupations include, for example, differences in training occupations' cognitive requirements or the attractiveness of training occupations (such as working hours or trainees' workload, training allowances, or whether they are the school leavers' desired occupation). A study by Beicht and Walden (2013), for example, found that training in the desired occupation reduces the dropout risk considerably—however, this study, like others, did not account for the other potential explanations (like satisfaction with training allowance).

Finally, research about the *reasons for the timing* of dropping out of training is very limited. We know that dropouts in the last training year are mainly trainees failing the final examinations (Uhly 2015, p. 9). Wydra-Somaggio's (2021) study indicates that early training dissolutions are more likely to be stopouts, while later dissolutions bear higher risks of permanent dropout. Connected to this, she also found a negative association between the timing of dropout/stopout and apprentices'

[2] These findings are based on rather small samples with less than 320 trainees covering three occupations (commercial trainees mainly from banks, cooks and painters).

prior school attainment (i.e., trainees with higher school attainment dropped out earlier than those with lower attainment). Her interpretation of this finding is that early stopouts result more from opportunities to change training programs, if training conditions are not satisfying (associated with higher school attainment). Later dropouts, on the other hand, were more likely to result in permanent dropout because of fewer opportunities in the training market (associated with lower school attainment). She could not study, however, the role of performance-related problems, because the data did not include competencies or socioemotional skills.

Despite the manifold abovementioned findings, the review of existing research on VET dropout reveals several shortcomings: (1) Dropping vs. stopping out is under-researched, including whether risk factors differ between the pathways taken after training dissolution; (2) The role of competencies and socioemotional skills for such dissolutions has been very rarely examined; (3) Selection into VET programs is often only poorly accounted for. Related to these shortcomings is the fact that research on VET dropouts is missing an overarching theoretical model (see critics in Boockmann et al. 2014; Uhly 2015).

4 Theoretical considerations and hypotheses

Against this backdrop, we borrow ideas from Tinto's theoretical model of college dropouts (Tinto 1975, 1988) in our theoretical framework, in order to address these shortcomings and, at the same time, build on the existing research on individual and institutional risk factors. His model allows us both to differentiate between dropouts and stopouts and to theorize about the relative importance of individual performance-related characteristics versus institutional integration-related factors for dropout and stopout. Thus, with respect to the abovementioned research gaps, the main goal of our study is to get a better understanding of the different pathways after training dissolution and the relative importance of the two different risk factor sets identified in previous research for the different pathways. The aim is not to test single theories (which would not in any case be possible with the NEPS data used in this study, as they provide little information on subjective perceptions during training, and no direct measures of training requirements and quality).

Applying Tinto's model, we proceed from the basic idea that performance- and integration-related factors generate (mis)matches between individuals and their environment—*ceteris paribus* of intake selection based on pre-VET characteristics. These (mis)matches influence whether trainees complete or prematurely drop out of a training program, and in case of dropout, whether trainees decide to permanently drop out of education or to continue in a new program (a new occupation or training institution). While performance-related problems may result in trainees being either overwhelmed or insufficiently challenged, integration-related problems may result in trainees' dissatisfaction with their training situation (see Fig. 1).

Intake selection characteristics include family background, individual characteristics (like gender, school-leaving certificate, and grades) and prior educational experiences (like participation in prevocational programs). Based on the NEPS data, we use school-leaving certificate, grades and prevocational programs prior to VET as

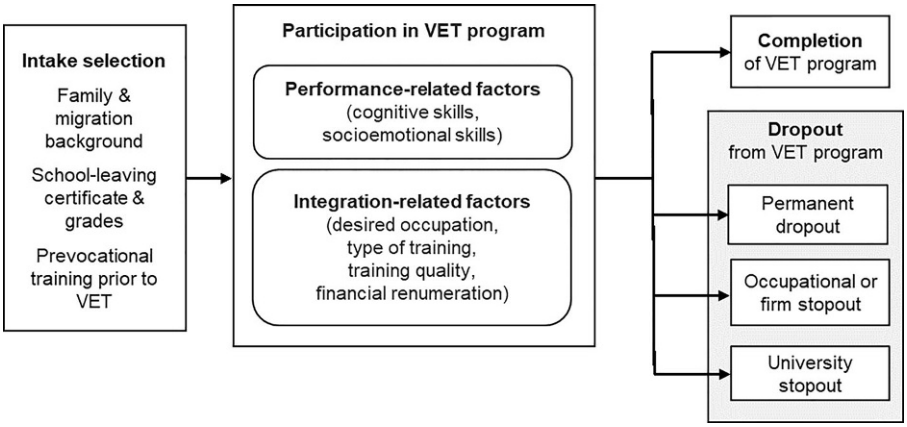

Fig. 1 Theoretical framework of VET dropout-stopout risks. (Adopted from Tinto's theoretical model of college dropouts (Tinto 1975, 1988))

indicators of intake selection (see Fig. 1). As employers heavily base their decisions to recruit apprentices on these signals (see, e.g., Holtmann et al. 2017), we conceptualize them as intake selection factors. They may also be seen as performance-related factors.[3]

Performance-related risk factors (i.e., factors related to how well trainees perform in their training) are trainees' cognitive and socioemotional skills. The NEPS data provide measures of cognitive and socioemotional skills only prior to the start of (and not during) a VET program. As "skills beget skills" (Cunha and Heckman 2008, p. 35), we take the NEPS measures as proxies of whether trainees are meeting cognitive and socioemotional training requirements.[4]

Integration-related factors are sources of dis/satisfaction with an individual's training situation. Dissatisfaction may produce a sense of mismatch, which in turn increases the risk of dropout/stopout. Applying Tinto's ideas about integration-related factors to VET dropouts, these factors include: (i) occupational expectations (measured by training in the desired occupation); (ii) type of institution measured by type of VET program (company-based, school-based); (iii) training quality as indicated by satisfaction with training, opportunities for peer-group interactions and/or existence of professional trainers (factors that are highly correlated with institution size as smaller companies have fewer trainees, for example) and, for those in company-based training program, companies' training motivation (e.g., how strongly trainees are involved as "workers", performing low-skilled tasks); and (iv) financial renumeration (satisfaction with training allowance). Negative values in these integration-related factors may result in training dissolution.

[3] This could mean that we underestimate the relative importance of performance-related factors. We come back to this in the Results section.

[4] Cognitive and socioemotional skill measures prior to training may also influence employers' recruitment decisions but are less easy to assess before training starts. We therefore take them (controlled for school attainment) as proxies for performance-related risk factors.

