



When do prevocational programs ease the transition to vocational education and training?

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Abstract

Preparing youth for the transition from school to work is a key labor market challenge in many countries. Across Europe, there are many educational programs to improve youth's school-to-work transitions. In Germany, youth with difficulties in their school-to-work transitions are channeled into prevocational programs to help them to enter vocational education and training (VET), which serve as an entry into the labor market. Using data drawn from the National Educational Panel Study (NEPS; $N=1,282$ participants of prevocational programs), we (1) examined youth's transition trajectories after their attendance of a first prevocational program and (2) how using institutional resources such as internships during the first prevocational program supports youth's transitions to VET. Our findings of sequence and cluster analysis showed that approximately two-thirds of the participants had largely stable transitions to VET (i.e., transitions with a low risk of dropout), although many of these transitions were delayed by one year after leaving their first prevocational program. In contrast, one-third of the participants had at-risk transition trajectories and were at risk of being permanently excluded from the education and employment system. By conducting a multinomial logistic regression, we also found that attending long internships and attaining a higher school certificate during the first prevocational program was associated with a smooth transition to VET programs, and both factors "protected" youth from encountering difficult pathways with very low prospects of reaching VET programs after leaving prevocational programs. Moreover, mentoring during prevocational programs and the perceived degree to which the programs helped youth to form occupational aspirations were also associated with a lower probability of facing at-risk transition trajectories.

Keywords School-to-work transition · Transition sector · Prevocational programs · Vocational orientation · Mentoring · Internships · School certificates

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Introduction

The transition from school to working life is of particular importance not only for integration into the labor market, but also for overall life opportunities and health (Koen et al., 2012; Reuter et al., 2022). However, many countries in Europe struggle with the labor market integration of youth with low educational attainment. These youth are at high risk regarding their school-to-work transitions (Europe: Pastore et al., 2021; Germany: Achatz et al., 2022) and struggle to reach viable educational options at the upper-secondary level, such as vocational education and training (VET) or upper-secondary school tracks (Busse, 2020; Holtmann et al., 2017, 2021). They are also particularly vulnerable, given the relevance of qualifications in modern labor markets. For example, youth with low educational attainment face a high risk of being neither employed nor in formal education or training (NEET) (OECD, 2022).

Across Europe, there are many educational programs to improve youth's school-to-work transitions and employment opportunities. While some studies show that such educational programs have modest effects on subsequent employment prospects (England: Blundell et al., 2004; Dorsett & Stokes, 2022; Germany: Ehlert et al., 2012; Holtmann et al., 2021; Sweden: van den Berg & Vikström, 2022; international overview: Attanasio et al., 2017), the findings of existing meta-analyses are less optimistic and point to small treatment effects (Card et al., 2010; Kluve, 2010; Kluve et al., 2019). Moreover, the effect of such educational programs largely depends on the programs' features, such as the design and provided services (Kluve et al., 2019).

In Germany, youth with difficulties in the transition to upper-secondary education are channeled into prevocational programs of the vocational transition sector. The aim of these programs is to prevent youth from unemployment by helping them to enter VET, which serve as an entry into the labor market (Holtmann et al., 2021). The vocational transition sector provides a considerable number of prevocational programs¹ to support vulnerable youth and ease their school-to-work transitions (Achatz et al., 2022; Protsch & Solga, 2016). For this purpose, prevocational programs provide youth with different resources: during prevocational programs youth may invest in school certificates, attend internships, refine their occupational aspirations and/or receive support by mentors (Seeber et al., 2019). From the theoretical perspective of resource models (Eberhard, 2012), youth's transition from school to VET depend, among other factors, on whether they (can) access such institutional resources. In the context of educational transitions, we understand institutional resources as opportunities or initiatives available within educational institutions to enhance youth's transition process (ibid.). Institutional resources for school-to-work transitions provided in the school have the potential to leverage the preparation for the transition to the labor market (Kluve et al., 2019; Vermeire et al., 2022). However, research on the effects of prevocational programs in Germany is both scarce and inconclusive. Some research findings indicate positive effects of prevocational

¹ Throughout the article, we use the term "prevocational programs" which in the international context can be seen as educational programs for youth or bridge courses between school and work.

programs, such as a positive influence on participants' chances of VET access through the improvement of school certificates or spending time in companies that are most beneficial for the most disadvantaged youth (Holtmann et al., 2021; Kübler et al., 2019). In contrast, other studies found that prevocational programs have no effects on VET access (Rahn et al., 2017).

Focusing on the context of Germany, the aim of our study is to investigate youth's educational transitions after attending a first prevocational program. Drawing on longitudinal data from the German National Panel Study (NEPS), our study sheds light on the transition from a first prevocational program to subsequent educational options. It aims to answer two research questions: (1) what patterns emerge in the educational transitions of youth who leave their first prevocational program? And (2) how is the use of institutional resources during youth's first prevocational program associated with their subsequent educational transitions? By answering these questions, we contribute to the literature in several ways. *First*, the existing research on the effects of German prevocational programs has predominantly focused on single transition events (i.e., the transition to VET). In contrast, research on transition trajectories allows to cover a wide range of educational transitions (Achatz et al., 2022). Following this approach, we investigate the longitudinal patterns of youth's educational transitions after prevocational programs in Germany – an institutional stage of youths' school-to-work transitions also relevant in other countries (e.g., OECD, 2016; Sacchi & Meyer, 2016; Stalder et al., 2024). *Second*, research on how prevocational programs in Germany prepare youth for the subsequent educational transitions is limited. Our study provides insights into the degree to which youth use institutional resources during prevocational programs and how using them promotes their educational transitions after leaving a prevocational program. As the German VET largely functions like a labor market and serves as an entry into the labor market (Protsch & Solga, 2016), our study offers practical implications beyond the German context regarding what helps to prepare youth for their transition from school to work.

Prevocational Programs in the German VET System

At the end of lower-secondary education, students in Germany can continue general schooling and access upper-secondary general school tracks (provided they fulfill the admission criteria) or leave the general school system. For young people who do not move on to upper-secondary general schools, participation in one of the various VET programs at upper-secondary level is one of the most dominant pathways (Cedefop, 2020). The German VET system offers company-based VET which combines on-site training in companies and classes at vocational schools as well as school-based VET at vocational schools, predominant in service activities in the administrative sector, in technical laboratories and in the health, education, and social sectors (Cedefop, 2020). At the end of both, students can achieve an occupation-specific vocational qualification (at EQF level 3–4 and ISCED level 3; Cedefop, 2020), representing a crucial prerequisite for skilled employment in Germany (Brzinsky-Fay & Solga, 2016; Protsch & Solga, 2016). Thus, VET as one option of

upper-secondary education is assigned a high priority to foster integration into the labor market (Cedefop, 2020).

However, at the end of lower-secondary education many youths are not able to reach any of the various educational or vocational options of German upper-secondary education. Those students who are unable to enter upper-secondary education in Germany usually switch to prevocational programs of the transition sector (Holtmann et al., 2017, 2021). Since compulsory schooling lasts until at least age 18 (Solga et al., 2014), a direct entrance to the labor market for these young people is only rarely an option. Thus, participating in prevocational programs is often not so much a matter of ‘choice’ as most participants of prevocational programs are still of compulsory school age (Holtmann et al., 2021). Between 2011 and 2012, the focal starting years of this study, approximately 270,000 young people entered prevocational programs, compared to about 725,000 young people entering VET at the upper-secondary level and about 499,000 young people entering upper-secondary general school tracks (Federal Statistical Office, 2022, own calculations). Most of the young people who enter prevocational programs have no school certificate (26%) or a lower-secondary school certificate (46%), while approximately 26% have an intermediate school certificate (ibid., own calculations). Thus, most of program participants can be described as school leavers with low educational attainment (Holtmann et al., 2021).

Despite the heterogeneous configurations of prevocational programs, their main aim is to ease the school-to-work transition and to avoid early unemployment by helping school leavers to enter VET (Achatz et al., 2022; Euler & Nickolaus, 2018; Kupfer, 2010). Thus, prevocational programs are largely meant as bridges into VET. However, prevocational programs neither lead to a recognized vocational qualification nor guarantee the transition to company or school-based VET (Protsch & Solga, 2016).

Given the diversity of prevocational programs in terms of structure, content, duration, and governing actors, the landscape of German prevocational programs is difficult to systematize. The majority (81%) of the prevocational programs within the transition sector are provided by vocational schools (National Education Report, 2020). As the federal states are responsible for these programs, in each of the sixteen federal states there are different types of prevocational programs with differing designs. Most of the prevocational programs offered at vocational schools are one-year courses (usually full-time) that prepare the participants for the demands of VET by providing a wide range of opportunities such as vocational orientation, application writing support or the opportunity to acquire a lower-secondary school certificate (ibid.). Two-year courses are also available and often allow for the acquisition of intermediate-secondary school certificates in the second course year (ibid.). Only a small share (19%) of the prevocational programs is provided by the German Federal Agency of Employment. These programs comprise training courses for young people who are no longer of compulsory school age (National Education Report, 2020).

