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Dropout predictors in the academic fields of economics and engineering in cooperative education: an observation of the first academic year using cox regression

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Abstract

Cooperative education programs are usually based on a partnership between companies and universities. Dropouts have a particular impact here, for example the loss of junior staff in the companies. Most dropouts in cooperative education occur in the first academic year. In this multicausal dropout process, the influence of the cooperation partner is less pronounced in research. Consequently, we shed light on perspectives of organizational commitment to the company and motivational aspects in the academic fields of economics and engineering. We analyze collected data using a cross-sectional study design and estimated cox regression analysis on 2263 first-year students at Baden-Wuerttemberg Cooperative State University (DHBW) in Germany with 149 dropouts. Our analysis presents associations between affective commitment to the company, relatedness and competence at the university, and demographic and performance control variables with dropping out. Findings are contextualized within the current state of research. Practical implications are discussed in our study.

Introduction

Cooperative education, seen as an intertwined educational program between university study programs and vocational education and training (in short VET; Graf 2013; Wolter 2016) with international recognition (Coll and Zegwaard 2011), is becoming increasingly prevalent in Germany. This is supported by the fact that the number of students has approximately doubled from 64,093 to 2012 to 120,517 in 2022 (Hofmann 2023). Additionally, some companies see this study program as a method to "selecting the best" (Kupfer 2013; Weich et al. 2017). In the context of the increasing relevance of this study format, research is now being conducted on a variety of topics, such as the individual return on investment of dual study (Brändle et al. 2021) or how students in cooperative education differ from students in other higher education programs (Kramer et al. 2011). Despite these initial research initiatives, research on this type of educational programs is still considered underdeveloped (Weich et al. 2017; Weiß 2016). One important topic



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area, for example, is the issue of dropouts in cooperative study programs where multiple stakeholders are involved (beneath students and university there are also employers).

In cooperative education, it appears that the dropout rate is a smaller but not an underrated problem compared to VET or higher education (Kupfer 2013; Nickel et al. 2022). Notably, it is predominantly highest in the first academic year in all of these education programs (Chen 2012; Krötz and Deutscher 2022; Wild and Schulze Heuling 2020). Furthermore, a challenge in the field of dropout research is that researchers don't focus on actual dropouts, but retrospective view of dropout decisions, study doubts or dropout thoughts (Klein and Stocké 2016; Krötz and Deutscher 2022; Sarcletti and Müller 2011). This is remarkable because, for example, the prognostic validity of an intention to drop out is acceptable but not always the best. Current analysis by receiver operating characteristic curves (ROC analyses) between study dropout intentions and following actual dropout (AUC=0.60 to 0.68) show this (Deuer and Wild 2019). Consequently, on the one hand, there is a need to develop appropriate measurement instruments, e.g., for intention to drop, that predict actual dropouts. On the other hand, other predictors instead of intention to drop out are also being discussed, such as study doubts (Nextcareer n.d.).

While research about dropouts for VET shows a well-elaborated perspective of the companies (Böhn and Deutscher 2022), the framework of dropouts in higher education research, such as Heublein (2014); Tinto (1975); or Bean and Metzner (1985), does not focus on the company or workplace enough. There are first suggestions to explain dropouts in cooperative education, such as Deuer and Wild (2018), but no detailed and widely accepted framework.

One aim of our ongoing research on dropouts is to elucidate associations within multicausal factors of the dropout developing process (e.g., Heublein 2014). Bäulke et al. (2021) suggested, for example, a kind of motivational decision-making process with empirical evidence of the five named phases: (1) non-fit perception, (2) thoughts of quitting, (3) deliberation, (4) information search, and (5) final decision. However, we analyze overarching predictors in our research, that cannot easily be clearly assigned to the five different phases of Bäulke et al. (2021) and at the time of data collection, the model by Bäulke et al. (2021) had not yet been published. As a result, we use the theoretical assumptions of Heublein (2014) from his model of the drop-out process in our research. In detail, we focus on motivational aspects as well as on organizational commitment in our research, because these variables are associated with performance and dropout, both at the university and in companies (Kuusio et al. 2010; Richardson et al. 2012; Riketta 2002; Schneider and Preckel 2017; Schnettler et al. 2020). Furthermore, these variables decrease in the course of higher education programs (Benden and Lauermann 2022; Wild et al. 2020).

Our research addresses several challenges. We conducted research by analyzing data of the first academic year from cooperative students at DHBW. Our research focuses on students in the academic fields of economics and engineering, both highly popular fields of study (Federal Statistical Office of Germany 2022, p. 31), where subject-specific analyses are needed (Sarcletti and Müller 2011).Furthermore, our research is based on survey data matched with university administration data, which has the advantage of reducing measurement errors and effects of social desirability. We address the current research

perspective of motivation by analyzing the precondition of motivation and its correlation with dropouts. We also integrate the view of the horizontal dropout direction of the company from a VET perspective (Krötz and Deutscher 2022) in our research by analyzing commitment to the company on dropouts, where research is needed for cooperative education.

Conceptualizing of dropout

Dropout in our research is defined as "situations where a student leaves the university study in which (s)he has enrolled before having obtained a formal degree" (Larsen et al. 2013, p. 5). Official dropout quotes in Germany, like Heublein et al. (2022) reported for higher education with 28 to 31% for bachelor's or 25% for VET in 2020 (Federal Institute for Vocational Education and Training 2022), do not exist for cooperative education. However, Kupfer (2013) and Nickel et al. (2022) emphasized that cooperative education programs have low dropout rates. The consequences of a high number of dropouts are, for example, for companies, this can lead to withdrawal from offering training programs in the future, reduced work capacity, increased recruitment efforts, and lost opportunities to secure a skilled workforce (cf. Deuer 2003; Böhn 2020); additionally, individuals may experience economic or psychological disadvantages, while society may suffer from malinvestment, lower tax revenues, or academic skills shortages (Neugebauer et al. 2019).

Our theoretical assumptions are based on the model of the drop-out process by Heublein (2014). According to the model, there are three phases (cf. Fig. 1): the pre-study phase (Phase 1), the study phase (Phase 2) and the decision to drop out (Phase 3). Every phase has different influencing factors of a specific interrelationship of individual qualifications and institutional conditions. Next, we go into details.

Some predictors correlate with the dropout process even before the beginning of the study program (Phase 1; Heublein 2014). Three factors are fundamental in this model: origin, personality and socialization. Specifically, origin is defined as social and familial background, whilst personality focuses on the Big Five traits. Socialization includes education choices and qualification for study program prior to the study decision. These factors influence the study decision, expectations to the study program and decisions in



Fig. 1 Drop out process from higher education institutions. (adapted from Heublein 2014)

later phases. Isleib et al. (2019); Kehm et al. (2019) and Neugebauer et al. (2019) give an detailed overview with current empirical results of predictors in this phase.

The second phase focuses on the study situation itself (Heublein 2014). This phase is seen as a complex, ongoing, dynamic interplay between internal and external factors. While internal factors are a central theme of concrete actions of individual students in the study context, external factors relate to conditions determined by the institutions. The four internal influence factors in this framework are (1) study behavior, (2) study motivation, (3) performance and (4) psychological and physical resources. In addition to these internal influence factors, there exist external factors of (1) studying conditions, like the quality of teaching, (2) living condition related to financing of studies and accommodation, (3) existing alternatives and (4) supply of information. Isleib et al. (2019) argue for external factors that mechanisms of rational choice aspects are used here that students integrate in their decision for or against dropping out of university. All factors are based on several subdimensions and characteristics that influence each other. The coherence between internal and external factors as they change and develop is indispensable for academic success. Neugebauer et al. (2019) and Kehm et al. (2019) provide an overview of empirical results of this phase.