As mentioned above, participants in prevocational training prior to regular VET programs may have better occupational orientation and may be more mature than similar nonparticipants (i.e., school leavers who directly entered regular VET programs after leaving school) (see, e.g., Menze and Holtmann 2019). Participants may therefore have fewer integration-related, and possibly also performance-related, problems than similar nonparticipants and thus lower dropout/stopout risks (after accounting for selection into prevocational programs, i.e., compared to comparable school leavers who directly enter training).

According to Tinto (1975, 1988), performance- and integration-related problems generate different kinds of mis/matches and therefore should be of *different relative importance for stopouts vs. dropouts*: performance-related problems may be a major source of permanent dropouts. Dropouts followed by entry into a VET program in a new training occupation (hereafter: occupational stopouts)—or by entry into tertiary education if eligible (hereafter: university stopouts)—may be caused by performance-related problems, when programs are too demanding or not demanding enough. Dissatisfaction with the training occupation (as integration-related risk factor) may also lead to changes in training occupation (occupational stopouts or university stopouts), while low training quality and training allowances may prompt the trainees to switch to another training company (company stopouts).

Moreover, the relative importance of performance- and integration-related risk factors for dropout and stopout may vary for early and late dissolutions. Borrowing again from Tinto (1975, 1988), we differentiate between two distinct stages of training participation: the transition stage (the first year, which includes the probationary period) and the incorporation stage (second and third year). In the transition period, new trainees have to adjust to the social and intellectual life of the world of work and their training institution. Thus, as with college dropout, integration-related factors may be more important than performance-related factors for training dissolution in this stage. Performance problems may not yet have become severe, because exams at vocational school may only take place at the end of the first year. There may also be some goodwill among colleagues at the workplace, or teachers at the vocational school, as they recognize that the young person is just beginning their work socialization. Moreover, there may be mismatches between apprentices' occupational plans and reality, owing to a lack of proper career and occupational guidance, limited knowledge of the quality of companies and/or limited opportunities. Due to such integration-related problems, and less visible performance mismatches, training dissolution in the transition stage may result in company or occupational stopouts rather than permanent dropouts.

In the incorporation period, trainees have to establish themselves as "members" of the training company and/or vocational school. Performance problems (related to cognitive and socioemotional skills) may appear over time, as skill requirements increase with the duration of training. Hence, performance-related risk factors can be expected to become a major source of later dropout/stopout. Moreover, if this is true, later training dissolution may more frequently lead to permanently dropping out of training.

Based on these theoretical considerations, we derive different hypotheses on dropping/stopping out and the relative importance of performance- and integration-re-

lated risk factor sets (always *ceteris paribus* of intake selection into VET programs and including the other potential risk factor sets, see Fig. 1):

Hypothesis 1 Performance-related risk factors increase the risk of permanent dropout and occupational stopout.

Hypothesis 2 Integration-related risk factors increase the risk of permanent dropout and stopout—with problems concerning occupational expectations increasing the risks of occupational stopout, while problems with training quality, type of training and training allowances increase the risks of company stopout.

Hypothesis 3 Participation in prevocational programs is associated with a lower risk of training dissolution (because it may lessen performance and/or integration-related problems).

Concerning the timing, we expect to find:

Hypothesis 4 Integration-related risk factors are more important for early dissolutions than performance-related ones, while the latter are a major source of later dissolutions.

If Hypothesis 4 is supported, late dissolutions may more often go along with the experience of failure than early dissolutions because they are more often due to performance problems. In addition, late dissolutions mean a greater loss of trainees' time investment. For later dissolutions, we therefore assume a larger disengagement from education in the future. Consequently, we hypothesize:

Hypothesis 5 Later training dissolutions will more likely lead to permanent dropout, while early dissolutions will more likely lead to stopout.

5 Data and methods

5.1 Data and sample

To test these five hypotheses, we used longitudinal data from the German National Educational Panel Study (NEPS) on a cohort of students who attended grade 9 in German secondary schools in fall 2010 and have been surveyed once or twice each year since then (Blossfeld and Roßbach 2019; Leuze et al. 2011). We used the scientific use file SUF SC4 11.0.0 (https://doi.org/10.5157/NEPS:SC4:11.0.0), which includes the first 11 waves (conducted between fall 2010 and fall 2018).

Our sample consists of 4575 respondents who started a regular (company- or school-based) VET program, and were observed until they finished their VET program or until a time point at least 10 months after they dropped out of this program. The 10-month requirement ensured that we included the possibility of observing entry into a new VET program in the next VET year (which always starts in early

fall). Table S1 (Online Supplement) shows that the distributions of the variables used in our analyses changed very little with our sample inclusion criteria.

As suggested by Steinhauer and Zinn (2016), we used weights for our descriptive statistics and survey models without weights in our multivariate analysis to account for the NEPS sampling design.[5] To deal with item nonresponse, we used multiple imputations to estimate missing values of independent variables. 59% of the cases have a missing value in at least one independent variable used in the analyses (or the robustness checks). White et al. (2011) argue that one should generate at least roughly the same number of imputations. We generated 80 imputations for each missing value using the iterated chained equations algorithm in Stata 16.1. We are not aware of any problems caused by increasing the number of imputations (apart from making the imputation and analysis more computation intensive with the added benefit approaching zero). The prediction equation included the dependent variable (differentiating between dropout and different stopouts, see below) and all variables listed in the Online Supplement, Table S1.

5.2 Dependent variables

We use three dependent variables. First, we use the binary variable of dropout (yes/no), corresponding to whether respondents successfully completed their training program or not. Second, we differentiate between successful VET completion and permanent dropout, occupational stopout, company stopout and university stopout as mutually exclusive outcomes. Occupational stopout is defined as a difference in the 3-digit occupational group of the German classification of occupations Kldb 2010 between the first and the second (new) VET occupation (this may additionally include a company change). Company stopouts are defined as those who entered a new VET program in the same occupation. University stopouts are all those who reported a university episode that started after dropping out of VET. Third, we distinguish between early dropouts as those that occurred in the first VET year and late dropouts as those after one year. Descriptive distributions for our dependent variables are reported in the results section (see below).

5.3 Independent variables

Table 1 reports the independent variables and the variables used to control for selection into VET programs. As indicators for performance-related problems (or their absence) we used mathematics competence and a selection of socioemotional skills to avoid overfitting. We include measures of prosocial behavior, problematic

[5] We estimated survey models using the "svy" command in Stata. With survey models, it is not possible to compute (adjusted) R^2 in multinomial regression analysis (based on log-likelihoods). As log-likelihoods assume that all cases are independent from each other, this conflicts with the use of survey models accounting for clustering and stratification. Therefore, the estimation reported in Table 4 used survey models, while the estimations reported in Table S6 in the Online Supplement are not based on survey models. The re-estimation of Table 4 excluding the svy-command shows similar results, with only miniscule changes for significance levels in three cases, none of which changes whether an effect is statistically significant or not.