After completing a first prevocational program, youth face different educational options. They can switch to (1) company- or school-based VET, (2) enter upper-secondary general school tracks of general or vocational schools or (3) even attend

another prevocational program. If they have completed the compulsory school age, they can also directly switch to the labor market or enter unemployment. However, access to the educational options after leaving prevocational programs is structured by school certificates (Solga et al., 2014). For example, companies alone decide whether and to whom they offer a training place based on their own selection criteria, which are mainly focused on applicants' school certificates as they represent productivity signals for employers (see Sect. "[The Role of Institutional Resources for the Transition to VET](#)" for details). In contrast, there are admission requirements for school-based VET and upper-secondary school tracks. Access to upper-secondary school tracks requires intermediate school certificates. For most school-based VET programs, an intermediate secondary school certificate is required as well (Seeber et al., 2019).

Theory and State of Research

Transition Trajectories after Prevocational Programs

Broader definitions of transitions from school to work acknowledge the role of education in the preparation for the school-to-work transition (Vermeire et al., 2022). In Germany, the transition from school to work is particularly determined by the highly stratified and standardized system of VET (see Sect. "[Prevocational Programs in the German VET System](#)") and its established VET programs, "their availability and their duration and regulations regarding access and content" (Achatz & Schels, 2023, p. 320). Thus, in Germany, normative ideas about the ideal-typical transition from school to work are particularly determined by the predominant role of VET programs (Heinz, 1999). Therefore, this study focuses especially on the access to VET programs (i.e., the preparation phase of the school-to-work transition).

Analyses of educational transitions need to consider the transition trajectory covering at the same time the type of educational track individuals attend, the timing at which different transitions occur, and the sequence of events within one's educational transition trajectory (Milesi, 2010). Given the complexity and dynamics of transitions from school to VET (e.g., Busse, 2020), we conceptualize educational transitions as an individual process rather than a punctual event. The educational transition can imply a smooth transition or be a turbulent phase with various attempts to establish oneself in the educational system (i.e., moving in and out of education and training; Schoon & Heckhausen, 2019). Individuals' educational transitions are many-faceted, do not necessarily follow linear patterns, may deviate from the pre-structured routes of the system of VET and can result in trajectories with multiple transitions (Achatz et al., 2022; Busse, 2020; Dorsett & Luchino, 2014).

We expect to find differences within youth's transition trajectories regarding (1) the educational track they switch to, (2) the time they need to enter the respective track after leaving the prevocational program as well the (3) the stability of the respective transition (i.e., probability of dropout). Based on previous research (Achatz et al., 2022; Achatz & Schels, 2023; Busse, 2020; Michaelis et al., 2022)

and the configuration of the German VET system, we expect to find different patterns in youth's educational transitions at the end of prevocational programs. Previous research indicates that approximately half of the participants enter VET directly after completing their first prevocational program (Achatz et al., 2022; Achatz & Schels, 2023; Busse, 2020; Michaelis et al., 2022). Therefore, we assume to find one pattern with direct and stable transitions to company- or school-based VET programs after youth leave their first prevocational program (*Hypothesis 1a*). In addition, we assume that there are other patterns with youth who face difficulties at the entrance to VET programs in terms of delays or discontinuities as research points to the prevalence of problematic transition patterns among participants of prevocational programs (e.g., Achatz et al., 2022; Achatz & Schels, 2023; Michaelis et al., 2022): We expect to find a pattern with individuals who experience “waiting loops” in the vocational transition sector in that they attend other prevocational programs after leaving their first prevocational program (*Hypothesis 1b*). As outlined in Sect. “Prevocational Programs in the German VET System”, often youth attend more than one prevocational program. Following previous research (e.g., Achatz et al., 2022), we hypothesize that there is a group with at-risk trajectories characterized by turbulences with various attempts to establish oneself in the educational system (i.e., they move in and out of education and training) leading to detachments from the educational landscape (i.e., unskilled employment or unemployment) (*Hypothesis 1c*).

The Role of Institutional Resources for the Transition to VET

Previous research has identified two main sources of individual differences in transitions from school to VET: (1) individuals' self-selection (i.e., individuals' occupational aspirations and choices; see, e.g., Busse, 2020; Nießen et al., 2022; Tomasik et al., 2009) and (2) opportunities and constraints due to selection processes and criteria by gatekeepers (i.e., schools and companies; Granato & Ulrich, 2014; Ludwig-Mayerhofer et al., 2019; Schoon & Heckhausen, 2019). Both mechanisms require different theoretical perspectives. According to the social cognitive career theory (Lent et al., 2002), individuals' self-selection processes (i.e., the goals individuals set for themselves and pursue; Nießen et al., 2022) can be seen as the result of learning experiences. Selection processes and criteria by gatekeepers refer to “characteristics and behaviors of students that influence employers' perceptions of their aptitude, and thus employers' decision whether to offer students a VET position” (Nießen et al., 2022, p. 2). In this regard, the signaling theory (Spence, 1973) suggests that employers' hiring decisions are made under uncertainty since the productivity of potential trainees is unknown. Due to the “signaling power of education” (ibid., p. 356), employers use school certificates and grades as market signals to estimate applicants' expected productivity (Spence, 1974). In addition, other directly or indirectly visible individual characteristics are used in the selection process as potential information about the expected productivity of applicants (e.g., cognitive and noncognitive skills; see Humburg & van der Velden, 2015; Protsch, 2021). Individuals' self-selection and gatekeepers' selection processes are, in turn, shaped by

the social (Busse, 2020; Glauser & Becker, 2023) and regional context (Glauser & Becker, 2016) in which individuals are embedded.

Following the resource theory (Eberhard, 2012), we argue that, in addition, the institutional opportunity structure within educational institutions (e.g., vocational schools) is important for individuals' transition from school to VET (see also Holtmann et al., 2021; Kluve et al., 2019; Menze & Holtmann, 2019; Solga & Kohlrusch, 2013). We propose that prevocational programs offer institutional resources (i.e., opportunities within educational institutions to ease school-to-work transitions) that may promote youths' productivity signals through human capital development (Spence, 1973) and their decision-making through learning experiences (Lent et al., 2002). We argue that there are four main resources German prevocational programs provide to improve participants' subsequent educational transitions (for an overview: Euler & Nickolaus, 2018; Seeber et al., 2019): One resource is to offer participants the opportunity to acquire a first or higher school certificate. A second resource is to offer direct linkages to companies through the integration of internships in the prevocational program. A third resource focuses on refining vocational orientation (e.g., the identification of occupational aspirations), while a fourth resource is to provide additional support by mentors. The influence of these institutional resources encompasses not only whether offerings are available, but also individuals' capacity to use them for their careers after prevocational programs. In accordance with the notion of contextual influences (Lent et al., 2002, p. 274–275), this perspective does not diminish the relevance of the institutional opportunity structure; rather, it emphasizes the individual's active role in making meaning from the offerings of educational programs. We focus on how using institutional resources within the prevocational programs improves youth's prospects to enter VET programs or other educational options available at the end of prevocational programs.

Taken together, our framework bridges distinct theoretical approaches to examine the role of institutional resources in the process of educational transitions. We argue that an integrative model of educational transitions is necessary that accounts not only for mechanisms of individuals' self-selection and gatekeepers' selection processes as well as social and regional contexts, but also for the influence of institutional resources provided in educational contexts. Yet, no theory of school-to-work transition or career development focuses explicitly on institutional resources while incorporating the previously mentioned mechanisms. Nevertheless, various theoretical perspectives and related empirical findings suggest that institutional resources provided in prevocational programs contribute to individual' educational transitions as they may positively influence (1) individuals' decision making, (2) individuals' productivity signals and/or (3) reduce eventual constraints by gatekeepers' selection processes (e.g., by employers).