The third and last phase in this process is the decision for or against dropping out (Heublein 2014). If internal and external factors are not adequate fulfil, students become motivated to drop out of the study program.

This dropout model is complex. However, it is very flexible because it can address different problems and integrate different interdisciplinary and theoretical aspects. With this background, it is possible to design and conduct diverse empirical research.

Different approaches are used in the international state of research, described shorted and simplified here according to Neugebauer et al. (2019). The model of Tinto (1975), based on the work of Spady (1970), postulates that there is a decreased risk of dropout when students are socially and academically integrated into the university. The concept of habitus by Bourdieu (1980) proclaims a dropout in case of a mismatch between the family background and the higher education institution. Assumptions from the background of rational choice theory postulate a consideration process, that more benefits exist in a dropout in comparison to staying at university (Beekhoven et al. 2002). Psychological approaches highlight the meaning of cognitive, personal or motivational aspects and resources for a successful study program. Suggestions exist for explaining all dropout assumptions by one model (Kuh et al. 2006; Blüthmann et al. 2008; Heublein 2014), but no model is currently seen as ideal.

Our research focuses on the two aspects of motivation development in the study program and commitment to the company in cooperative education. The model of the dropout process by Heublein (2014) integrates motivation into the second phase of the study situation as an internal influence factor on dropout. This factor is seen as important, because motivation has been the subject of a recent discussion in dropout research, as there are associations between motivation and intention to drop out (Grassinger 2018; Fleischer et al. 2019; Wild and Grassinger 2023). Furthermore, motivation decreases in the study program (Benden and Lauermann 2022; Schnettler et al. 2020) and other predictors of achievement (e.g., cognitive abilities or family background) are hardly modifiable compared to the motivational components (von Maurice et al. 2014). Janke et al. (2021) argue that optimal motivation can ensure that students spend time and effort handling the learning content. Research by Richardson and Abraham (2009) demonstrates that the effect of conscientiousness on university students' grade point average is fully mediated by achievement motivation.

However, Heublein's (2014) model of the dropout process does not integrate the perspective of corporate partners into its framework. According to Böhn and Deutscher (2022), the process of activity factors to understand the premature termination of a contract should be more elaborated from the VET perspective and adjusted to cooperative education analysis of input factors. Because of the situation of changing the company of a trainee, we focus on the ideas of Krötz and Deutscher (2022) in the context of the horizontal perspective from dropout direction. Consequently, we broach the issue of commitment to a cooperative partner and dropout in our research. First empirical research in Germany for cooperative education in this field underlines the importance of this variable, because there exist negative correlations between commitment to a cooperative partner and dropout (Wild and Schulze Heuling 2020) and commitment to the cooperative partner decline in cooperative study program (Wild et al. 2020).

Determinants of dropout: empirical evidenceand background

Motivation is seen as important to explain dropout. In the line of self-determination theory (SDT), satisfying the three basic psychological needs (BPN) of (1) autonomy, (2) competence, and (3) relatedness is a precondition to increasing motivational aspects, social values, vitality, and cognitive performance (Ryan and Deci 2017; Wild et al. 2023). According to Sheldon and Prentice (2019), the three BPN can be seen in more detail for (1) autonomy as a need of own behaviors and choices, for (2) the need to be competent (effective and masterful) to do more, experience more, and learn more as other people, and for (3) relatedness as a feeling of connecting with other persons to remain psychologically and physically healthy. The three BPNs are considered equally important in the theoretical context.

The theoretical assumptions regarding the relevance of BPN are confirmed by empirical analyses, as Wild et al. (2023) summarized for education research. The effect of BPN on dropout has been demonstrated mainly in school research. For example, Ricard and Pelletier (2016) investigated the general influence of BPN on school dropouts. Taylor et al. (2012) and Alivernini and Lucidi (2011) demonstrate a correlation of autonomy with school dropout intentions. Further research in this field has analyzed the association of autonomy and competence (combining them to a single factor of "autonomysupportive climate") with dropout risk (Gueta and Berkovich 2022). Hang et al. (2017) showed the relevance of autonomy for motivation and the effects of motivation and competence on dropout intention for first-year students of a vocational college in Vietnam.

Research on the association between BPN and student dropout in higher education is rare. Wild et al. (2023) reported further findings in their research on cooperative students in Germany, where relatedness directly affects dropout, and relatedness and autonomy indirectly affect dropout via subject interest in first-year students. Jeno et al.'s (2018) research in Norway with 754 biology students using a cross-sectional design found a negative association between perceived competence and intention to drop out, as well as autonomous motivation to drop out. Consistent with this, Teuber et al. (2021) found in a cross-sectional study of 477 participants in Germany that meeting the need for competence was associated with lower scores on intention to drop out of education.

The aspect of commitment to the company is frequently emphasized in research, as the average length of time employees stay with the company continues to fall, resulting in an increase in staff turnover (Brachle and Waples 2022). In line with Voigt and Jöns (2006), many suggestions have offered different definitions and typologies for (organizational) commitment. However, the three-component conceptualization by Meyer and Allen (1991, p. 61) has prevailed with the definition that "commitment, as a psychological state, has at least three separable components reflecting (a) a desire (affective commitment), (b) a need (continuance commitment), and (c) an obligation (normative commitment) to maintain employment in an organization." Voigt and Jöns (2006) emphasized the historical assumption that affective commitment is an emotional link or component to being in the company as a central aspect (Mowday et al. 1982); continuance commitment is a consideration that the cost of staying in the company is higher than leaving from the background of a side-bet conceptualization of Becker (1960); and in normative commitment, it is a moral obligation to stay in the company (Wiener 1982). The current educational research discusses the cost of low (organizational) commitment (Klaiber 2018). The three components of (organizational) commitment are seen as equally important in the theoretical context.

Empirical studies also underline the significance of these assumptions concerning organizational commitment. Meyer et al. (2002) presented results in a meta-analysis that affective commitment is associated more strongly with performance outcomes than the other two commitment components. In this research, demographic variables show low associations. Additional meta-analyses show an association between commitment and thriving at work (Kleine et al. 2019) as well as meaningful work (Allan et al. 2019).

Research on organizational commitment in cooperative education is rare. Pennaforte and Pretti (2015) demonstrate results from France using a quasi-experimental design to show that affective organizational commitment by students to the company is increased by (1) the socialization of the co-op students in the organization and (2) the support of the co-op students during their studies and after graduation by the supervisor and cooperative company. Wilder (2019) presents similar results in the United States, that mentored cooperative students showed higher organizational commitment and their intention to stay after graduation, if offered a full-time position, is higher. Further research in Germany pointed out that affective commitment to the cooperative company decreases faster in the academic field of economics than in engineering in the course of the study program (Wild et al. 2020). However, to the best of our knowledge, detailed analyses on associations between organizational commitment to the cooperative company and dropouts from the study program in cooperative education have not been done yet.

Cooperative education program in Germany

The beginning of cooperative education in Germany goes back to mid-1970 in Baden-Wuerttemberg and the establishment of the *Berufsakademie* (Huf 2004). This program was situated in the education system between higher education and VET with granted qualifications at the ISCED97 5B level (Wolter and Kerst 2015). In recent years,

differences between VET and higher education are increasingly dissolved by politics, with more persons getting university degrees (e.g., from recruiting academic workforce due to demographic decline or achieving a higher rate of first-year students while Germany has a low average rate compared to other countries in OECD; Nickel and Püttmann (2015); Wolter and Kerst 2015).