Table 1 Overview of the intake and independent variables (variables only used in robustness checks in brackets)

Construct	Measurement	Coding for our analysis, Cronbach's alpha α (if applicable)	Time of measurement
Intake selection and controls			
Highest level of parental education	Highest qualification of father or mother	0 no certificate, 1 vocational certificate, 2 tertiary certificate	Parent (or student) questionnaire, wave 1 (2010)
School-leaving certificate	School-leaving certificate at beginning of VET	0 no certificate, 1 lower secondary certificate, 2 intermediate certificate, 3 university entrance diploma (Abitur)	At beginning of VET
Grade point average	GPA on school-leaving certificate held at beginning of VET	Range: high (=1) to low grades (=6)	At beginning of VET
Prevocational program (also independent variable of interest for H3)	Participation in prevocational program(s) before first regular VET program episode	0 no, 1 yes	Before beginning of VET
Gender	Gender categories	0 male, 1 female	School registry
Migration background	Student and/or at least one parents not born in Germany	0 no, 1 yes	See "highest level of parental education"
Performance-related factors			
Cognitive skills			
Mathematics competence	Scale based on 22 test items (Duchhardt and Gerdes 2013)	Range: –4.4 to 4.6	Grade 9
[Reading competence]	Scale based on 25 test items (Gehrer et al. 2012)	Range: –4.7 to 3.3	Grade 9
Socioemotional skills			
Strength & Difficulties Questionnaire	Goodman (1997) Please give a description of yourself. Think of the last half year	Scale: 0 not applicable, 1 partly applicable, 2 clearly applicable	End of grade 9 (wave 2)
– Prosocial behavior	I try to be nice to other people, their feelings are important to me. Normally, I share with others (e.g., candy, toys, or colored pencils). I am ready to help people when they are injured, sick, or sad. I am nice to younger children. I often help others voluntarily (parents, teachers, or children of the same age)	Sum score, range: 0–10, α = 0.66	
– Problematic peer relationship behavior	Most of the time I am by myself; I rather concentrate on myself. I have one or several good friends. (reverse coding) Generally, I am popular with children of the same age. (reverse coding) I am teased or harassed by others. I get along better with adults than with children of the same age	Sum score, range: 0–10, α = 0.55	

Table 1 (Continued)

Construct	Measurement	Coding for our analysis, Cronbach's alpha α (if applicable)	Time of measurement
Goal pursuit	Brandtstädter and Renner (1990) The following statements refer to situations where your wishes, goals or plans might not be realized the way you would like to. Please check the extent to which the following statements apply to you	Scale: 1 "does not apply at all" to 5 "applies completely"	End of grade 10 (wave 3); if missing: wave 5
– Tenacious goal pursuit	The more difficult it is to reach a goal, the more I think it's worth doing. I can be very persistent in pursuing my interests. When there are difficulties in my path, I normally try harder. I tend to keep on fighting, even if the situation seems hopeless. Once I set my mind to doing something, I don't let even major difficulties keep me from pursuing it	Sum score, range: 5–25, $\alpha = 0.69$	
– [Flexible goal adjustment]	I often am still able to find meaning in major disappointments. Even if something really goes wrong for me, I can still see that I've made a bit of progress. I can sometimes get satisfaction from doing without. If I don't get what I want, I see that as an opportunity to learn how to deal with things. I can easily see a good side even in the unpleasant aspects of life	Sum score, range: 5–25; reverse coded: higher values indicate less flexible goal adjustment, $\alpha = 0.68$	
Big Five personality traits	Rammstedt and John (2007) To what extent do the following statements apply to you?	Scale: 1 not at all, 2 rather not, 3 partly, 4 rather yes, 5 totally; mean of subscale items, range: 1–5	Beginning of grade 9 (wave 1)
– Agreeableness	I trust other people easily, I believe in the goodness in people. I tend to criticize other people. (reverse coding) I am considerate towards others, I am a sensitive person	$\alpha = 0.38$	
– Conscientiousness	I am idle, I tend to be lazy. (reverse coding) I carry out tasks thoroughly	$\alpha = 0.53$	
– Openness to experience	I have only little interest in the arts. (reverse coding) I have an active imagination, I am an imaginative person	$\alpha = 0.42$	
– [Emotional stability]	I am relaxed and I do not get worked up by stress. I get nervous and insecure easily. (reverse coding)	$\alpha = 0.40$	
– [Extraversion]	I am rather restrained, reserved. (reverse coding) I come out of my shell, I am a sociable person	$\alpha = 0.63$	
[Global self-esteem]	Von Collani and Herzberg (2003) To what extend do the following statements apply to you? All in all, I am satisfied with myself. Now and then, I think that I am not very useful. (reverse coding) I have some positive attributes. I can do many things just as well as most other people. I am afraid there is not much I can be proud of. (reverse coding) Sometimes I really feel useless. (reverse coding) I consider myself a valuable person; at least I am not less valuable than the others. I wish I could have more respect for myself. (reverse coding) All in all, I tend to consider myself a loser. (reverse coding) I have a positive attitude towards myself	Scale: 1 not at all, 2 rather not, 3 partly, 4 rather yes, 5 totally; sum score of all items, range: 10–50, $\alpha = 0.85$	Beginning of grade 9 (wave 1)

Table 1 (Continued)

Construct	Measurement	Coding for our analysis, Cronbach's alpha α (if applicable)	Time of measurement
Integration-related factors			
Occupational expectation: training in desired occupation	To what extent does the following statement apply to this occupation. This occupation is my desired occupation	1 "does not apply at all" to 5 "applies completely"	After beginning of VET
Type of training (company-based vs. non-company-based)	Have you signed a training contract? (yes/no) With whom did you sign your training contract? Is/was it … – a training company, e.g., a company, a business, a government agency or a practice – a training center where only vocational training is offered – a vocational school	Contract with company = 1 if signed contract with a training company (company-based), otherwise 0 (non-company-based)	After beginning of VET
Financial renumeration: satisfaction with wages	How satisfied are you with what you have? Think of money, income and things you own	Score 0–10, 0 "completely dissatisfied" to 10 "completely satisfied"	At beginning of VET
Training quality			
Satisfaction with training	How satisfied are you with your vocational training program?	Score 0–10, 0 "completely dissatisfied" to 10 "completely satisfied"; average score over all measurement points	Asked every time a respondent reports an ongoing VET episode
Company variables [only available for company-based training]			
– [Company size]	How many persons are/were employed at this company?	11 categories from 1 "1 to less than 5 employees" to 11 "2000 employees and more"	At beginning of VET
– [Number of apprentices]	How many apprentices/trainees were/are there in total?	8 categories from 1 "solely the respondent" to 8 "more than 100 apprentices"	At beginning of VET
– [Involvement in company's work processes]	Now it's about the company-based part of your vocational training. How often do you work on actual jobs or tasks in your training company? Does that happen …	Scale from 1 "never" to 5 "very often"; average score over all measurement points	Asked every time a respondent reports an ongoing VET episode