Attaining (Higher) School Certificates

One way to improve participants prospects to access VET programs “is to give participants the opportunity to attain a higher school certificate” (Holtmann et al., 2021, p. 221) as access is largely structured by school certificates (Protsch & Solga, 2016). On the one hand, there are formal admission requirements for school-based VET

programs or upper-secondary school tracks (see Sect. "[Prevocational Programs in the German VET System](#)"). Thus, attaining a higher school certificate can widen one's own field of accessible educational options at the upper-secondary level. On the other hand, access to company-based VET largely depends on employers' selection criteria (Protsch & Solga, 2015). Regarding access to company-based VET, applicants' school certificates represent important signals of productivity for VET employers (Fossati et al., 2020; Schuchart & Schimke, 2024). From the perspective of the job competition model (Thurow, 1979) and signaling theory (Spence, 1973), it can be assumed that VET employers rank applicants by their expected productivity on a scale from best to worst. To estimate the suitability of applicants, companies use information on applicants' school certificates as selection criteria (Protsch & Solga, 2015). Thus, applicants with low school certificates might be ranked lower or screened out entirely from the applicant pool—leading to lower probabilities of being selected for a VET position (Holtmann et al., 2017). Following this assumption, attaining a higher school certificate should not only improve one's chances of getting a training place, but also the time it takes to search and apply for a training place, given the expected higher rank in the application pool. Studies reveal that the higher the applicants' level of school certificates, the more likely they are to enter company-based VET (e.g., Fossati et al., 2020) and the less likely they are to experience delays in being selected for company-based VET compared to those with lower or no school certificates (Protsch & Dieckhoff, 2011; Michaelis et al., 2022). Furthermore, school certificates are an important individual characteristic in studies of dropout from upper-secondary education (Holtmann & Solga, 2023). Several studies found higher rates of VET dropout for trainees with lower school certificates as school certificates may be a proxy of whether trainees can meet cognitive training requirements (Aarkrog et al., 2018; Gubbels et al., 2019; Holtmann & Solga, 2023). In sum, we assume that attaining a higher school certificate during prevocational programs affects participants' transition trajectories in several ways.

Hypothesis 2: Attaining a higher school certificate during prevocational programs is associated with a higher probability of directly entering VET programs and with a lower probability of experiencing at-risk trajectories characterized by discontinuities.

Attending Long Internships

During prevocational programs, internships in companies provide another important resource for individuals' subsequent transition trajectory as they may improve their productivity signals. The signaling theory (Spence, 1973) suggests that VET employers' hiring decisions are made under uncertainty since the productivity of potential trainees is unknown. Youth may use internships to signal productivity or to improve productivity signals through different channels. First, during an internship, youth can show their skills, motivation, and commitment, thereby offering the company a different impression such as a CV or school certificate might (Holtmann et al., 2021; Solga & Kohlrausch, 2013). Internships may, thus, counteract negative productivity signals due to low or no school certificates (Holtmann et al., 2021). Second, internships offer

youth information about specific occupations and companies and provide vocational orientation (Erban, 2010; Ebner et al., 2021; Seeber et al., 2019), which can potentially signal employability (Jerez Gomez et al., 2023). Research shows that if internships help youth to improve their vocational orientation, they significantly increase youth's probability of entering company-based VET programs after leaving prevocational programs (Méliani et al., 2019). Third, internships enable and encourage workplace learning and, thus, the development of vocational and professional skills (Virtanen et al., 2009). Taken together, through these outlined mechanisms internships are expected to improve youth's productivity signals and thereby facilitate opportunities to access company-based VET.

These benefits, however, are influenced by several aspects of the internship, with duration being a key factor (Jerez Gomez et al., 2023). From the perspective of the signaling theory (Spence, 1973), the longer the duration of the internship, the more opportunities youth have to signal productivity or to improve productivity signals during their internship by accumulating vocational and professional skills (e.g., O'Higgins & Pinedo Caro, 2021) or by clarifying, solidifying and showing their interest in a specific occupation (e.g., Varghese et al., 2012). In line with these assumptions, various studies suggest that the integration of long practical phases in the prevocational program positively influences young people's chances to get a training place (Holtmann et al., 2021; Menze & Holtmann, 2019; Solga & Kohlrausch, 2013). Research also shows that increasing the duration of the internship period helps individuals find a job in a shorter time (Alp et al., 2023).

Hypothesis 3 Attending a long internship during prevocational programs is associated with a higher probability of directly entering company-based VET programs and with a lower probability of experiencing at-risk trajectories characterized by discontinuities.

Identifying Occupational Aspirations

In strong VET systems, such as in Germany, youth form occupational aspirations within the constraints and opportunities of the segmented and largely market-based VET system (Protsch & Solga, 2016). Uncertainty in occupational aspirations is one of the main reasons why individuals participate in prevocational programs after school (Holtmann et al., 2017; Kamm et al., 2020). Beyond the German context, empirical evidence suggests that there is a small but substantial share of youth who express uncertain occupational aspirations (Gutman & Schoon, 2012). To assist youth in the development of occupational aspirations, prevocational programs and their diverse measures of vocational orientation are considered to be important (Kamm & Gebhardt, 2019). Yet, there is no empirical evidence regarding the effects of vocational orientation provided during prevocational programs. However, the importance of finding an occupation one is interested in, is reflected in many studies: Research has revealed that not only the transition to upper-secondary education such as VET (Holtmann et al., 2017) but also the completion of VET programs (Michaelis & Richter, 2022) is associated with individuals' occupational aspirations. Those students with certain occupational aspirations are more likely to apply for

a training place and to enter VET programs (Holtmann et al., 2017). In addition, research shows that young people's occupational aspirations might not always be realistic and attainable (Mann et al., 2020) and that unmet occupational aspirations when entering VET can lead to VET dropout (Holtmann & Solga, 2023). Taken together, we assume that helping youth refining their occupational aspirations during prevocational programs is associated with participants' subsequent educational transitions.

Hypothesis 4 The degree to which the prevocational program helps participants to identify their occupational aspirations is associated with a higher probability to enter VET programs and with a lower probability to experience at-risk trajectories characterized by discontinuities.

Receiving Support by a Mentor

Mentoring has been found to have a positive effect on educational and occupational attainment – especially for youth at risk (Caliendo & Schmidl, 2016; DuBois et al., 2002, 2011; Eby et al., 2013; Friiht & Wray-Lake, 2013; Kraft et al., 2023; Rhodes et al., 2000). In many countries, mentoring is part of the repertoire of vocational orientation techniques with the aim of reducing career uncertainty through several development efforts that “expand a person's skills, experience, perspectives, and network, all of which increases the chances of being the right person for the right job at the right time when such opportunities arise” (Berman & Berman, 2012, p. 194). From the theoretical perspective of the signaling theory (Spence, 1973), mentoring may enhance youths' productivity signals (Kraft et al., 2023), as mentors may support their socio-emotional, cognitive, and identity development, as proposed in Rhodes' (2005) youth mentoring model. These benefits of mentoring have been supported by previous research (Miranda-Chan et al., 2016; Rhodes, 2005).

Mentoring does not necessarily have to be formalized to unfold effects. Individual teachers may act as mentors as they have a positive impact on students' achievement or socio-emotional development (McDonald et al., 2007). Another professional group supporting youth in the transition sector in Germany is school social workers (Erban, 2010). However, there is only small evidence regarding the influence of mentoring on youth's educational transition. For young adults in the US, Friiht and Wray-Lake (2013) report that having a teacher-mentor predicted young adults' educational transition after high school. For Germany, Erban (2010) shows that mentors help students find a VET position. More rigorous findings are provided by a recent field experiment in Germany: Resnjanskij et al. (2024) report that mentoring significantly increased lower-secondary school students' probability to enter VET programs compared to those students who did not receive mentoring. Findings from a meta-analysis reveal that mentoring also seems to be associated with the stability of transitions to VET as Böhn and Deutscher (2021) find a negative correlation between mentoring and trainees' intention to terminate the training contract prematurely. In sum, we assume that receiving support by a mentor (e.g., teacher, school social worker) is associated with youth's educational transitions after leaving prevocational programs.

Hypothesis 5 Receiving support by a mentor during the prevocational program is associated with a higher probability to enter VET programs and with a lower probability to experience at-risk trajectories characterized by discontinuities.

Methods

Data and Sample

To test our hypotheses, the Starting Cohort 4 (<https://doi.org/10.5157/NEPS:SC4:12.0.0>) of the German National Educational Panel Study (NEPS) (NEPS Network, 2021) is used for the empirical analyses.² This NEPS cohort is a representative sample of students who attended grade 9 in German secondary schools. The sample design followed a stratified two-stage sampling strategy, sampling first schools and then classes within schools (Steinhauer & Zinn, 2016). The first survey of the NEPS-SC4 cohort was conducted in autumn 2010 with an initial sample of 16,425 ninth-grade students. Since the first survey in autumn 2010, the respondents were surveyed once or twice each year. The surveys took place in the classroom context if they were still in the general school system. After leaving general school, the respondents were surveyed individually.

The NEPS-SC4 cohort is particularly suitable for our study since it allows to assess the educational and vocational paths youth choose after general school education. In addition, this substudy oversampled students from lower-secondary schools as well as special-needs schools (Steinhauer & Zinn, 2016). This is important for our study, as these students are likely to switch to prevocational programs after general school education (see Sect. "Prevocational Programs in the German VET System").