As a result, the *Berufsakademie* has transformed into universities of applied sciences or the Baden-Württemberg Cooperative State University (Duale Hochschule Baden-Württemberg; DHBW) in 2009 (Wolter and Kerst 2015). The German Council of Science and Humanities (2013) structured this education program by distinguishing between training-integrated (*ausbildungsintegrierend*; academic or/and vocational track, usually four years long) and practice-integrated (*praxisintegrierend*; academic degree based on an academic program with comprehensive phases of practical work and training in the company; e.g. at DHBW) cooperative education, whereby most of its courses of study can be assigned to practice integrated cooperative education programs (Wolter and Kerst 2015).

The cooperative study programs at DHBW are described according to Wild and Neef (2019). Each student has normally 3-month rotations of academic training at the university in small courses with approximately 30 students and workplace training at their corporate partner, mainly in the academic fields of economics, engineering, and social work. After six semesters, they could get 210 European Credit Transfer System points for a bachelor's degree. A precondition is a contract with a corporate partner. Cooperative students have the advantage of a monthly salary, even during the theoretical semesters, benefit of being a regular employee, official vacation, and insurance protection. This makes this education program attractive for students with low social background, such as in the academic field of economics (Kramer et al. 2011). The DHBW study program is also interesting for other countries like Thailand or China (Reinhard and Gerloff 2020).

Objective

The findings described above show that the dropout risk is highest in the first year of an education program at VET, higher education, or cooperative education. Furthermore, research presented in the previous chapter indicates that the reasons for dropping out of cooperative education can be seen from motivation perspective and by commitment to the company. Consequently, in our hypotheses, we investigate the BPN of SDT as a precondition of motivation and the approach of organizational commitment to the company as association variables on dropout in cooperative education.

Hypothesis 1 The three components of organizational commitment—affective, continuance, and normative commitment—are predictors that correlate with dropout from cooperative education.

Hypothesis 2 The three BPN—autonomy, competence, and relatedness—are predictors that are associated with dropout from cooperative education.

Research based on the model of the drop-out process from Heublein (2014) and empirical findings about dropping out presents further known predictors that are necessary to control in our research. We do this for the demographic variables of gender (male students have a higher dropout rate across a range of subjects; Kehm et al. 2019), age (younger students have a lower dropout risk; Kehm et al. 2019), and social background (students with higher social background have a lower dropout risk; Neugebauer et al. 2019). The academic field is seen as an important control variable because the dropout rate for science, technology, engineering, and mathematics (STEM) education is higher than for economics (Heublein et al. 2022). Furthermore, higher cognitive performance variables are associated with a lower dropout risk (Neugebauer et al. 2019). Fig. 2 presents a visualized overview of our research questions.

Methods

Participants and design

We used data from the panel study entitled "Study Process – Crossroads, Determinants of Success and Barriers during a Study at the DHBW" (Deuer and Meyer 2020). Participants were students enrolled at DHBW in their first academic year of a bachelor's program. In March 2019 (Wave 4), data were collected from an online questionnaire. Cooperative students had completed a three-month phase at the university as well as three months in practice at a cooperative partner at the time of data collection. We matched data from our survey with demographic and status data from the university's administration at the end of the same academic year (September 30, 2019).

Participants in the sample (N=2,263; included n=149 dropouts) have an average age of M=21.69 (SD=2.91) years with 1,239 male (52%) and 1,124 female (48%) students. We do not have any data on gender-diverse persons. About 42% of the students in the sample have an academic family background (\triangleq high social background; with dropout of n=49), meaning at least one parent has a university degree. In 58% of the students, both parents have no university degree (\triangleq low social background; with dropout of n=100). The distribution of participants by faculty shows that 63% are enrolled in economics (with dropout of n=84) and 37% in engineering (with dropout of n=65). Students in



Fig. 2 Hypothesized model. (adapted from Deuer and Wild 2018)

the academic field of social work at DHBW could not be included in this study because there were only four dropouts in our sample. Such a small sample size would be problematic for statistic estimators.

Our data show that more female students (z = -6.7) are enrolled in economics, whereas more male students are studying engineering (z=8.3). There is a significant effect size ($\chi^2(1)=230.32$, $p \le .001$, $\Phi=0.31$).

Measures

To analyze the quality of our psychometric instruments of organizational commitment and BPN, we used McDonald's omega to estimate reliability in our sample (McDonald 1999). A value of $\omega \ge 0.70$ is considered acceptable (Viladrich et al. 2017). These scales for organizational commitment and BPN use items with a 5-point Likert scale ranging from 1 (= strongly disagree) to 5 (= strongly agree).

Organizational commitment

We used the instrument by Felfe et al. (2002) to measure organizational commitment in our survey. The reliability of the scales for affective ($\omega = .88$; 5 Items; item sample: "I feel a strong sense of belonging to my organization") and normative commitment ($\omega = 0.78$; 5 Items; item sample: "I would not leave the organization now because I feel obliged to some of the people in it") is judged as good. However, the reliability of continuance commitment ($\omega = 0.66$; 4 Items; item sample: "Too much in my life would change if I left this organization now") is seen as problematic.

Basic psychological needs

In our research, the three basic psychological needs are measured by an adapted instrument from Kunter (2005). The reliability of the scale competence is seen as acceptable (ω =.72; six items; item sample: "In the theory phase, I am trusted with difficult tasks"). The measure of autonomy is seen as good (ω =0.79, six items; item sample: "In the theory phase, we are encouraged by the lecturers to find our own solutions"). Finally, the reliability of relatedness is seen as excellent in our sample (ω =0.90; four items; item sample: "In the theory phase, I feel I belong to the class").

Time until dropout

The information about the time until dropout for 149 persons in the first academic year in our data was given by the university administration. We integrated the exact day into our data. Consequently, we can calculate how many days the persons stay in a study program. The dichotomous values for dropout in our data are 0 (= no dropout) and 1 (= dropout).

Cognitive performance

In our research, we used grades provided by the university administration to operationalize cognitive performance. In the German education system, the university entrance qualification grades vary between 1 (the highest score, equivalent to a grade A in Great Britain and the United States) and 4 (the lowest passing score, equivalent to a grade E in Great Britain or a grade D in the United States). The university administration provided us with this performance data. For a better interpretation of our research, we recoded the data. Consequently, higher scores indicated better academic performance.

Data analyses and missing values

In the chapter 'descriptive results and bivariate analysis', we use SPSS (Version 29) to explore data in the sample. We see *skewness* values falling outside the range of -1 to +1 as problematic because normal distribution is not given (Hair et al. 2014). According to Agresti (2007), we report standardized residuals (z) to interpret the direction of the association in χ^2 -test. Pearson's r is interpreted as per Cohen (1988); values from r = .10 to 0.29 are seen as small, between r = .30 to 0.49 as medium, and $r \ge .50$ as large. The interpretation of Hedges g is same as Cohens d, with 0.20 to 0.49 representing small effect size, 0.50 to 0.79 as medium effect size, and above 0.80 as large effect size (Cohen 1988). In our data analysis, we see p-values of less than p < .05 (two-tailed) as statistically significant.

To analyze our hypotheses, we use event history analysis by cox regression (Schendera 2014; Ziegler et al. 2007) and the packages "survminer" (Kassambara et al. 2021) as well as "survival" (Therneau 2023) from the software R. The assumption of the cox regression is inspected using the suggested nonproportionality test by Grambsch and Therneau (1994), where nonsignificant results (p > .05) indicate that assumptions are hit. Mills (2011, p. 96) concludes different advantages of this method, like no particular probability distribution is needed. Furthermore, Mills (2011) summarizes that if the hazard ratio (*HR*) is above 1 and the confidence interval is entirely over 1, then the predictor increases the risk of the event. If the *HR* falls under 1 and the confidence interval is entirely below 1, then the predictor decreases the risk of the event.