peer relationship behavior, tenacious goal pursuit and three Big Five personality traits (agreeableness, conscientiousness and openness to experience) as theoretically and empirically relevant performance-related characteristics (Nießen et al. 2020). As robustness checks, we reran our analyses including all available socioemotional-skill indicators as well as reading competence (see Table 1). Table 1 also includes the Cronbach's alpha for the socioemotional skills as a reliability measure. The Cronbach's alpha values for some of the Big Five facets are low. Rammstedt and John (2007) argue, however, that these values are sufficient for such 2-item scales as the two items are designed to measure different aspects of each dimension.[6] For the

[6] Previous research shows that the test-retest reliabilities are higher than the inter-item correlations (r = 0.75) (Rammstedt and John 2007). This indicates that interitem correlations do not capture all relevant aspects of psychometric quality—a broad topic, which we cannot cover in depth here.

mathematics competence assessment, Duchhardt and Gerdes (2013, p. 23) report an EAP/PV-reliability of 0.811 and a WLE reliability of 0.794 based on 22 test items.

Integration-related factors are captured by (a) training in the desired training occupation (as indicator for occupational expectations), (b) type of training (i.e., contract with a company or not) and the following proxies for training quality: (c) trainees' satisfaction with the training program and with the training allowance and (d) characteristics of the training company, for those who reported a training contract with a company. These company characteristics are company size, number of apprentices in the company and involvement in work processes, which are known to impact on training quality (e.g., Ebbinghaus and Krewerth 2014; Martsch and Thiele 2017).

To control for selection into VET programs, we included students' school-leaving certificate, grade point average and participation in prevocational programs as well as migration background and highest level of parental education. Moreover, we controlled for gender and age. Descriptive information for all independent, control and robustness check variables (differentiated by pathways after dropout) and a correlation matrix of these variables are reported in the Online Supplement, Tables S2 and S3.

5.4 Analytical strategy

To test Hypotheses 1 to 3, we use linear probability models (LPM) for dropout (yes/no) and early vs. later dropout as outcome variables, and multinomial regressions for different pathways after training dissolution vs. successful completion as outcome variable. For Hypothesis 5, we use descriptive statistics.

To test Hypothesis 4, concerning the relative importance of performance- and integration-related factors, we employ Shapley decompositions and quantify the importance of groups of variables to predict dropout/stopout by decomposing the R^2 scores. The Shapley decomposition method originates from cooperative game theory, used to quantify how much each player contributed to the total payout of a game (Shapley 1953). Groups of variables can be treated as "teams of players in a game" to predict an outcome. In this way, Shapley decompositions can be used to quantify the importance of these groups of variables to predict an outcome of regression analysis (Shorrocks 2013). The advantages of Shapley decompositions over other commonly used decomposition methods (like Kitagawa–Blinder–Oaxaca decompositions) are that the results are independent of the order in which the predictor variables are entered into the regression model and that they produce more reliable estimates, even if groups of variables are not independent of one another (Shorrocks 2013). This is because the contribution of a given set of variables is calculated as the average marginal contribution of that set of predictors across all possible sequences of variable inclusions. For our seven sets of predictors (see Table 3 in result section), we estimated the factorial of 7 (=5040) regressions for all possible sequences. To calculate Shapley coefficients and variances for the imputed data, we also looped over all imputations following Rubin's rules (Rubin 1987).

Table 2 Distribution of dropouts, stopouts, and completed first VET programs

	%	% within training dissolutions	N
VET successfully completed	79.2	–	3589
Dropouts for at least one training year	5.3	25.3	254
Stopouts	15.5	74.7	732
Occupational stopouts	*10.2*	*49.3*	*483*
Company stopouts	*3.5*	*16.9*	*169*
University stopouts	*1.8*	*8.5*	*80*
Total	100%	100%	4575
Time of dropout			
VET completed	79.2	–	3589
Dropout in 1st year	14.9	71.9	704
Dropout after 1st year	5.8	28.1	282
Total	100%	100%	4575

Source: NEPS SC4 SUF 11.0.0, authors' calculations, weighted

6 Results

Table 2 shows that 20.8% of the first VET episodes were prematurely dissolved.[7] Stopouts were much more frequent than permanent dropouts (15.5% vs. 5.3%)—thus, only one quarter of the training dissolutions were permanent dropouts (for at least one training year). About half of the training dissolution cases changed their occupation (49.3%), another 16.9% changed their training company (but not the occupation), and about 8.5% entered university. Finally, the majority of training dissolutions occurred during the first year (71.9%), and less than one third of the dropouts/stopouts happened later.

To facilitate comparison with previous research, we first consider the likelihood of "dropout"—without differentiating between pathways after training dissolution. The full model M4 in Table 3 shows that higher math competence is associated with a lower dropout risk, though the effect size is comparatively small but notable. A change of one standard deviation (SD) in math competence increases the dropout risk by 3 percentage points. Regarding socioemotional skills, the pattern is less clear: More openness to experience and tenacious goal pursuit predict a higher dropout risk. However, effect sizes are again comparatively small (1.7 percentage points per SD). Concerning integration-related problems, being trained in a more desired occupation or being more satisfied with the training (by one SD) decreases the likelihood of dropout by 9.1 and 3.4 percentage points, respectively.

All the variables together predict about 15% of the variance in the dropout risk (see M4, Table 3), comparable to other studies on VET dropouts. The last column in Table 3 shows how much the different groups of risk factors contribute to predicting dropout using a Shapley decomposition. The desired training occupation explains most variance compared to the other risk factors (about 40% of the R^2). Satisfaction

[7] When relaxing the sample restriction to every dropout (and not only to those observed at least 10 months after training dissolution), the share of dropouts is 25%—similar to other studies and official statistics.