Our analyses refer to youth who attended general school until grade 9 or 10 and then directly switched to prevocational programs after leaving general school, as prevocational programs mainly address this group of students. For the purpose of our analyses (see Sect. "Institutional Resources Supporting Transitions after the First Prevocational Program"), respondents for whom no information on their activity was available for more than nine months after leaving their first prevocational program were excluded from the dataset as longer episodes with missing information would affect the quality of the sequence analysis (Dlouhy & Biemann, 2015). Furthermore, respondents for whom no information on their school certificate was available were also excluded. These sample restrictions left a subsample of 1,282 young adults who were born between 1990 and 1996. They entered their first prevocational program between 2010 and 2013 (3.8% in 2010, 45.2% in 2011, 46.4% in 2012, and 4.6% in 2013) after leaving the general school system and participated in their first prevocational program on average for 13 months ($SD=8.3$).

The respondents were on average 16 years old ($SD=0.9$) at the time they entered their first prevocational program. The majority of the respondents (50.2%)

² This paper uses data from the National Educational Panel Study (NEPS; see Blossfeld & Roßbach, 2019). The NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi, Germany) in cooperation with a nationwide network.

participated in prevocational programs provided by vocational schools: 22.6% participated in a prevocational training year (*Berufsvorbereitungsjahr*), 6.9% in a basic vocational training (*Berufsgrundbildungsjahr*), and 20.7% in one or two-year courses in full-time vocational schools (*Berufsfachschule*) leading to a lower or intermediate secondary-school certificate. Another important share of the respondents (18.7%) attended a course provided by the Federal Employment Agency (e.g., an introductory training “*Einstiegsqualifizierung*”). The majority of the respondents can be defined as youth with a low educational attainment: While 21.1% of the sample entered their first prevocational program without a school certificate, 58.8% had a lower-secondary school certificate (including those students with an extended lower-secondary school certificate), and 20.1% had an intermediate-secondary school certificate. In addition, there is a lower share of females (45.9%) than males (54.1%) among the participants since males are often found to be overrepresented among youth with low educational attainment (Holtmann et al., 2017). These distributions largely correspond to official statistics (National Education Report, 2014).

Measures

The Use of Institutional Resources during the First Prevocational Program

The main independent variables are operationalized by four indicators based on youth’s self-reported information. At the individual-level, the indicators assess the resources participants used during the first prevocational program. However, the NEPS data do not provide information about the opportunities offered at institutional level. Data collection on these indicators took place towards the end of the first prevocational program.³ All indicators are measured with single items as the NEPS data do not provide scales on the main constructs of our paper. However, most of the items used have shown to be associated with individuals’ transition to VET (Holtmann et al., 2021; Menze & Holtmann, 2019).

- (1) *Improved school certificate during prevocational program*: To estimate the effects of attaining a higher school certificate, this indicator captures whether the respondents achieved a first or higher school certificate during the first prevocational program (coded as 0 = *no*, 1 = *yes*).
- (2) *Attended a long internship during prevocational program*: Following Holtmann et al. (2021), we use respondents’ self-reported information on how much time they spent in internships during their whole prevocational program (item: “*For how many weeks were you in this internship?*”) to identify the strength of company linkages during the first prevocational program. If respondents reported having spent at least half of the time of their prevocational program in an internship, we define this as a long internship (coded as 0 = *no*, 1 = *yes*).

³ Information on focal measures was collected approximately seven months ($SD=7$) before prevocational programs ended.

- (3) *Perceived prevocational program useful for identifying occupational aspirations*: In addition, we include how well the respective first prevocational program helped respondents to find an occupation they were interested in (item: “How well does vocational preparation help you to find a job that interests you?”; coded as 1 = not helpful at all, 2 = rather not helpful, 3 = rather helpful or, 4 = very helpful).
- (4) *Received support by a mentor during prevocational program*: Respondents were also asked if they had a mentor during the first prevocational program who, for example, had conducted application training with them or supported them in their search for a training position (item “Did you also have a mentor during the measure who, for example, conducted job application training with you or supported you in your search for a training position?”, coded as 0 = no, 1 = yes).

Control Variables

As analyses of the transition processes have to be placed in the overall context of important factors influencing transitions from school to VET (see Sect. “The Role of Institutional Resources for the Transition to VET”), the multivariate analyses (see Sect. “Institutional Resources Supporting Transitions after the First Prevocational Program”) are additionally controlled for a large set of control variables (see Supplementary Table 1A for the different control variables we account for in our multivariate analyses). Descriptive statistics for our control variables are presented in Table 1.

We include gender, social and migration background as control variables because they are associated with different educational transitions (Busse, 2020). Gender is measured based on students’ self-reports (45.9% female). Social background is measured with three indicators to capture important facets of this multidimensional construct: 1) Parents’ highest International Socio-Economic Index of Occupational Status (ISEI-08) (Ganzeboom, 2010) is included to account for respondents’ socioeconomic background ($M = 46.5$, $SD = 0.6$). 2) We included the highest education level of parents using the CASMIN educational schema and distinguish three main educational levels (see Table 1). 3) We include the Index of Home Possessions (HOMEPOS). Finally, we define students as having a migration background (32.1% of the total sample) if they have immigrated themselves or if they have at least one parent born abroad.

In addition, we control for respondents’ school biography and prior achievement as they affect individuals’ probability to access VET. All these indicators are measured before respondents entered their first prevocational program. We include respondents’ last school track and differentiate between special-needs schools (22.0% of the sample), lower-secondary school tracks (43.3%), intermediate-secondary school tracks (21.8%) and upper-secondary school tracks (12.9%). Individuals’ school certificates are used, and three categories are differentiated. In vertical order, respondents with no or a regular lower-secondary school certificate (*Hauptschulabschluss*, 60.6%), extended lower-secondary school certificate (*Qualifizierender Hauptschulabschluss*, 19.3%), or intermediate secondary school certificate (*Mittlerer Schulabschluss*, 20.1%) are distinguished (Table 1). In addition, students’ self-reported grade point average (GPA) ($M = 2.8$, $SD = 0.6$; grades are coded from 1 = very good to 6 = insufficient) is used to obtain additional information concerning the quality of respondents’

Table 1 Distribution of control variables

	No school certificate	Lower-second-ary certificate	Extended lower-secondary certificate	Intermediate-secondary certificate	Total	Missing (%)
<i>Social background</i>						
Parents' ISEI	38.7 [19.0]	41.6 [17.8]	42.1 [18.8]	43.4 [18.5]	41.7 [18.4]	9.3%
Index of Home Possessions (HOMEPOS)	4.6 [1.7]	5.2 [1.7]	5.5 [1.6]	5.6 [1.6]	5.2 [1.7]	10.4%
Parents' highest educational level (%)						13.6%
Low	17.4%	15.9%	18.9%	8.8%	15.4%	
Intermediate	79.3%	79.0%	76.5%	84.1%	79.6%	
High	3.3%	5.1%	4.7%	7.1%	5.0%	
<i>School biography and achievement before first prevocational program</i>						
School track (%)						0.0%
Special-needs school	72.2%	15.0%	4.5%	0.4%	22.1%	
Lower-secondary school track	15.6%	62.1%	55.1%	24.0%	43.3%	
Intermediate-secondary school track	7.0%	13.8%	17.0%	57.4%	21.7%	
Upper-secondary school track	5.2%	9.1%	23.5%	18.2%	12.9%	
GPA on school certificate	2.9 [0.7]	3.0 [0.6]	2.8 [0.6]	2.8 [0.5]	2.9 [0.6]	13.0%
<i>Cognitive and language skills before first prevocational program</i>						
Receptive vocabulary	44.6 [10.9]	47.9 [10.4]	49.2 [10.0]	53.6 [9.1]	48.6 [10.6]	6.2%
Cognitive ability (reasoning)	5.5 [2.8]	6.9 [2.8]	7.1 [2.6]	7.9 [2.5]	6.8 [2.8]	10.8%
<i>Occupational aspirations and application behavior</i>						
Desired occupation before first prevocational program (ISEI score)	42.1 [19.9]	48.2 [19.9]	52.4 [20.2]	56.2 [19.6]	49.3 [20.5]	27.1%
Applied for a training place during first prevocational program (% yes)	44.4%	64.9%	68.4%	80.6%	64.4%	0.0%

Table 1 (continued)

	No school certificate	Lower-second-ary certificate	Extended lower-secondary certificate	Intermediate-secondary certificate	Total	Missing (%)
Regional context factor						
Ratio of local supply and demand for training places (SDR)	93.2 [7.0]	91.3 [6.4]	91.7 [7.1]	89.9 [7.1]	91.5 [6.9]	0.0%
Controls						
Gender (% female)	49.2%	45.0%	41.3%	48.8%	45.9%	0.9%
Migration background (% yes)	25.5%	34.3%	40.6%	26.4%	32.1%	1.8%
N	270	507	247	258	1,282	
%	21.1%	39.5%	19.3%	20.1%	100.0%	

Notes. Column percentages or means [and standard deviations] of imputed data ($m = 30$). Data: NEPS SC4 SUF 12.0.0, own calculations. The distribution of the German federal states is not allowed to be reported by the NEPS regulations. To simplify interpretation, we do not display the distribution of the type of prevocational program

school certificates. Furthermore, we included indicators for respondents' cognitive ability and linguistic skills (see Supplementary Table 1A for details).