There are missing values in our data. Variables have missing values between 2.3% and 29.2% (M = 14.79; SD = 11.64). In 1608 (68.05% of the sample) of 2363 cases and in 16,100 (85.22% of the sample) of 18,904 values, there are no missing values. A missing values analysis indicates that Little's (1988) test of missing completely at random (MCAR) is not significant ($\chi^2 = 84.47$, df = 73, p = .169). There is no evidence suggesting the data were not MCAR (Peugh and Enders 2004). Consequently, we replace the missing data with multiple imputations by chained equations of the R package "mice" with 20 imputations (van Buuren and Groothuis-Oudshoorn 2011).

Results

Descriptive results and bivariate analysis

Descriptive statistics and correlations (r) are presented in Table 1. It is noticeable that the mean of variable relatedness is M=4.23, indicating a ceiling-effect, and shows a slightly problematic *skew* = -1.33 as well as *kurtosis* = 2.23 for holding the assumption of normal distribution. Age shows *skew* = 4.14 as well as *kurtosis* = 33.41, which is seen as problematic for the assumption of normal distribution, too. However, by trying various transformations for age, such as a logarithmization, no acceptable result is achieved, so we do not transform here. Furthermore, a large correlation between autonomy and competence (r=.68) exists that could lead to the same problems for multicollinearity in regression analysis (e.g., in cox regression; Schendera 2014).

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1. Affective commitment	I													
2. Continuance commitment	0.05	*	I											
3. Normative commitment	0.15	***	0.39	***	I									
4. Autonomy	0.11	***	0.02		0.00	I								
5. Competence	0.15	***	0.02		0.04	0.68	***	I						
6. Relatedness	0.16	***	- 0.04	#	- 0.04	0.29	***	0.37	***	I				
7. UEQG	0.08	***	- 0.01		- 0.04	- 0.10	***	- 0.06	**	- 0.03		I		
8. Age	- 0.05	*	0.03		- 0.01	0.04	*	0.02		- 0.04	#	- 0.37	***	I
M	3.38		3.25		3.86	3.38		3.65		4.23		3.84		21.69
SD	0.87		0.91		0.82	0.74		0.63		0.75		0.60		2.91
Skew	- 0.31		- 0.33		- 0.71	- 0.33		- 0.41		- 1.33		- 0.18		4.14
Kurtosis	- 0.21		- 0.35		0.23	0.17		0.38		2.23		- 0.63		33.41
N = 2363. Variables ranging from 1 (: 11FOG – university entrance gualifies	= strongly disa	gree) to 5 (= < 10 ^{. *} n < 1	= strongly agree). Universit	y entrance qua	lification grad	e ranges fro	m 2 (=lowest p	erformanc	e) to 5 (=best p	erformanc	e). Age vary betv	/een 18 an	d 60 years.

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Table 2 shows a descriptive comparison between the groups that did and did not dropout. The *t*-tests are used for further analysis. The results show higher scores for persons that didn't dropout with significant medium effect size of relatedness (t(159.78) = 5.36, $p \le .001$, g = 0.57) and competence (t(160.55) = 5.16, $p \le .001$, g = 0.54). A significant small effect size and higher scores for persons that didn't dropout exist for affective commitment (t(159.80) = 4.33, $p \le .001$, g = 0.46), university entrance qualification grade (t(2361) = 4.53, $p \le .001$, g = 0.38), and autonomy (t(163.56) = 3.39, $p \le .001$, g = 0.32).

There is an association between dropout and social background (χ^2 (1) = 5.21, *p* = .022, $\Phi = 0.05$). Persons with a high social background have a lower risk of dropout (*z* = -1.7) compared to low social background (*z*=1.4). No associations exist for dropout based on academic field (χ^2 (1)=3.09, *p*=.079, Φ =0.04) and gender (χ^2 (1)=1.78, *p*=.182, Φ =0.03).

Testing the hypotheses

In the first step, we analyze the precondition of the estimated cox regression model in Fig. 3 through inspecting the testing for nonproportional hazards. The global test for this model is not significant (χ^2 (11) = 15.52, p = .160), so assumptions for estimating cox regression are given. Specific tests for variables in the model show no significant results, except the test for autonomy is significant (χ^2 (1)=7.43, p=.006) and is seen as problematic for this variable.

Figure 3 presents the results for the estimated cox model. According to hypothesis 1 on organizational commitment, affective commitment shows a negative significant association (HR = 0.68; $p \le .001$), which means that the dropout risk decreases by 32% when affective commitment increases by one unit. From the background of hypothesis 2 on BPN, competence (HR = 0.57; $p \le .001$) and relatedness (HR = 0.70; p = .001) are significant predictors, too. Furthermore, age (HR = 0.89; $p \le .001$) and university entrance qualification grade (HR = 0.46; $p \le .001$) show significant negative correlation, and consequently, younger persons and lower university entrance qualification grades have a higher dropout risk. The hazard ratio of 0.67 in the academic field of economics indicates a 33% reduction in the dropout risk compared to engineering. In other words, engineering has a 49% higher risk of dropout. Finally, a high social background is a significant

	es between groe	xp3 (// = 2303)		
	Dropout		No dropout	
	Μ	SD	Μ	SD
Affective commitment	3.51	1.05	3.89	0.80
Continuance commitment	3.38	0.99	3.38	0.86
Normative commitment	3.28	0.91	3.25	0.91
Autonomy	3.15	0.83	3.39	0.73
Competence	3.34	0.78	3.68	0.62
Relatedness	3.83	0.96	4.26	0.73
University entrance qualification grade	3.62	0.65	3.85	0.59
Age	21.42	2.58	21.70	2.93

Table 2 Comparing descriptive statistics between groups (N = 2363)

n(Dropout) = 149, n(No dropout) = 2,214. Variables ranging from 1 (= strongly disagree) to 5 (= strongly agree). University entrance qualification grade ranges from 2 (= lowest performance) to 5 (= best performance). Age vary between 18 and 60 years



Fig. 3 Forest Plot for Cox proportional hazards model from influence factors on dropout in cooperative education in first academic year (N = 2,263; included n = 149 dropouts; UEQG = university entrance qualification grade; Economy with reference category Engineering; Female with reference category male; Social background high with reference category Social background low)



Days until Dropout

Fig. 4 Estimated function of probability for staying at university in academic field Engineering (total n = 872; with dropout of n = 65) and Economy (total n = 1,491; with dropout of n = 84). Caution y-axis starts not at 0%

predictor (HR = 0.63; p = .008), which indicates persons with a lower social background have a higher dropout risk in our sample. The two survival curves for academic fields (Fig. 4) and social background (Fig. 5) from this cox regression are discussed next.

We obtained information on the exact day of dropout after our survey was done in March 2019 until the end of September 2019 in the first academic year of the participants. Consequently, we can analyze significant control variables for academic fields and social background of the cox regression in Figs. 4 and 5 for dropout over this period. The survival curves for the two academic fields (Fig. 4) show a relatively equal progression approximately until two-thirds through the first academic year. From this time point on, the engineering curve declines faster than that for economics. The two survival curves



Fig. 5 Estimated function of probability for staying at university with low social background (total n = 1,375; with dropout of n = 100) and high social background (total n = 988; with dropout of n = 49). Caution y-axis starts not at 0%

for social background (Fig. 5) show that the curve of low social background is always below that of high social background. It also appears that the two curves increasingly drift apart as time goes on.