Table 3 Linear probability model on dropout and Shapley decomposition

	M1: Intake selection	M2: Including performance-related factors	M3: Including integration-related factors	M4: Full model	Shapley decomposition of M4: % of explained variance
Intake selection & demographics					
Age at start of 1st VET	0.046***	0.044***	0.036***	0.035***	*6.3****
Female (Ref. male)	0.051***	0.039**	0.035**	0.021	
Migration background	0.028	0.026	0.005	0.002	
Parental education (Ref: vocational)					
No certificate	0.061*	0.053	0.039	0.030	
Tertiary certificate	0.019	0.016	–0.009	–0.009	
School-leaving certificate (Ref.: intermediate)					*20.7****
No certificate	0.124**	0.117**	0.111**	0.108**	
Lower secondary certificate	0.120***	0.116***	0.102***	0.088***	
University entrance diploma (Abitur)	–0.170***	–0.146***	–0.161***	–0.139***	
Grade point average	0.074***	0.063***	0.060***	0.053***	
Prevocational participation	–0.059**	–0.062**	–0.047*	–0.050**	*1.3****
Performance-related factors					
Math competence[a]	–	–0.033***	–	–0.030***	*7.8****
Socioemotional skills[a]					*4.9****
Prosocial behavior	–	–0.010	–	–0.007	
Problematic peer relationship behavior	–	0.015*	–	0.012*	
Tenacious goal pursuit	–	0.016*	–	0.017*	
Agreeableness	–	–0.001	–	0.004	
Conscientiousness	–	–0.014*	–	–0.004	
Openness to experience	–	0.026***	–	0.017*	
Integration-related factors					
Desired training occupation[a]	–	–	–0.093***	–0.091***	*41.6****
Satisfaction with					*17.4****
Training[a]	–	–	–0.033***	–0.034***	
Wages[a]	–	–	–0.008	–0.008	
Type of training (company-based = 1)	–	–	–0.012	–0.010	–[b]
Constant	–0.834***	–0.767***	–0.602***	–0.559***	
R^2	*0.064*	*0.074*	*0.146*	*0.153*	*0.153*

"Dropout" includes all pathways taken after training dissolution. $N = 4575$. Imputed values (M = 80). Company characteristics are only available for company-based VET (see Online Supplement, Table S5). Source: NEPS SC4 SUF 11.0.0, authors' calculations

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (two-sided tests)

[a]z-standardized variables (mean = 0, SD = 1)

[b]Not included in Shapley decomposition

Table 4 Multinomial regression analysis of (direction of) training dissolution (*AME*)

	Completed VET	Permanent dropout	Occupational stopout	Company stopout	University stopout
Intake selection & demographics					
Age at start of 1st VET	–0.028***	0.018***	0.010*	–0.001	0.001
Female	–0.019	0.009	–0.004	0.011	0.003
Migration background	–0.003	0.006	–0.006	0.009	–0.007
Parental education (Ref.: vocational)					
No certificate	–0.010	0.021	–0.019	0.016	–0.008
Tertiary certificate	0.025	–0.020*	–0.019	–0.003	0.017**
School-leaving certificate (Ref.: intermediate)					
No certificate	–0.084*	0.132***	–0.030	–0.005	–0.021***
Lower secondary certificate	–0.074***	0.053***	0.012	0.016	–0.007*
University entrance diploma (Abitur)	0.118***	–0.036***	–0.073***	–0.028***	0.020**
Grade point average	–0.052***	0.013*	0.030***	0.014*	–0.005
Prevocational participation	0.056**	–0.014	–0.021	0.001	–0.022*
Performance-related factors					
Math competence[a]	0.036***	–0.015*	–0.023**	–0.000	0.002
Socioemotional skills[a]					
Prosocial behavior	0.006	–0.001	–0.011*	0.001	0.005*
Problematic peer relationship behavior	–0.010	–0.002	0.007	0.004	0.002
Tenacious goal pursuit	–0.016*	0.008	0.003	0.003	0.002
Agreeableness	–0.003	0.002	0.009	–0.004	–0.005*
Conscientiousness	0.005	–0.006	0.006	–0.000	–0.005*
Openness to experience	–0.018**	–0.001	0.011*	0.004	0.004
Integration-related factors					
Desired training occupation[a]	0.071***	–0.016***	–0.042***	–0.002	–0.011***
Type of training (company-based = 1)	0.007	–0.010	–0.000	0.005	–0.002
Satisfaction with					
Training[a]	0.028***	–0.003	–0.016***	–0.007*	–0.002
Wages[a]	0.009	–0.003	–0.002	–0.002	–0.001

N = 4575. Average marginal effects. Imputed values (M = 80). For Shapley decompositions see Online Supplement, Table S6. Source: NEPS SC4 SUF 11.0.0, authors' calculations
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (two-sided tests)
[a]z-standardized variables (mean = 0, SD = 1)

with training and wages explains another 17%. In contrast, cognitive and socioemotional skills (as performance-related factors) explain only 12.7%. When taking school attainment—school-leaving certificate and grades—as additional proxies for performance-related problems, their predictive power increases to 33.4%—which is still less than the sum of the integration-related indicators (59%).

Table 5 Shapley decomposition for training dissolution by timing of dissolution (in % of the explained variance)

	Dropout during 1st year	Dropout after 1st year
Intake selection & demographics		
Socio-demographics (age, gender, parental education)	6.0***	7.6***
School attainment (school-leaving certificates, GPA)	13.8***	43.0***
Prevocational training participation	1.0***	2.2***
Performance-related factors		
Math competence	5.6***	12.5***
Socioemotional skills (see Table 4 above)	3.7***	9.5***
Integration-related factors		
Desired training occupation	53.3***	6.5***
Satisfaction with training/wages	16.8***	18.6***
Total	100.0	100.0
R^2 decomposed	*0.165*	*0.044*
N (dropout/completion)	*704/3589*	*282/3589*
N (total)	*4293*	*3871*

Imputed values (M = 80). Shapley decomposition values for R^2 for linear regressions (LPM). Dependent variable: training dissolution vs. completed VET. For coefficients see Online Supplement, Table S7. Source: NEPS SC4 11.0.0, authors' calculations
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (two-sided tests)

We also estimated separate models for company-based and non-company-based VET programs (see Online Supplement, Table S5). Socioemotional skills have a higher predictive power for non-company-based programs (9.1%) than company-based programs (4.0%), while differences in occupation desirability are more important for dropping out from company-based programs (42.6% vs. 30.7%). Company variables are only available for trainees who have a contract with a company. Estimating the Shapley decomposition scores including company characteristics for the company-based subsample shows that company characteristics predict 12.6% of the explained variance of dropout and are thus important predictors of training dissolution. This is similar to the contribution made by satisfaction with training/wages (13.6%) but much smaller than the contribution of training in the desired occupation (38.9%).