Since occupational aspirations are expected to influence educational transitions, we also include respondents' ISEI score of the desired occupation measured in Grade 9. In addition, we control for youth's application behavior during prevocational programs with the item "*How many times have you applied for a vocational training position in any profession?*" (recoded as 0 = *never*, 1 = *at least once*).

Furthermore, regional context factors at the level of employment agency districts and the type of prevocational program are controlled (see Supplementary Table 1A for details).

Analytical Strategy

In the first step, we used sequence analysis (Macindoe & Abbott, 2006) and cluster analysis (Everitt et al., 2011) to identify different transition patterns after respondents had left their first prevocational program. The optimal matching algorithm was used to generate a similarity measure by comparing each sequence with the others. Based on this similarity measure, the Ward's algorithm was then applied to create groups such that within-group differences were minimized (Brzinsky-Fay & Solga, 2016) since it provides the most valid outcomes (Dlouhy & Biemann, 2015). For the sequence analysis, status information on the first 30 months after respondents left their first prevocational program was available. Due to panel mortality, a longer observation period would have substantially reduced the sample size.⁴ In line with previous research (e.g., Michaelis & Richter, 2022), nine types of activities were distinguished: (1) company-based VET, (2) school-based VET, (3) upper-secondary schools (e.g., upper-secondary vocational schools⁵ or *Gymnasium*), (4) prevocational programs, (5) skilled employment (i.e., with a vocational qualification),⁶ (6) unskilled employment (i.e., without a vocational qualification), (7) unemployment, (8) other activities (e.g., voluntary military service), and (9) gaps (e.g., missing information or panel mortality).⁷

In the second step, we conducted multinomial regression analyses to estimate the extent to which utilizing institutional resources ease school-to-work transitions or reduce difficulties in educational transitions after leaving prevocational programs. Average marginal effects (AMEs) are reported to display the average effect of an independent variable on the probability of transition, given that all other covariates are held constant

⁴ Status information for 40 months after leaving the first prevocational program was available for 1,052 respondents, while the sample size decreased to 833 respondents by expanding the observation period to 50 months.

⁵ Full-time vocational schools at upper-secondary level require an intermediate-school certificate and offer two- to three-year vocationally oriented general education courses (Cedefop, 2020).

⁶ Skilled employment refers to periods of employment of respondents who had achieved a vocational qualification. However, given the limited observation period of 30 months, in many cases we could not observe the end of respondents' VET periods which usually last 36 months.

⁷ Respondents had issues classifying episodes that incorporated school activities because VET, prevocational programs, and upper-secondary education in vocational schools all comprise school elements (Menze et al., 2016). In such cases, the information provided by the respondents had to be modified.

at their values. *AMEs* have the advantage of allowing a simple interpretation and, in addition, are robust against scaling and superior to other coefficients in many respects (Best & Wolf, 2015). Missing information on independent variables are estimated using Multivariate Imputation by Chained Equations (MICE) (Azur et al., 2011). In line with the recommendations of simulation and validation studies (von Hippel, 2007), both the dependent and independent variables are included in the imputation model. To increase the robustness of imputations, 30 imputation data sets are generated.

All analyses were estimated in Stata 18.

Results

Institutional Resources Used During the First Prevocational Program

During the first prevocational program, 21.9% improved a school certificate during VET. This proportion was especially high among youth who entered the prevocational program with a lower-secondary school certificate (31.8%). Almost one-third of the participants attended a long internship during the first prevocational program, and more than half of the participants reported that they received support by a mentor. Compared with the other students, those without a school certificate received support from a mentor to a higher degree and attended long internships to a larger degree. On average, the respondents indicated that the prevocational program was rather helpful for the identification of their own occupational aspirations. There were only very small differences in the perceived extent to which the program helped participants to identify an occupation there are interested in depending on students' achieved school certificate (Table 2).

Regarding the associations between the main measures (i.e., the institutional resources used by the respondents) the results of bivariate analyses⁸ (see Table 2) show that youth who attained a higher school certificate during the first prevocational program were significantly less likely to attend long internships (Cohens' $h = -0.6$; $p < 0.001$) and to receive support by a mentor (Cohens' $h = -0.3$; $p < 0.001$) compared to those who did not improve the school certificate. In contrast, the perceived extent to which the prevocational program helped youth to identify their occupational aspirations did not differ depending on whether they improved their school certificate (Cohens' $d = 0.0$; $p > 0.05$), attended long internships (Cohens' $d = -0.0$; $p > 0.05$) or received support by a mentor (Cohens' $d = -0.1$; $p > 0.05$).

⁸ For a detailed interpretation, we calculated different effect sizes for mean differences (Cohen's d) and proportion differences (Cohen's h ; Cohen, 1988). Following Cohen's convention, effect sizes (for both Cohen's d and Cohen's h) with an absolute value of 0.2 can be interpreted as small, with an absolute value of 0.5 as medium, and with an absolute value of 0.8 as strong group differences.

Table 2 Distribution of the institutional resources used during the first prevocational program

	No school certificate	Lower-secondary certificate	Extended lower-secondary certificate	Intermediate-secondary certificate	Total
Improved school certificate (% yes)	23.0%	31.8%	23.5%	0.0%	21.9%
Received support by a mentor (% yes)	61.2%	57.9%	55.6%	47.7%	56.1%
Attended a long internship (% yes)	42.3%	29.8%	27.8%	30.3%	32.3%
Perceived prevocational program useful for identifying occupational aspirations	3.5 [0.6]	3.5 [0.7]	3.5 [0.7]	3.5 [0.8]	3.5 [0.7]
<i>N</i>	270	507	247	258	1,282

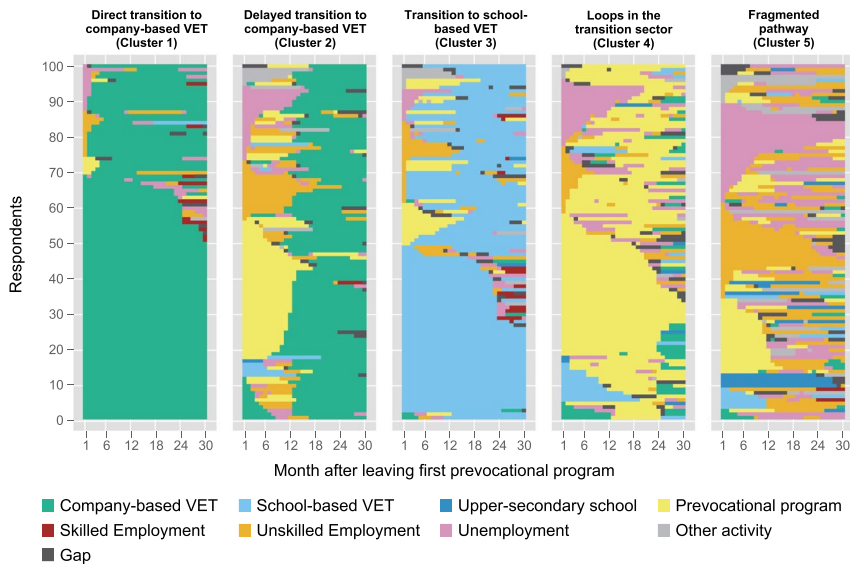
Notes. Column percentages or means [and standard deviations] of imputed data ($m=30$). Data: NEPS SC4 SUF 12.0.0, authors' calculations

Transition Patterns after the First Prevocational Program

Sequence and cluster analyses identified five distinct transition patterns for youth leaving their first prevocational program. Compared to other cluster solutions, the 5-cluster solution (Pseudo- $R^2=0.439$; Pseudo- $F=249.908$) provided sufficiently high case numbers and delivered distinct transition trajectories.⁹ Figure 1 shows the cluster members' individual transition trajectories, Supplementary Fig. 1A shows the monthly proportion plots of the five clusters, and Supplementary Table 2A reports the clusters' main characteristics.