Discussion

Our research aims to identify dropout predictors in cooperative education programs because dropping out is a problem in this study format (Nickel et al. 2022). There are some serious consequences for companies (Deuer 2003), higher education institutions (Klein and Stocké 2016), and the persons who drop out (Neugebauer et al. 2019). A well-elaborated framework for dropout in cooperative education does not exist. Frameworks in higher education concerning dropout, like Heublein (2014), Tinto (1975), or Bean and Metzner (1985), only look at the academic perspective and do not consider the work-place perspective. Consequently, we have taken this into account following VET frameworks, like Krötz and Deutscher (2022). In our research, we focus on the first academic year because the dropout risk at this point in time is highest in higher education programs (Chen 2012; Wild and Schulze Heuling 2020).

Two hypotheses are tested in our research on the prediction of dropout in cooperative education: organizational commitment in hypothesis 1 (Meyer and Allen 1991) and satisfying BPN at university in hypothesis 2 (Ryan and Deci 2017). According to hypothesis 1, we can confirm the correlation between affective commitment to the company and reduced dropout. This result is in line with the current empirical and theoretical state of research, that organizational commitment predicts performance and dropout (Kuusio et al. 2010; Meyer and Allen 1991; Meyer et al. 2002; Riketta 2002). According to SDT (Ryan and Deci 2017), we can confirm hypothesis 2 that satisfying the two BPN of competence and relatedness reduces dropout. These findings exist in previous research, like Wild et al. (2023) and Teuber et al. (2021), and confirm the theoretical framework. However, when looking at the empirical research findings on the three BPN on dropout, it is important to note there is no consistency of elaborated single influence factors of BPN on dropout but rather differences across studies. In other words, the same BPN factors do not always influence student dropout. One reason for the tendency that not all three components of BPN or (organizational) commitment get significant in our research could be period or cohort effects (Bell 2021). A cohort effect is possible when, for example, a new examination regulation begins, restrictions on entry change (e.g. Numerus clausus), new lecture rooms are used or the head of the degree program changes temporarily. A period effect could be external influences, such as the emerging Fridays for Future movement in 2018. These reasons of possible cohort or period effects can change the values and attitudes of students. Consequently, the postulated associations do not exist, because of bias in the sample or other associations cause a lower correlation for the postulated association. However, it is not possible to analyze this with our cross-sectional data. Another reason for this result could be that the cooperative students started the theory and practice phase at different times.

Furthermore, our research confirms the assumed association direction for the control variables. The current state of research shows that for the academic field, engineering has a higher risk of dropout than economics (Heublein et al. 2022); for social background, lower social background has a higher dropout risk (Neugebauer et al. 2019); and for cognitive performance, higher performance reduced the dropout risk (Neugebauer et al. 2019). The significant correlation of age in our study is negative and opposite to the current state of research in higher education, where positive predictors were found (Kehm et al. 2019). It is possible that younger cooperative students still have several study alternatives and, therefore, more often opt for a different subject or study format after a few months of cooperative study. Consequently, these would tend to be "disappointed" dropouts, not those who drop out of their studies for reasons of performance or stress.

Based on the theoretical perspectives, it must be noted that research on the model of the dropout process from Heublein (2014) can be applied in many perspectives and ways. Our research has highlighted the motivational development aspect and the focus on SDT. The results of our research support this model based on our associations of BPN and dropout (Hypothesis 2). However, the model of the dropout process from Heublein (2014) does not address the perspective of cooperative partners, and consequently, we have to refer to the work of Deutschers' research group (Krötz and Deutscher 2022) to address the horizontal perspective of dropout, in detail company change of persons in education programs. Analysed association between organizational commitment and dropout supports the assumption of the model from Krötz and Deutscher (2022).

After all, we can summarize that focusing on only one perspective in the case of dropouts in cooperative education, like workplace or academic perspective, is important but not enough. Our empirical analysis underlines that dropout is a developing process with many predictors influencing it (Bäulke et al. 2021; Heublein 2014). We elaborate on the importance in our research of the framework of organizational commitment and SDT. However, further perspectives, like society or labor market aspects, must be considered in research on dropout.

From the background of our research, several practical implications are suggested. We see a first possibility to improve organizational commitment by installing support through a supervisor (Pennaforte and Pretti 2015) or mentoring programs (Wilder 2019). A second suggestion is to strengthen instruction quality, such as by offering didactic training to raise teachers' awareness of BPN (Wild et al. 2023). Wild and Grassinger (2023) underline the importance because they present results that instruction quality influences dropout mediated by motivation. A third suggestion from the background of the significant negative predictor of relatedness on dropout highlighted that supporting students in their academic and social integration is essential. There are approaches and arrangements to integrate students (Wild et al. 2023), like remediation (Bettinger and Long 2009; Tieben 2019), attending to the composition of groups in teaching courses (Booij et al. 2017), and academic advising (Kot 2014).

Our research has several strengths. We can test the theoretical frameworks of organizational commitment and SDT on the population of cooperative education. So, we show the robustness of these frameworks. Moreover, these frameworks fit into the research gap of cooperative education, where few studies exist (Weich et al. 2017). Furthermore, we research a growing population that has nearly doubled in the last decade (between 2012 and 2022) to approximately 120,000 cooperative students in Germany (Hofmann 2023). A further positive aspect is that we use data from the university administration, so we can reduce measurement errors and effects of social desirability. Our data collection was done in 2019, and consequently, our data are not biased by the COVID-19 pandemic. We can collect data before dropout happens and do no retrospective survey. Finally, we research the first academic year, where the dropout risk is highest and heavily discussed (Chen 2012; Grassinger 2018; Schneider 2010; Willcoxson et al. 2011).

Our research has limitations. We use data from only one university with 12 campuses in one federal state of Germany and not from many different higher education institutions, like Krone et al. (2019). Consequently, the generalizability from our sample to all cooperative students is problematic. Furthermore, the high correlation of r = .68between autonomy and competence is seen as problematic because of possible multicollinearity in cox regression as well as a test for nonproportional hazards, which shows that holding the assumption for autonomy in cox regression is problematic. This situation could have the consequence that autonomy is not a significant predictor of dropout in the cox regression. Measures of continuance commitment ($\omega = 0.66$) and the BPN of competence ($\omega = 0.72$) are seen as not ideal. Consequently, these measurement instruments should be analyzed in more detail, reflected upon, or further developed in the future. The reasons for the methodological problems in BPN measurement may be due to the specific subpopulation of cooperative students. It is possible that a bias exists for the reason that cooperative partners selected the students, or because of the rotation of theoretical and practical phases. An alternative instrument for BPN could be Rackow et al. (2013). Another weakness is that measurement of organizational commitment and BPN occurred only once for each person. Longitudinal data have advantages for researching a higher quality level, such as modeling processes or giving a first indication of causality. We emphasize here that no causality conclusion is possible based on our research. Furthermore, our sample was not large enough to analyze data from the academic field of social work, whose students are also enrolled at DHBW. We are only able

to do research based on the binary gender of male as well as female students, and not on the category diverse in our analysis. Finally, we have not replicated our research on subsequent study cohorts, which is necessary for the robustness of the results.