We now turn to our study's main area of interest, that is, the pathways taken after training dissolution. The results of multinomial regressions are presented in Table 4. Hypothesis 1 states that performance-related risk factors increase both the permanent dropout and the occupational stopout risks. Table 4 shows that higher math competence increases the likelihood of successfully completing VET programs and decreases the likelihood of both permanent dropouts and occupational stopouts by 1.5 and 2.3 percentage points per standard deviation, respectively (vice versa, poorer competences increase these risks). The results of the Shapley decomposition reveal that the impact of math competence equates to 12.4% of the explained R^2 for permanent dropout and to 9.4% for occupational stopout (see Online Supplement, Table S6). The regression coefficients for socioemotional skills (the second

Table 6 Distribution of dropouts or stopouts by timing of training dissolution (in row percentage)

	Permanent dropout	Occupational stopout	Company stopout	University stopout
In the 1st year	19.9	52.8	16.7	10.6
After the 1st year	32.1	41.5	20.4	6.0
Total	23.5	49.5	17.8	9.3

Source: NEPS SC4 SUF 11.0.0, authors' calculations, weighted

set of performance-related indicators) are mostly zero. Supporting Hypothesis 1 is the observation that higher values of prosocial behavior reduce the likelihood of occupational stopout, and that higher values of openness to new experiences increase it (each with 1.1 percentage point per SD). All socioemotional skills included in the regression only contribute 6.2% of the total explained variance for occupational stopouts (see Online Supplement, Table S6). Overall, these findings are in line with Hypothesis 1: Performance-related problems are associated with higher dropout and occupational stopout rates—but with more consistent and larger support for cognitive than socioemotional skills.

Hypothesis 2 expects that integration-related risk factors increase the likelihood of permanent dropout, of company stopout (because of problems in training quality, type of training, and training allowances) and of occupational stopout (because of mismatches between actual and desired occupation). Table 4 shows that access to the desired occupation increases the likelihood of completing training by 7.1 percentage points per SD and, vice versa, it reduces the risk of permanent dropout and occupational or university stopout. Similarly, satisfaction with training increases the likelihood of successful VET completion and decreases the likelihood of occupational and company stopout. Dis/satisfaction with wages or whether training is company-based or not is not associated with training dissolution (controlled for the other variables). The Shapley decompositions show that, among the variables included, training in the desired occupation is the most predictive factor for occupational and university stopout (see Online Supplement, Table S6). It contributes 44 and 34%, respectively, to the explained variance. Training satisfaction is also an important factor for stopping out but less so for permanent dropping out. In sum, the results support Hypothesis 2. Negative values of integration-related factors such as occupational expectations (measured by training in the desired occupation) are associated with higher permanent dropout and occupational stopout risks, while lower training quality (indicated by dissatisfaction with training) is associated with higher occupational and company stopout risks.

Hypothesis 3 claims that prior participation in prevocational programs should reduce the risk of training dissolution (compared to nonparticipants similar in all other controlled characteristics). The results presented in Table 4 (above) support this hypothesis: Ceteris paribus, former participants in prevocational programs indeed are 6 percentage points more likely to finish their VET program successfully than nonparticipants. We hypothesized that this is because prevocational training lessens performance- and/or integration-related problems. The stepwise inclusion of integration-related variables slightly reduces the effect of prevocational training participation—indicating that prevocational programs may increase the likelihood

of entering the desired occupation (analyses not shown). The stepwise inclusion of performance-related indicators does not change the effect of prevocational training. Note, however, that math competence and socioemotional skills were measured before participation in prevocational training and thus do not capture potential changes during prevocational training.

Hypotheses 4 and 5 relate to the timing of training dissolution. Hypothesis 4 states that integration-related problems are more important for early training dissolution, while performance-related problems are more important for later training dissolution. The Shapley decomposition results reported in Table 5 support this hypothesis (for the regression coefficients see Online Supplement, Table S7). Whether the training corresponds to the desired occupation is the most important predictor for early dissolution (53% of the explained variance); for later dissolution it explains only 6.5%. By contrast, math competence and socioemotional skills (the two performance-related factors) have higher predictive power for later dissolution than for early dissolution (math competence: 12.5% vs. 5.6%, socioemotional skills: 9.5% vs. 3.7%). These findings did not change substantially when using reading (instead of mathematics) test scores (see Online Supplement, Table S8) or when including all available socioemotional skill measures (see Online Supplement, Table S9). Note, however, that math competence has higher predictive power than reading competence for both early and later training dissolution (early: 5.6% vs. 1.1%, later: 12.5% vs. 9.6%).

Finally, Hypothesis 5 expects that later dissolutions are more likely to be permanent dropouts, while early dissolutions are more likely to be stopouts. Table 6 supports this hypothesis: Occupational stopouts are overrepresented among first-year training dissolutions, while permanent dropouts are overrepresented among later dissolutions. However, even among dissolutions after one year, the share of occupational stopouts is higher than the share of permanent dropouts (41.5% vs. 32.1%).

7 Conclusions

Dropping out of vocational education and training (VET) programs is seen as problematic both individually and societally. This is, however, only the case if training dissolutions result in permanently dropping out of education. If, by contrast, training dissolution is followed by training in a new occupation, a new company, or in a college program, dropping out of one's VET program could be understood less as a "problem", but rather more as part of young people's search and adjustment behavior in their school-to-work transition (e.g., Schmid and Stalder 2012). Existing research rarely differentiates between permanent dropout and temporary stopout. It provides little insight into the reasons for the different pathways taken after training dissolutions, and for their timing—but this knowledge is crucial when assessing how "problematic" training dissolutions are. Dropping out early and transitioning to a more desirable occupation or company or enrolling in a university program (if eligible) can be understood as a normal adjustment, while dropping out permanently due to performance problems is certainly problematic.

Against this background, the main goal of our study was to better understand why young people do not successfully complete their training program. We adopted Tinto's model of college dropout (1975, 1988) to VET dropout. The model provides a theoretical framework to better understand both the reasons for permanent dropouts versus stopouts and for early versus later dropout/stopout—by differentiating between performance- and integration-related risk factors. In doing so, we have contributed new insights on what "dropping out" from training actually means in terms of educational participation and on the extent to which the different risk factors identified in previous research predict chances of stopout and permanent dropout. Future research may continue this line of investigation, and examine specific mechanisms (e.g., based on motivational theories, goal theories, or Eccles' expectancy-value model of achievement, see Eccles and Wigfield 2002).

Our study clearly demonstrates, for a representative sample of trainees in Germany, that training dissolutions in most cases are not permanent dropouts but stopouts (mostly stopouts that lead to training in a new occupation). Our analyses have shown that the match between VET program and desired occupation is the most important risk factor. Poor match increases the risk of both permanent dropout and occupational stopout. Moreover, lower satisfaction with training leads to changes in occupations or training companies. Performance-related risk factors in terms of low math competence also increase the risk of permanent dropout, and both low math competence and less favorable values of prosocial behavior and openness to experience increase the risks of occupational stopout.