Three of the five clusters represent trajectories to VET at the upper-secondary level (Fig. 1). Cluster 1, “*Direct transition to company-based VET*,” comprised 38.8% of the total sample. The cluster members passed smoothly to company-based VET after leaving the first prevocational program. The average accumulated length of the apprenticeship period (26.8 months) also demonstrated high continuity (see Supplementary Table 2A). Cluster 2, “*Delayed transition to*

⁹ The identification of the number of relevant transition patterns “is an explorative approach” (Brzinsky-Fay & Solga, 2016). Quality of the obtained cluster solution is measured according to within-cluster homogeneity and “separation” (or difference) between clusters. However, quality indices lack thresholds values indicating whether the typology is good enough (Liao et al., 2022). Following Brzinsky-Fay and Solga (2016), we examined many cluster solutions for determining the optimal number of transitions patterns. The examined cluster solutions ranged from 3 transition patterns to 10 transition patterns. The Pseudo- R^2 increased steadily with the number of clusters, while the Pseudo- F decreased with the number of clusters (see Table A5 in Supplemental Material). We opted for the 5-cluster solution (Pseudo- $R^2=0.439$; Pseudo- $F=249.908$, $p=.001$) as it provided a sufficiently high case number in all clusters and delivered distinct sequence types. While higher cluster solutions added transition patterns of only limited distinctiveness, lower cluster solutions blurred the heterogeneity of the transition trajectory. Compared to the 5-cluster solution, in the 6-cluster solution the transition pattern “fragmented pathway” split into two patterns of limited distinctiveness. Compared to the 4-cluster solution, the 5-cluster solution allows to differentiate between students who experience “wating loops” in the transition sector and students who have a largely fragmented pathway.



Notes. The plots display individual trajectories of 100 respondents per cluster and must be read horizontally. The horizontal axis denotes the timeline for all graphs in the month, and every line on the vertical axis denotes the individual trajectory of one respondent. Cluster 1 = Direct transition to company-based VET, Cluster 2 = Delayed transition to company-based VET, Cluster 3 = Transition to school-based VET, Cluster 4 = Loops in the transition sector, and Cluster 5 = Fragmented pathway. For monthly proportion plots, see Supplementary Figure 1A. Data: NEPS SC4 SUF 12.0.0; authors' calculations.

Fig. 1 Trajectory patterns within 30 months after leaving prevocational programs (individual trajectories)

company-based VET,” represented 17.4% of the total sample and most commonly started with another prevocational program (duration 6.0 months on average) before the cluster members entered company-based VET. After their delayed entry to company-based VET, the cluster members had a low dropout risk: Only 7% of youth with delayed transitions to company-based VET dropped out. Members of Cluster 3, “*Transition to school-based VET*” (9.5% of the total sample), passed to school-based VET (Fig. 1). However, the transition to school-based VET ran less smoothly compared with Cluster 1, as some cluster members attended prevocational programs (2.1 months on average), unskilled employment (1.4 months on average), and unemployment (1.1 months on average) before they enter school-based VET. Nevertheless, periods of school-based VET largely lasted until the end of the observation period, which was also indicated by the average accumulated length of the VET period (23.2 months; Supplementary Table 2A).

For a third of the respondents, the transition processes were characterized by uncertainty and risk (Fig. 1). After leaving the first prevocational program, youth affiliated with the fourth cluster “*Loops in the transition sector*” (14.4% of the total sample) again switched to other prevocational programs and mostly stayed there until the end of the observation period. Thirty months after leaving the first prevocational program, 26.1% of cluster members were still participating in other prevocational programs, 23.9% were unskilled employed or unemployed, and only 35.3% were able to switch to VET programs or to upper-secondary schools. Taken together, youth affiliated with Cluster 4 participated, on average,

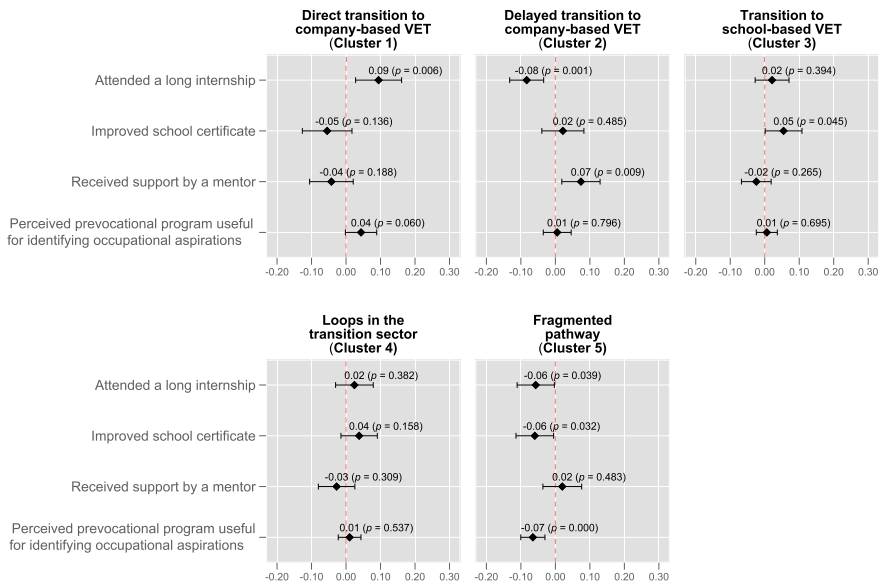
29.1 months in prevocational programs (10.7 months in the first prevocational programs + 18.4 months after leaving the first prevocational programs). The fifth cluster, “*Fragmented pathway*” (19.9% of the total sample), clearly showed the most problematic transition processes. Youth affiliated with this cluster did not only show frequent changes in activities at a level that was above average ($M=3.9$), but also their VET episodes were largely unstable (53% dropout of company- and school-based VET). Moreover, cluster members showed sustained accumulated periods of unskilled employment (8.7 months on average compared with the sample mean of 3.0 months) and unemployment (9.2 months on average compared with the sample mean of 3.2 months) (Supplementary Table 2A). At the end of the observation period, 72.6% of the cluster members were neither in VET programs nor in prevocational programs or in upper-secondary schools (Fig. 1; Supplementary Fig. 1A).

Institutional Resources Supporting Transitions after the First Prevocational Program

This section outlines the multinomial logistic regression we used to examine the extent to which the use of institutional resources led to direct transitions to company-based VET (Cluster 1), delayed transitions to company-based VET (Cluster 2), transitions to school-based VET (Cluster 3), loops in the transition sector (Cluster 4), or fragmented pathways (Cluster 5). Net of all other controls of the multinomial regression, Fig. 2 displays the AMEs of the main variables of interest (Table 3A for the full model). Overall, the model fit (Pseudo- R^2 [Mc-Fadden]=0.14; $\chi^2=545.7$, $p<0.001$) is comparable to previous analyses of differentiated patterns of educational transitions (see Busse, 2020; Busse et al., 2023). The fit of the model can also be compared with previous studies on VET access, which consider only single transition events and thus a lower complexity of the transition process (Holtmann et al., 2017; Menze & Holtmann, 2019). The indicators for the institutional resources used during the first prevocational program substantially contributed to the model fit (Table 3).¹⁰

Regarding the *direct transition to company-based VET* (Cluster 1), Fig. 2 shows that (net of all other controls) long internships ($AME=0.09$, $p<0.01$) were systematically associated with a higher probability of directly switching to company-based VET after leaving prevocational programs. More precisely, youth who attended a long internship during prevocational programs were nine percentage points more likely to directly switch to company-based VET than students who did not attend a long internship. Improving school certificates ($AME=-0.05$, $p>0.05$) or receiving support by a mentor during prevocational programs ($AME=-0.04$, $p>0.05$) were negatively but not significantly associated with higher direct transition rates to company-based VET. *Delayed transitions to company-based VET* (Cluster 2)

¹⁰ Further analyses showed that adding the main variables of interest to the equation of a regression model with all other control variables significantly increased the fit of the regression model (likelihood ratio tests with $p<.001$).



Notes. Results based on a multinomial regression analysis with 30 imputed data, average marginal effects (AMEs) with 95% confidence interval, and discrete change effects for binary variables. All models control for gender, migration background, GPA, school certificate, cognitive skills, receptive vocabulary, application behavior, ISEI of desired occupation, parents' HISEI and highest CASMIN, HOMEPOS, regional ratio of supply and demand of training place (SDR), type of prevocational program, and federal state. Pseudo-R² (Mc-Fadden) = .14. Data: NEPS SC4 SUF 12.0.0; authors' calculations.