Our results raise new research questions. Generally, researchers should take the change of analyzing influence factors on the dropout process, like for the model of Bäulke et al. (2021). The motivation aspect-like the framework of situated expectancy-value theory (SEVT) by Eccles and Wigfield (2020) with the three detailed value components of effort, opportunity, and emotional cost (Flake et al. 2015)-is seen as important (Schnettler et al. 2020). Another research gap is seen in analyzing factors for changing the study program and staying in the same cooperative company or changing the cooperative company and staying in the same study program. Research in higher education shows that dropout reasons and reasons for changing a study program vary, particularly motivational aspects (Blüthmann et al. 2012; Spiess 1997). In line with Böhn and Deutscher (2022), it is necessary to analyze dropout from a different perspective, like students or companies, and analyze the effects of elaborated prevention programs. Research should further investigate, if the sequence of theory and workplace phases has an effect on academic success combined with motivational aspects. In addition, the question of the effect of theory-practice linkage as well as special learning content areas dependent on the academic field, like math or communication skills, on study success is another important topic to explore. Finally, a well-developed theoretical framework on dropout in cooperative education should be established to enable researchers to address this issue.

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Availability of data and materials

Data and syntax are available. Please contact the corresponding author.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and its later amendments or comparable ethical standards. It was approved by Baden-Wuerttemberg Cooperative State University (8th July 2015) and local heads of the research groups for ethical standards. All the subjects gave their digital informed consent.

Informed consent

Informed consent was obtained from all students who participated in the study prior to their completion of the research questionnaires.

Competing interests

The authors declare that they have no competing interests.

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References

Agresti A (2007) An introduction to categorical data analysis, 2nd edn. John Wiley & Sons, New Jersey Alivernini F, Lucidi F (2011) Relationship between social context, self-efficacy, motivation, academic achievement, and intention to drop out of high school: a longitudinal study. J Educ Res 104(4):241–252. https://doi.org/10.1080/ 00220671003728062 Allan BA, Batz-Barbarich C, Sterling HM, Tay L (2019) Outcomes of meaningful work: a meta-analysis. J Manage Stud 56(3):500–528. https://doi.org/10.1111/joms.12406

Bäulke L, Grunschel C, Dresel M (2021) Student drop out at university: a phase-orientated view on quitting studies and changing majors. Eur J Psychol Educ 37:853–876. https://doi.org/10.1007/s10212-021-00557-x

Bean JP, Metzner BS (1985) A conceptual model of nontraditional undergraduate student attrition. Rev Educ Res 55(4):485–540. https://doi.org/10.2307/1170245

Becker HS (1960) Notes on the concept of commitment. Am J Sociol 66:32–40. https://doi.org/10.1086/222820
Beekhoven S, De Jong U, Van Hout H (2002) Explaining academic progress via combining concepts of integration theory and rational choice theory. Res High Educt 43:577–600. https://doi.org/10.1023/A:1020166215457

Bell A (2021) Age, period and cohort effects. Statistical analysis and the identification problem. Routledge, London Benden DK, Lauermann F (2022) Students' motivational trajectories and academic success in math-intensive study

programs: why short-term motivational assessments matter. J Educ Psychol 114(5):1062–1085. https://doi.org/ 10.1037/edu0000708

Bettinger E, Long B (2009) Addressing the needs of under-prepared college students: does college remediation work? J Hum Resour 44(3):736–771. https://doi.org/10.3368/jhr.44.3.736

Blüthmann I, Lepa S, Thiel F (2008) Studienabbruch und -wechsel in den neuen bachelorstudiengängen: untersuchung und analyse von abbruchgründen. Z für Erziehungswissensch 11(3):406–429. https://doi.org/10.1007/ s11618-008-0038-y

Blüthmann I, Lepa S, Thiel F (2012) Überfordert, enttäuscht, verwählt oder strategisch? Eine typologie vorzeitig exmatrikulierter bachelorstudierender. Z für Pädagogik 58(1):89–108. https://doi.org/10.25656/01:10497

Böhn S (2020) Training quality and premature termination of apprenticeship contract—conceptualization, operationalization and measurement. Dissertation, University of Mannheim

Böhn S, Deutscher V (2022) Dropout from initial vocational training—a meta-synthesis of reasons from the apprentice's point of view. Educ Res Rev 35:100414. https://doi.org/10.1016/j.edurev.2021.100414

Booij A, Leuven E, Oosterbeeck H (2017) Ability peer effects in university: evidence from a randomized experiment. Rev Econ Stud 84:547–578. https://doi.org/10.1093/restud/rdw045

Bourdieu P (1980) Le Sens pratique. Minuit, Paris

Brachle BJ, Waples CJ (2022) CSR and affective organizational commitment: a moderated mediation model exploring the roles of prestige and psychosocial development. Curr Psychol. https://doi.org/10.1007/s12144-022-03970-7

Brändle T, Kugler P, Zühlke A (2021) Individuelle erträge eines dualen studiums. Z für Erziehungswissensch 24:1007–1032. https://doi.org/10.1007/s11618-021-01028-1

Chen R (2012) Institutional characteristics and college student drop out risks: a multilevel event history analysis. Res High Educt 53(5):487–505. https://doi.org/10.1007/s11162-011-9241-4

Cohen J (1988) Statistical power analysis, 2nd edn. Erlbaum, New York

Coll R, Zegwaard KE (eds) (2011) International handbook for cooperative and work-integrated education: international perspectives of theory, research and practice, 2nd edn. World Association for Cooperative Education (WACE), Toronto

Deuer E (2003) Abbruchneigung erkennen - Ausbildungsabbrüche verhindern. ibv 25:20–26

Deuer E, Wild S (2018) Studienbedingungen und Studienabbruchneigung – ein Erklärungsmodell. Forschungsbericht 5/2018. Duale Hochschule Baden-Württemberg. http://www.dhbw.de/studie.html. Accessed 27 Mar 2023

Deuer E, Wild S (2019) Messinstrument zur Identifikation von Studienabbruchneigung im dualen Studium (MIS-ANDS). Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS). https://doi.org/10.6102/zis265

Deuer E, Meyer T (2020) Studienverlauf und Studienerfolg im Kontext des dualen Studiums. Ergebnisse einer Längsschnittstudie. WBV, Bielefeld

Eccles JS, Wigfield A (2020) From expectancy-value theory to situated expectancy-value theory: a developmental, social cognitive, and sociocultural perspective on motivation. Contemp Educ Psychol 61:101859. https://doi. org/10.1016/j.cedpsych.2020.101859

Federal Institute for Population Research (= Bundesinstitut für Bevölkerungsforschung) (2021) Ausbildungs- und Studienanfänger. Federal Institute for Population Research. https://www.demografie-portal.de/DE/Fakten/ ausbildung-studium-anfaenger.html. Accessed 27 Mar 2023

Federal Institute for Vocational Education and Training (= Bundesinstitut für Berufsbildung) (2022) Datenreport Zum Berufsbildungsbericht 2022. Bundesinstitut für Berufsbildung, Bonn

Federal Statistical Office of Germany (= Statistisches Bundesamt) (2022) Bildung Und Kultur. Studierende an Hochschulen. Wintersemester 2021/2022. Fachserie 11 Reihe 4.1. Statistisches Bundesamt, Wiesbaden

Felfe J, Six B, Schmook R, Knorz C (2002) Commitment Organisation, Beruf Und Beschäftigungsform (COBB). Zusammenstellung sozialwissenschaftlicher items und Skalen (ZIS). 10.6102/zis9

Flake JK, Barron KE, Hulleman C, McCoach BD, Welsh ME (2015) Measuring cost: the forgotten component of expectancy-value theory. Contemp Educ Psychol 41:232–244. https://doi.org/10.1016/j.cedpsych.2015.03.002

Fleischer J, Leutner D, Brand M, Fischer H, Lang M, Schmiemann P, Sumfleth E (2019) Prediction of student drop-out in STEM study programs. Z für Erziehungswissensch 22(2):1077–1097. https://doi.org/10.1007/ s11618-019-00909-w