Concerning the timing of training dissolution, we found that integration-related problems (especially training in a less desired occupation) are a major cause of early dropout, while performance-related risk factors are more important for later dropout. Hence, the permanent dropout rate is higher for later training dissolutions, while the occupational stopout rate is higher for early dissolutions. In sum, performance- and integration-related factors predict training dissolutions (as shown in previous studies) but differently in terms of permanent dropout or temporary stopout of training.

Accounting at least for observed characteristics for selection into prevocational training, we found that participation in such programs is associated with both lower permanent dropout and stopout risks, because participants are more likely to be trained in the desired occupation (i.e., less institutional-integration problems) than comparable nonparticipants. It is important to note, that this prevocational effect only becomes visible after accounting for intake selection and thus heterogeneity between participants and nonparticipants, a step that is often missing in existing studies. From a policy perspective, this finding indicates that prevocational training participation may not only improve school leavers' probability of entering regular VET programs (Holtmann et al. 2021) but also of successfully completing VET programs.

Our study is not without limitations. We had to limit the observation window after training dissolution to 10 months (which covers the duration until the beginning of the next VET year) in order not to lose too many cases due to panel attrition. Thus, some training dissolutions classified as permanent dropouts may ultimately prove to be stopouts (if a new training episode starts after 10 months). The results of Shapley decompositions depend on how well performance- and integration-related

risk factors are captured by the available variables. The NEPS data are better than most available datasets (see Introduction section), but still limited in this respect as measures of cognitive and socioemotional skills during training, direct measures of training quality and information on vocational school environments are not available. Moreover, because competencies are only measured before the VET participation and not during VET (i.e., in each VET year), it is difficult to clearly define whether school leavers' competencies should be used to account for selection into training or as a predictor for performance problems during training.

Despite these limitations, our study extends previous research on dropping out of upper secondary education in several respects. First, we have shown that trainees who prematurely dissolve their training program are not a homogenous group. Second, we have found that both performance- and integration-related risk factors are predictors of training dissolutions, but they lead to different pathways afterwards. Third, our analyses have accounted for selection into training more comprehensively than previous research.

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Conflict of interest A.C. Holtmann and H. Solga declare that they have no competing interests.

References

Aarkrog, V., Wahlgren, B., Larsen, C. H., Mariager-Anderson, K., & Gottlieb, S. (2018). Decision-making processes among potential dropouts in vocational education and training and adult learning. *International Journal for Research in Vocational Education and Training*, *5*(2), 111–129.

Bäckman, O., Jakobsen, V., Lorentzen, T., Österbacka, E., & Dahl, E. (2015). Early school leaving in Scandinavia. *Journal of European Social Policy*, *25*(3), 253–269.

Beicht, U., & Ulrich, G. J. (2008). *Welche Jugendlichen bleiben ohne Berufsausbildung* (BIBB Report, Vol. 06/08).

Beicht, U., & Walden, G. (2013). *Duale Berufsausbildung ohne Abschluss* (BIBB Report, Vol. 21/13).

BIBB (2020). Datenreport zum Berufsbildungsbericht 2020. Bonn: BIBB. https://www.bibb.de/dokumente/pdf/bibb_datenreport_2020.pdf. Accessed 18. April 2023.

Blossfeld, H. P., & Roßbach, H. G. (2019). *Education as a lifelong process—the German National Educational Panel Study (NEPS)* (Edition ZfE, Vol. 3). Wiesbaden: Springer VS.

Boockmann, B., Dengler, C., Nielen, S., Seidel, K., & Verbeek, H. (2014). *Ursachen für die vorzeitige Auflösung von Ausbildungsverträgen in Baden-Württemberg*. Tübingen: IAW.

Bradley, S., & Lenton, P. (2007). Dropping out of post-compulsory education in the UK. *Journal of Population Economics*, *20*, 299–328.

Brandtstädter, J., & Renner, G. (1990). Tenacious goal pursuit and flexible goal adjustment. *Psychology and Aging*, *5*, 58–67.

von Collani, G., & Herzberg, P. Y. (2003). Eine revidierte Fassung der deutschsprachigen Skala zum Selbstwertgefühl von Rosenberg. *Zeitschrift für Differentielle und Diagnostische Psychologie*, *24*, 3–7.

Cunha, F., & Heckman, J. J. (2008). Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. *Journal of Human Resources*, *43*, 738–782.

Duchhardt, C., & Gerdes, A. (2013). *NEPS technical report for mathematics—Scaling results of starting cohort 4 in ninth grade* (NEPS working paper, Vol. 22). Bamberg: LIfBi.

Ebbinghaus, M., & Krewerth, A. (2014). Ausbildungsqualität und Zufriedenheit – Analysen aus Sicht von Betrieben und Auszubildenden in Deutschland. In M. Fischer (Ed.), *Qualität in der Berufsausbildung* (pp. 77–96). Bielefeld: wbv.

Eccles, J., & Wigfield, A. (2002). Motivational beliefs, values and goals. *Annual Review of Psychology*, *53*, 109–132.

Eegdeman, I., Meeter, M., & Van Klaveren, C. (2018). Cognitive skills, personality traits and dropout in Dutch vocational education. *Empirical Research in Vocational Education and Training*, *10*(11), 1–18.

Gehrer, K., Zimmermann, S., Artelt, C., & Weinert, S. (2012). *The assessment of reading competence (including sample items for grade 5 and 9)*. Bamberg: University of Bamberg, NEPS.

Goodman, R. (1997). The strengths and difficulties questionnaire. *Journal of Child Psychology and Psychiatry*, *38*, 581–586.

Gubbels, J., van der Put, C. E., & Assink, M. (2019). Risk factors for school absenteeism and dropout. *Journal of Youth Adolescence*, *48*, 1637–1667.

Gutman, L. M., & Schoon, I. (2016). A synthesis of causal evidence linking non-cognitive skills to later outcomes for children and adolescents. In M. S. Khine & S. Areepattamannil (Eds.), *Non-cognitive skills and factors in educational attainment* (pp. 171–198). Leiden: Brill.

Holtmann, A. C., Menze, L., & Solga, H. (2017). Persistent disadvantages or new opportunities? The role of agency and structural constraints for low-achieving adolescents' school-to-work transitions. *Journal of Youth and Adolescence*, *46*, 2091–2113.

Holtmann, A. C., Ehlert, M., Menze, L., & Solga, H. (2021). Improving formal qualifications or firm linkages—what supports successful school-to-work transitions among low-achieving school leavers in Germany? *European Sociological Review*, *37*, 218–237.

Jäppinen, A.-K. (2009). Get a vocation: keeping on top of studies. *European Journal of Vocational Training*, *47*, 28–49.