Fig. 2 Influence of using institutional resources during prevocational programs on transition processes (AMEs with 95% CI)

were only partly related to students' use of institutional resources during prevocational programs. Only the attendance of long internships and the support of a mentor were significantly linked to delayed transitions to company-based VET: Attending an internship was associated with a lower probability of having a delayed transition to company-based VET ($AME = -0.08$, $p < 0.001$), while there was a positive and significant relationship between receiving support from a mentor and a delayed transition to company-based VET ($AME = 0.07$, $p < 0.01$). Regarding the *transition to school-based VET* (Cluster 3), youth who improved their school certificate during prevocational programs had a higher probability of switching to school-based VET than youth who did not improve their school certificate ($AME = 0.05$, $p < 0.05$). The effect sizes of other institutional resources were close to zero and not significant ($p > 0.05$) and, therefore, did not matter for a transition to school-based VET net of the other controls. *Loops in the transitions sector* (Cluster 4), or in other words, the probability of attending prevocational programs again after attending a first prevocational program, was not associated with using institutional resources ($p > 0.05$). Finally, and this is perhaps the most striking finding, almost all institutional

resources of interest were associated with a significantly lower probability of ending up in a *fragmented pathway* (Cluster 5) after the attendance of a prevocational program. Youth who attended a long internship ($AME = -0.06, p < 0.05$), improved their school certificate ($AME = -0.06, p < 0.05$), or found their first prevocational program to be helpful to identify their occupational aspirations ($AME = -0.07, p < 0.001$) were significantly less likely to have a fragmented pathway than their respective reference group.

Taken together, using institutional resources during prevocational programs mattered for later transition trajectories net of students' gender, social and migration background, prior school biography and achievement, occupational aspirations, type of prevocational program and regional context factors. To examine the extent to which the use of institutional resources during prevocational programs contributed to differences in transition processes, a further test step was carried out. Groups of variables were consecutively excluded from the full regression model, and the Akaike information criterion (AIC) was specified for each removal (Best & Wolf, 2010). Additionally, the pseudo- R^2 was calculated for each omission of the model variables. This approach attempts to determine how much of the model fit is attributable to different groups of factors in the model (Zimmermann & Skrobánek, 2015). Table 3 shows which groups of variables had the strongest influence on the transition processes after prevocational programs (i.e., pseudo- R^2 with the lowest value and AIC with the highest value). According to Table 3, youth's application behavior and regional context factors (e.g., supply and demand ratio of training places) had the strongest impact on the model fit compared to the included variables. The use of institutional resources seemed to contribute to the model fit to a similar extent as the prior school biography (e.g., school track attended) and prior achievement (e.g., school certificate and GPA) of the young people. If the indicators for using institutional resources were excluded from the full model, the Pseudo- R^2 dropped to 12.5%, and the AIC increased to 3,684.3.

Table 3 Calculation of the model fit after omitting variables from the full model

Model fit after omitting...	Pseudo- R^2	AIC
...using institutional resources	12.5%	3,684.3
...migration background	14.2%	3,634.8
...social background	13.5%	3,636.6
...prior school biography and achievement	11.9%	3,665.6
...occupational aspirations	13.9%	3,649.3
...application behavior	11.8%	3,731.3
...regional context factors	11.4%	3,628.0
Full model	14.2%	3,642.1

Notes. The larger the AIC value and the lower the Pseudo- R^2 , the greater the model degradation and the more significant the omitted group of variables. Results based on multinomial regression analyses with 30 imputed data. Data: NEPS SC4 SUF 12.0.0; authors' calculations

Robustness Checks

To test the sensitivity and validity of the results, we conducted various robustness checks (see Table 1A in the supplementary material for the operationalization of the added variables). All robustness checks are provided in the supplementary material. Given the relevance of social resources for students' school-to-work transitions (Nennstiel, 2022), the first robustness check comprised the estimation of all models by adding respondents' perceived likelihood of receiving support from their social environment to find interesting training places (Robustness check 1, Supplementary Fig. 2A). As previous research suggested that the demands and expectations of the social environment are mechanisms responsible for differences in school-to-work transitions (Busse, 2020), we included a variable for parents' educational expectations to the models (Robustness check 2, Supplementary Fig. 2A). As linear probability models have received increasing attention in research on educational transitions (e.g., Nennstiel, 2022), we estimated linear probability models instead of multinomial logistic regression to test the sensitivity of the results to carry out the analysis (Robustness check 3, Supplementary Fig. 2A). In a fourth robustness check, we estimated multilevel models, which account for the regional hierarchical data structure where individuals are nested into regional labor market districts (Robustness check 4, Supplementary Table 4A). In a last robustness check, we excluded respondents with intermediate secondary school certificates from the sample as they cannot improve their school certificates during prevocational programs (Robustness check 5, Supplementary Table 6A). Notwithstanding these robustness checks, the empirical relevance of using institutional resources for youth's transition trajectories remained largely robust against all those tests.

Discussion

In many European countries, educational programs aim to ease school-to-work transitions for youth of low educational attainment. The present study focused on the preparation phase of school-to-work transitions in Germany by examining youth who were channeled into prevocational programs after leaving general school. We aimed to empirically identify patterns in youth's transition trajectories after their first prevocational program. Regarding our first research question, the findings of our sequence analysis revealed heterogeneous transition patterns after the attendance of a first prevocational program. In line with hypotheses 1a-1c, three main patterns can be distinguished. Two-thirds of the participants (65.8%) had stable transitions to company- or school-based VET (Clusters 1, 2, and 3), with some occurring directly after leaving a first prevocational program, while many were delayed by approximately one year. Nevertheless, our findings support hypothesis 1a, as we identified a pattern with stable transitions to VET. However, one-third of the participants had at-risk transition trajectories and were at risk of being permanently out of the education and employment system (for similar findings, see Mascherini, 2019; Michaelis & Richter, 2022), which should be given particular policy attention: 14.3% experienced "waiting loops" in the transition sector as they attended prevocational programs for

approximately 2.5 years with only limited possible prospects of accessing VET or other educational options at the upper-secondary level (Cluster 4), thereby confirming hypothesis 1b. For 19.9%, the transition processes were characterized by high risks of unskilled (un-)employment and severe obstacles to reaching company- or school-based VET (Cluster 5), which points to sustained detachment from the institutionalized educational system (hypothesis 1c).

With regard to our second research question, the results revealed that utilizing institutional resources during prevocational programs is associated with youth's subsequent educational transitions. Attaining a higher school certificate (hypothesis 2) was associated with a higher probability to enter school-based VET, while there was no significant relationship with the transition to company-based VET net of controls. From a theoretical perspective, we expected that improving school certificates increases youth's productivity signals perceived by employers and, thereby, youth's probability to enter company-based VET. While research provides strong evidence for the relevance of school certificates in employers' screening processes (e.g., Di Stasio & van de Werfhorst, 2016; Fossati et al., 2020; Hupka-Brunner et al., 2010; Protsch & Solga, 2016), it seems that improving school certificates rather helps program participants to access VET positions in the school-based VET system. In line with previous research (Holtmann et al., 2021; Solga & Kohlrausch, 2013), we found that—despite the credentialized German VET system—attending long internships during prevocational programs mattered for the transition to company-based VET, thereby confirming hypothesis 3. Based on our theoretical considerations, there are different explanations for this association: Long internships may serve as an “extended screening period” for employers through which program participants can counteract negative productivity signals of their usually low school certificates and/or reduce employers' uncertainties about their actual skills (Holtmann et al., 2021). Thereby, participants may circumvent the influence of mechanisms present in the competition for training places (i.e., their otherwise low rank in the application pool), as expected by the job competition theory (Thurow, 1979). Attending long internships may also enhance participants' vocational orientation as internships provide insights into certain occupations and help youth build ties to the respective company providing the internship (Holtmann et al., 2021; Méliani et al., 2019). Long internships may also help accumulate vocational skills and thereby improve productivity signals (e.g., O'Higgins & Pinedo Caro, 2021). While the exact mechanism remains unclear, our findings align with international research highlighting the importance of long internships for youths' employability (Jerez Gomez et al., 2023). Extending previous research, we could further show that both factors—improving school certificates and attending long internships—can “protect” youth from having difficult trajectories with very low prospects of reaching VET after leaving prevocational programs.