German Council of Science and Humanities (= Wissenschaftsrat) (2013) Empfehlungen Zur Entwicklung Des Dualen Studiums. German Council of Science and Humanities, Köln

Graf L (2013) The hybridization of vocational training and higher education in Austria, Germany, and Switzerland. Budrich UniPress, Leverkusen. https://doi.org/10.3224/86388043

Grambsch P, Therneau T (1994) Proportional hazards tests and diagnostics based on weighted residuals. Biometrika 81(3):515–526. https://doi.org/10.2307/2337123

Grassinger R (2018) Unfulfilled expectancies for success, unfulfilled study values and their relevance for changes in achievement motivation, achievement emotions and the intention to drop out in the first semester of a degree program. Z für Empirische Hochschulforschung 2(1):23–39. https://doi.org/10.3224/zehf.v2i1.02

Gueta B, Berkovich I (2022) The effect of autonomy-supportive climate in a second chance programme for at-risk youth on dropout risk: the mediating role of adolescents' sense of authenticity. Eur J Psychol Educ 37:85–100. https://doi.org/10.1007/s10212-021-00542-4

Hair JF, Black WC, Babin BJ, Anderson RE (2014) Multivariate data analysis, 7th edn. Pearson, Harlow

- Hang BTT, Kaur A, Nur AHB (2017) A self-determination theory based motivational model on intentions to drop out of vocational schools in Vietnam. Malays J Learn Instr 14(1):1–21. https://doi.org/10.32890/mjli2017.14.1.1
- Heublein U (2014) Student drop-out from German higher education institutions. Eur J Educ 49(4):497–513. https://doi. org/10.1111/ejed.12097
- Heublein U, Hutzsch C, Schmelzer R (2022) Die entwicklung der studienabbruchquoten in Deutschland (DZHW brief 05|2022). Deutsches Zentrum für Hochschul- und Wissenschaftsforschung Hannover. https://doi.org/10.34878/2022.05.dzhw_brief

Hofmann S (2023) AusbildungPlus. Duales Studium in Zahlen 2022. Trends Und Analysen. Verlag Barbara Budrich

- Huf S (2004) Career success despite or because of the berufsakademie. The impact of higher education on professional careers. German J Res Hum Resource Manage 18(1):64–82. https://www.jstor.org/stable/23277838 . Accessed 27 Mar 2023
- Isleib S, Woisch A, Heublein U (2019) Causes of higher education dropout: theoretical basis and empirical factors. Z für Erziehungswissenschaft 22:1047–1076. https://doi.org/10.1007/s11618-019-00908-x
- Janke S, Messerer LAS, Merkle B, Krille C (2021) STUWA: ein multifaktorielles inventar zur erfassung von studienwahlmotivation. Z für Pädagogische Psychol 37(3):215–231.
- Jeno LM, Danielsen AG, Raaheim A (2018) A prospective investigation of students' academic achievement and dropout in higher education: a self-determination theory approach. Educational Psychol 38(9):1163–1184. https://doi.org/ 10.1080/01443410.2018.1502412
- Kassambara A, Kosinski M, Biecek P (2021) survminer: Drawing Survival Curves using 'ggplot2'. R package version 0.4.9. https://CRAN.R-project.org/package=survminer. Accessed 27 Mar 2023
- Kehm BM, Larsen MD, Sommersel HB (2019) Student drop out from universities in Europe: a review of empirical literature. Hung Educ Res J 9(2):147–164. https://doi.org/10.1556/063.9.2019.1.18
- Klaiber S (2018) Organisationales Commitment. Der Einfluss lernförderlicher Aspekte Bei Der Arbeit Auf die Mitarbeiterbindung. Springer, Wiesbaden
- Klein D, Stocké V (2016) Studienabbruchquoten als Evaluationskriterium Und Steuerungsinstrument Der Qualitätssicherung Im Hochschulbereich. In: Großmann D, Wolbring T (eds) Evaluation Von Studium Und Lehre. Grundlagen, methodische Herausforderungen Und Lösungsansätze. Springer, Wiesbaden. https://doi.org/10.1007/978-3-658-10886-1_10
- Kleine AK, Rudolph CW, Zacher H (2019) Thriving at work: a meta-analysis. J Organizational Behav 40(9–10):972–999. https://doi.org/10.1002/job.2375
- Kot FC (2014) The impact of centralized advising on first-year academic performance and second-year enrollment behavior. Res High Educt 55:527–563. https://doi.org/10.1007/s11162-013-9325-4
- Kramer J, Nagy G, Trautwein U, Lüdtke O, Jonkmann K, Maaz K, Treptow R (2011) Die Klasse an die Universität, die Masse an die anderen Hochschulen? Wie Sich Studierende Unterschiedlicher Hochschultypen unterscheiden. Z für Erziehungswissenschaft 14(3):465–487. https://doi.org/10.1007/s11618-011-0213-4
- Krone S, Nieding I, Ratermann-Busse M (2019) Dual Studieren—Und Dann? Hans-Böckler-Stiftung, Düsseldorf
- Krötz M, Deutscher V (2022) Drop–out in dual VET: why we should consider the drop–out direction when analyzing drop–out. Empir Res Vocat Educ Train 14:1. https://doi.org/10.1186/s40461-021-00127-x
- Kuh GD, Kinzie J, Buckley JA, Bridges BK, Hayek JC (2006) What matters to student success: a review of the literature (commissioned report for the national symposium on postsecondary student success: spearheading a dialog on student success). National Postsecondary Education Cooperative, Washington
- Kunter M (2005) Multiple ziele Im Mathematikunterricht. Waxmann, Münster
- Kupfer F (2013) Duale Studiengänge aus Sicht Der Betriebe—Praxisnahes Erfolgsmodell Durch Bestenauslese. Z Berufsbildung Wissenschaft Und Praxis 42(4):25–29
- Kuusio H, Heponiemi T, Sinervo T, Elovainio M (2010) Organizational commitment among general practitioners: a crosssectional study of the role of psychosocial factors. Scand J Prim Health Care 28(2):108–114. https://doi.org/10. 3109/02813431003779647
- Larsen MR, Sommersel HB, Larsen MS (2013) Evidence on drop out phenomena at universities. Danish Clearinghouse for Educational Research, Copenhagen
- Little RJ (1988) A test of missing completely at random for multivariate data with missing values. J Am Stat Assoc 83:1198–1202. https://doi.org/10.1080/01621459.1988.10478722
- McDonald RP (1999) Test theory: a unified treatment. Lawrence Erlbaum, New York
- Meyer JP, Allen NJ (1991) A three-component conceptualization of organizational commitment. Hum Resour Manage Rev 1(1):61–89. https://doi.org/10.1016/1053-4822(91)90011-z
- Meyer JP, Stanley DJ, Herscovitch L, Topolnytsky L (2002) Affective, continuance, and normative commitment to the organization: a meta-analysis of antecedents, correlates, and consequences. J Vocat Behav 61(1):20–52. https://doi.org/10.1006/jvbe.2001.1842
- Mills M (2011) Introducing survival and event history analysis. SAGE, London
- Mowday R, Porter L, Steers R (1982) Employee—organization linkages: the psychology of commitment, absenteeism, and turnover. Academic Press, New York
- Neugebauer M, Heublein U, Daniel A (2019) Studienabbruch in Deutschland: Ausmaß, Ursachen, Folgen, Präventionsmöglichkeiten. Z für Erziehungswissenschaft 22:1025–1046. https://doi.org/10.1007/s11618-019-00904-1
- Nextcareer (n.d.) Studienzweifel und Beratung an den Hochschulen in Nordrhein-Westfalen. Retrieved from https://nextcareer.de/ueber-das-projekt/studie-zum-thema-studienzweifel-und-beratung/. Accessed 06 Sep 2023
- Nickel S, Püttmann V (2015) Erfolgsfaktoren für die durchlässigkeit zwischen beruflicher und akademischer bildung am beispiel des studierens ohne abitur. In: Esholz U (ed) Beruflich qualifizierte im studium. Analysen und Konzepte zum Dritten Bildungsweg. WBV, Bielefeld