Kohlrausch, B., & Solga, H. (2012). Übergänge in die Ausbildung: Welche Rolle spielt die ‚Ausbildungsreife'? *Zeitschrift für Erziehungswissenschaft*, *15*(4), 753–773.

Kotte, V. (2018). „Durchläufer" und „Drop-Outs". (Dis-)Kontinuitäten von Ausbildungsverläufen im dualen System. *Zeitschrift für Pädagogik*, *64*(4), 441–460.

Kropp, P., Danek, S., Purz, S., Dietrich, I., & Fritzsche, B. (2014). *Die vorzeitige Lösung von Ausbildungsverträgen* (IAB-Forschungsbericht, Vol. 13/2014).

Krötz, M., & Deutscher, V. (2021). Differences in perception matter—How differences in the perception of training quality of trainees and trainers affect drop-out in VET. *Vocations and Learning*, *14*(3), 369–409.

Laporte, C., & Mueller, R. (2013). The completion behaviour of registered apprentices in Canada. *Empirical Research in Vocational Education and Training*, *5*(1), 1–30.

Lechner, C., Anger, S., & Rammstedt, B. (2019). Socioemotional skills in education and beyond. In R. Becker (Ed.), *Research handbook on sociology of education* (pp. 427–453). Cheltenham: Elgar.

Leuze, K., Ludwig-Mayerhofer, W., & Solga, H. (2011). The German National Educational panel study: a wealth of potential for research in school-to-work transitions. *Longitudinal and Life Course Studies*, *2*(3), 346–355.

Martsch, M., & Thiele, P. (2017). Ausbildungszufriedenheit und Vertragsauflösungen als regionaler Spiegel betrieblicher Ausbildungsqualität. BWP@ (Berufs- und wirtschaftspädagogik-Online) 32. http://www.bwpat.de/ausgabe32/martsch_thiele_bwpat32.pdf. Accessed 18. April 2023.

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality*, *2*, 175–215.

Menze, L., & Holtmann, A. C. (2019). Was können Schulabgängerinnen und Schulabgänger ohne Mittleren Schulabschluss aus Übergangsmaßnahmen mitnehmen? *Zeitschrift für Erziehungswissenschaft*, *22*(3), 509–533.

Michaelis, C., & Richter, M. (2022). Discontinuities in vocational education and training. *Empirical Research in Vocational Education and Training*, *14*, article no. 7.

National Education Report (2014). *Bildung in Deutschland 2014*. Bielefeld: wbv.

National Education Report (2016). *Bildung in Deutschland 2016*. Bielefeld: wbv.

National Education Report (2022). *Bildung in Deutschland 2022*. Bielefeld: wbv.

Negrini, L., Forsblom, L., Schumann, S., & Gurtner, J.-L. (2015). Lehrvertragsauflösungen und die Rolle der betrieblichen Ausbildungsqualität. In K. Hafeli, M. Neuenschwander & S. Schumann (Eds.), *Berufliche Passagen im Lebenslauf* (pp. 77–99). Wiesbaden: Springer.

Nießen, D., Danner, D., Spengler, M., & Lechner, C. M. (2020). Big five personality traits predict successful transitions from school to vocational education and training. *Frontiers in Psychology*, *11*, article no. 1827.

Protsch, P., & Solga, H. (2016). The social stratification of the German VET system. *Journal of Education and Work*, *29*(2), 637–661.

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less. *Journal of Research in Personality*, *41*, 203–212.

Rohrbach-Schmidt, D., & Uhly, A. (2015). Determinanten vorzeitiger Lösungen von Ausbildungsverträgen und berufliche Segmentierung im dualen System. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, *67*(1), 105–135.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Rumberger, R. W. (1987). High school dropouts: a review of issues and evidence. *Review of Educational Research*, *57*(2), 101–121.

Rumberger, R. W., & Lim, S. A. (2008). *Why students drop out of school: a review of 25 years of research* (California dropout research project, policy brief, Vol. 15). Santa Barbara: UC.

Schmid, E., & Stalder, B. E. (2012). Dropping out from apprenticeship training as an opportunity for change. In P. Tynjälä, M.-L. Stenström & M. Saarnivaara (Eds.), *Transitions and Transformations in Learning and Education* (pp. 117–130). Dordrecht: Springer.

Schöngen, K. (2003). Ausbildungsvertrag gelöst = Ausbildung abgebrochen? *BWP*, *5/2003*, 35–39.

Shapley, L. S. (1953). Stochastic games. *Proceedings of the National Academy of Sciences*, *39*(10), 1095–1100.

Shorrocks, A. F. (2013). Decomposition procedures for distributional analysis: a unified framework based on the Shapley value. *Journal of Economic Inequality*, *11*(1), 99–126.

Solga, H., & Konietzka, D. (1999). Occupational matching and social stratification. *European Sociological Review*, *15*, 25–47.

Steinhauer, H. W., & Zinn, S. (2016). *NEPS technical report for weighting: weighting the sample of starting cohort 4 of the national educational panel study (wave 1 to 6)* (NEPS Survey Paper No. 2).

Stromback, T., & Mahendran, A. (2010). An analysis of factors contributing to apprenticeship and traineeship completion. *International Journal of Training Research*, *8*, 63–79.

Tinto, V. (1975). Dropout from higher education. *Review of Educational Research*, *45*(1), 89–125.

Tinto, V. (1988). Stages of student departure. *The Journal of Higher Education*, *59*(4), 438–455.

Uhly, A. (2015). *Vorzeitige Vertragslösungen und Ausbildungsverlauf in der dualen Berufsausbildung* (Wissenschaftliche Diskussionspapiere, Vol. 157). Bonn: BIBB.

Volodina, A., Nagy, G., & Köller, O. (2015). Success in the first phase of the vocational career: The role of cognitive and scholastic abilities, personality factors, and vocational interests. *Journal of Vocational Behavior*, *91*(1), 11–22.

Weißeno, S., Seeber, S., Kosanke, J., & Stange, C. (2016). Development of mathematical competency in different pre-vocational training programmes of the transition system. *Empirical Research in Vocational Education and Training*, *8*(14), 1–18.

White, I. R., Royston, P., & Wood, A. M. (2011). Multiple imputation using chained equations. *Statistics in Medicine*, *30*(4), 377–399.

Woll, C., Prüstel, S., & Linten, M. (2015). *Vorzeitige Lösung von Ausbildungsverträgen. Zusammenstellung aus Literaturdatenbank Berufliche Bildung, Version: 2.0*. Bonn: BIBB.

Wydra-Somaggio, G. (2021). Early termination of vocational training: dropout or stopout? *Empirical Research in Vocational Education and Training*, *13*(5), 1–23.