Furthermore, our results suggest that the degree to which youth perceived the prevocational program to be useful for identifying occupational aspirations is associated with their educational transitions, thereby providing support for hypothesis 4. Youth who considered their initial prevocational program helpful in identifying their occupational aspirations were found to have a lower probability of experiencing a fragmented pathway after completing the prevocational program. While we cannot

determine the exact channels through which the degree to which youth perceived the prevocational program to be useful for identifying occupational is associated with youths' educational transitions, we discuss different theoretical interpretations. In accordance with the social cognitive career theory (Lent et al., 2002, p. 275–276), we suggest that prevocational programs help shape occupational aspirations through its opportunity structure (most possibly through opportunities for vocational orientation) and thereby may prepare youth for educational transitions. Moreover, we expected that perceiving the prevocational program as useful for identifying occupational aspirations would also be associated with youths' probability to directly enter company-based VET. While respondents on average perceived their prevocational program as helpful in identifying occupational aspirations, the degree to which youth perceived the prevocational program to be useful for identifying occupational was not associated with the probability of directly entering company-based VET. We highlight here that this result further points to individuals' active role in making meaning out of what the institutional opportunity structure provides, which is also in line with the social cognitive career theory (Lent et al., 2002, p. 275). Nevertheless, the observed association between perceiving the prevocational program to be useful for identifying occupational aspirations and educational transitions is a promising finding, as family's resources for vocational orientation differ depending on their social background (Dräger & Wicht, 2021), and many youths in prevocational programs are from educationally disadvantaged homes with few resources for vocational orientation. Vocational orientation at vocational schools and institutionalized offerings can make an important contribution to compensating for such social inequalities (Dräger & Wicht, 2021; Kamm & Gebhardt, 2019) and “offers them the opportunity to build a more traditional biography after taking some detours” (Landberg & Noack, 2022, p. 79). In addition, the vocational orientation in the transition sector can help to provide youth with an acceptable career perspective apart from their originally desired unrealizable occupational aspirations (Landberg & Noack, 2022).

Moreover, our empirical results suggest that receiving support by a mentor is only marginally associated with youth's transition patterns, thereby providing limited evidence for hypothesis 5. There was a positive relationship between receiving support from a mentor (e.g., application training) and VET access, in that mentoring was associated with a delayed transition to company-based VET. This finding is also in line with other studies that have pointed out that mentoring, in particular job search assistance, positively influences employment outcomes (Caliendo & Schmidl, 2016). The finding that mentoring had a significantly positive effect only among the youth in Cluster 2 with the delayed transitions to company-based VET may be explained by the fact that a larger proportion of the youth without or with a lower-secondary school certificate received support from a mentor. These were possibly youth who, during their school career, already had a greater need for support and assistance. We assume that these youth had to make an effort to compensate for disadvantages and needed special encouragement – thus, mentoring could have been able to help with both (Resnjanskij et al., 2024). Taken together, our results align with previous research on the complexity of the relationship between receiving support from a mentor and VET access (e.g., Hofmann et al., 2014). Small influences

of mentoring have also been found regarding other educational and employment outcomes (e.g., DuBois et al., 2002; Raposa et al., 2019) and may also be due to various pitfalls and conflicting effects for those who receive support. For example, a reduction in self-esteem can be caused by the unreliability and absence of mentors and counteract or reverse the positive effects of mentoring (Karcher, 2005).

Further analyses of subgroups suggest that using institutional resources during prevocational programs may especially help youth with uncertain occupational desires. Occupational desires can be seen as an indicator of youth's vocational orientation (Hirschi, 2011). For youth who had no specific occupational desires when entering the first prevocational program, the association between the degree to which they perceived the prevocational program to be helpful for identifying their occupational aspirations and the probability of having a fragmented pathway was greater than for youth with specific occupational desires ($AME = -0.083$, $p < 0.01$ vs. $AME = -0.046$, $p < 0.05$) (Supplementary Fig. 3A). In other words, the perceived degree to which the prevocational program helped youth to identify their occupational aspirations seems to have mattered more for youth with uncertain occupational aspirations (i.e., no specific occupational desires) as it protected them to a larger extent from having a fragmented pathway than youth with specific occupational desires. This phenomenon could also be observed regarding the attendance of long internships, which was associated with larger effects for youth with no desired occupation than for youth with specific occupational desires. For example, for youth who had no specific occupational desires when entering the first prevocational program, the association between attending a long internship and directly entering company-based VET was greater than for youth who reported specific occupational desires ($AME = 0.117$, $p < 0.05$ vs. $AME = 0.077$, $p > 0.05$) (Supplementary Fig. 3A). In sum, the results suggest that helping youth to refine occupational aspirations and providing opportunities to attend long internships is especially important for youth with uncertain occupational aspirations.

Limitations

The present study faces different limitations. First, our study can only assess the influence of institutional resources used by the individuals as the NEPS data does not provide information regarding the opportunities offered at the institutional level. Thus, we could not investigate the programs' characteristics independently of whether respondents took advantage of them.

Second, we could not account that individuals are nested into classes and vocational schools or programs of the German Federal Employment Agency as the NEPS does only provide class or school identifier for general school education. However, we controlled for the type of prevocational program in all multivariate analyses. In addition, in our robustness checks we estimated multilevel models which account for the regional hierarchical data structure where individuals are nested into regional labor market districts.

Third, the operationalization has been limited in that the NEPS data provides only single items to measure our constructs of interest. For example, NEPS provides

only one indicator that captures the extent to which respondents perceived that the respective vocational program helped them to find an occupation in which they were interested. The measurement of processes of vocational orientation requires more complex assessments (Dodd et al., 2022). Similarly, assessing the influence of attending internships with a single item cannot fully represent the multi-faceted relevance of internships. For example, studies have revealed that the quality of the preparation, supervision, and reflection of internships matters for the transition to VET (Méliani et al., 2019). In addition, referring to “mentoring” with a single item cannot adequately represent the multi-faceted tasks of a mentor and describing a mentor as someone “who had conducted job application training with them or supported them in their search for a training position” could apply to teachers, trainers or school social workers engaged in the prevocational programs. Moreover, studies have also indicated that the effect of mentoring depends on mentorship quality (Kram, 1988; Meijers, 2008). Despite these limitations, the association between our main independent variables and youth’s transition trajectory remained robust against all sensitive tests and was observed, even if a rich set of controls was considered. Yet, our findings cannot be interpreted causally although we draw on longitudinal data.

Fourth, in accordance with Tjaden and Hunkler (2017, p. 224), potential endogeneity issues that are common to most non-experimental research designs have to be discussed. Youth could have adjusted their responses according to their transition trajectory which would reverse causal pathways. Yet, as data collection on all indicators for using institutional resources largely took place before the end of the first prevocational program (on average, seven months before the end of respondents’ first prevocational program), reversal causality would have been unlikely. Furthermore, the careful wording in NEPS of the questions regarding our main indicators reduces this potential bias. In addition, reverse causality would not explain why using institutional resources mattered, particularly for those students with no occupational desires.

Conclusion

Notwithstanding the aforementioned limitations of our study, the findings suggest that using institutional resources during prevocational programs can ease the subsequent transition to company- or school-based VET and protect youth from problematic and fragmented pathways. The current study makes two important contributions to research on educational programs. *First*, the results go beyond common studies by drawing a more detailed picture of transition processes after prevocational programs in Germany. However, our study does not consider current changes of the German labor market (e.g., shortages of skilled workers in numerous domains, a reduced competition for VET positions as well as increasing mismatches in the VET market; National Education Report, 2020). *Second*, we contribute to existing literature by showing the extent to which using institutional resources during prevocational programs is associated with later educational transitions. Beyond the German case, the results shed light on the factors supporting school-to-work transitions as

the German VET system largely functions like a labor market (Protsch & Solga, 2016). Our findings suggest that youth who usually face difficulties in their school-to-work transition can improve their labor market opportunities depending on the degree to which they (can) access institutional resources such as internships during youth educational programs. Our results suggest that employers' uncertainty about the trainability of program participants can be reduced by enabling youth to attend long internships serving as an extended screening period (see also Holtmann et al., 2021). Moreover, our findings point to the relevance of the support of mentors as well as processes of vocational orientation helping youth to identify occupational aspirations. However, future research should focus on aspects that remain black box in this study, that is, the exact mechanisms by which improving school certificates, attending internships, identifying occupational aspirations and receiving support by mentors affect youth's school-to-work transitions.

In terms of policy implications, our study suggests that for preparing youth for the school-to-work transition it is not only necessary to focus on the acquisition of school certificates but also to support youth with company linkages, vocational orientation, and mentors. This is in line with research that shows the benefit of youth educational programs that combine different institutional resources (Kluve et al., 2019). This leads to the requirement to precisely identify the needs of young people, to tailor the educational programs to their needs, and to empower the youths to use the institutional resources provided. This would not only promote a smoother transition from school to working life in the short term but would also have a positive impact on overall life opportunities in the longer term (Koen et al., 2012; Reuter et al., 2022).

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Data availability The data that support the findings of this study are available from the Leibniz Institute for Educational Trajectories (LIfBi) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

Declarations

Competing interest The authors have no relevant financial or non-financial interests to disclose.

Consent for publication All participants provided written, informed consent for publication.

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