Nickel S, Pfeiffer I, Fischer A, Hüsch M, Kiepenheuer-Drechsler B, Lauterbach N, Reum N, Thiele A-L, Ulrich S (2022) Duales Studium: Umsetzungsmodelle Und Entwicklungsbedarfe. WBV, Bielefeld

Pennaforte A, Pretti TJ (2015) Developing the conditions for co-op students' organizational commitment through cooperative education. Asia-Pac J Coop Educ 16(1):39–51

Peugh JL, Enders CK (2004) Missing data in educational research: a review of reporting practices and suggestions for improvement. Rev Educ Res 74(4):525–556. https://doi.org/10.3102/00346543074004525

Rackow P, Scholz U, Hornung R (2013) The German psychological need satisfaction in exercise scale: validation of a measure of need satisfaction in exercise. Swiss J Psychol 72(3):137–148. https://doi.org/10.1024/1421-0185/a000107

Reinhard K, Gerloff A (2020) Internationalizing cooperative education: implementing the German DHBW model in Thailand and China. Int J Work-Integrated Learn 21(3):289–301

Ricard NC, Pelletier LG (2016) Dropping out of high school: the role of parent and teacher self-determination support, reciprocal friendships and academic motivation. Contemp Educ Psychol 44–45:32–40. https://doi.org/10.1016/j. cedpsych.2015.12.003

Richardson M, Abraham C (2009) Conscientiousness and achievement motivation predict performance. Eur J Pers 23(7):589–605. https://doi.org/10.1002/per.732

Richardson M, Abraham C, Bond R (2012) Psychological correlates of university students' academic performance: a systematic review and meta-analysis. Psychol Bull 138:353–387. https://doi.org/10.1037/a0026838

Riketta M (2002) Attitudinal organizational commitment and job performance: a meta-analysis. J Organ Behav 23:257–266. https://doi.org/10.1002/job.141

Ryan RM, Deci EL (2017) Self-determination theory. Basic psychological needs in motivation, development, and wellness. Guilford Press, New York

Sarcletti A, Müller S (2011) Zum stand der studienabbruchforschung. Theoretische perspektiven, zentrale ergebnisse und methodische anforderungen an künftige studien. Z für Bildungsforschung 1:235–248. https://doi.org/10.1007/s35834-011-0020-2

Schendera CFG (2014) Regressionsanalyse mit SPSS, 2nd edn. De Gruyter, Berlin

Schneider M (2010) Finishing the first lap: the cost of first-year student attrition in America's Four-Year Colleges and Universities. American Institutes for Research, Arlington. https://www.air.org/sites/default/files/AIR_Schneider_Finis hing_the_First_Lap_Oct101.pdf. Accessed 27 Mar 2023

Schneider M, Preckel F (2017) Variables associated with achievement in higher education: a systematic review of metaanalyses. Psychol Bull 143:565–600. https://doi.org/10.1037/bul0000098

- Schnettler T, Bobe J, Scheunemann A, Fries S, Grunschel C (2020) Is it still worth it? Applying expectancy–value theory to investigate the intraindividual motivational process of forming intentions to drop out from university. Motiv Emot 44:491–507. https://doi.org/10.1007/s11031-020-09822-w
- Sheldon KM, Prentice M (2019) Self-determination theory as a foundation for personality researchers. J Pers 87(1):5–14. https://doi.org/10.1111/jopy.12360

Spady WG (1970) Dropouts from higher education: an interdisciplinary review and synthesis. Interchange 1:64–85. https://doi.org/10.1007/BF02214313

Spiess C (1997) Studienfachwechsel. Rüegger Verlag, Glarus und Chur, Ausmaß, Bedingungen Und Folgen

Taylor G, Lekes N, Gagnon H, Kwan L, Koestner R (2012) Need satisfaction, work-school interference and school dropout: an application of self-determination theory. Br J Educ Psychol 82(4):622–646. https://doi.org/10.1111/j.2044-8279. 2011.02050.x

Teuber Z, Jia H, Niewöhner T (2021) Satisfying students' psychological needs during the COVID-19 outbreak in German higher education institutions. Front Educ 6:679695. https://doi.org/10.3389/feduc.2021.679695

Therneau T (2023) A package for survival analysis in R. R package version 3.5-0. https://CRAN.R-project.org/package= survival. Accessed 27 Mar 2023

Tieben N (2019) Remedy mathematics course participation and dropout among higher education students of engineering. Z Für Erziehungswissensch 22:1175–1202. https://doi.org/10.1007/s11618-019-00906-z

Tinto V (1975) Dropout from higher education: a theoretical synthesis of recent research. Rev Educ Res 45(1):89–125. https://doi.org/10.3102/00346543045001089

van Buuren S, Groothuis-Oudshoorn K (2011) Mice: multivariate imputation by chained equations in R. J Stat Softw 45(3):1–67. https://doi.org/10.18637/jss.v045.i03

Viladrich C, Angulo-Brunet A, Doval E (2017) A journey around alpha and omega to estimate internal consistency reliability. Ann Psychol 33(3):755–782. https://doi.org/10.6018/analesps.33.3.268401

Voigt A, Jöns I (2006) Multiples commitment als erweiterung bestehender konzepte Der mitarbeiterbindung? Mannheimer Beiträge Zur Wirtschafts- Organisationspsychol 1:3–9

von Maurice J, Dörfler T, Artelt C (2014) The relation between interests and grades: path analyses in primary school age. Int J Educ Res 64:1–11. https://doi.org/10.1016/j.ijer.2013.09.011

Weich M, Kramer J, Nagengast B, Trautwein U (2017) Differences in study entry requirements for beginning undergraduates in dual and non-dual study programs at bavarian universities of applied sciences. Z Für Erziehungswissensch 20:305–332. https://doi.org/10.1007/s11618-016-0717-z

Weiß R (2016) Duale Studiengänge—Verzahnung beruflicher und akademischer Bildung. In: Faßhauer U, Severing E (eds) Verzahnung beruflicher und akademischer Bildung. Duale Studiengänge in Theorie Und Praxis. Bundesinstitut für Berufsbildung, Bonn

Wiener Y (1982) Commitment in organization: a normative view. Acad Manage Rev 7(3):418–428. https://doi.org/10. 2307/257334

Wilder CW (2019) The Effects of Mentoring Program Type on Organizational Commitment for Cooperative Education Students (Publication No. 22584768). Dissertation, Mississippi State University

Willcoxson L, Cotter J, Joy S (2011) Beyond the first-year experience: the impact on attrition of student experiences throughout undergraduate degree studies in six diverse universities. Stud High Educ 36(3):331–352. https://doi.org/10.1080/03075070903581533

- Wild S, Neef C (2019) The role of academic major and academic year for self-determined motivation in cooperative education. Industry and Higher Education 33(5): 327–339. https://doi.org/10.1177/0950422219843261
- Wild S, Rahn S, Meyer T (2020) Gut gebunden oder Loslösung auf Zeit? Zur Entwicklung des affektiven Commitments von dual Studierenden unter längsschnittlicher Betrachtung. Zeitschrift für Soziologie der Erziehung und Sozialisation 40(4):312–334.
- Wild S, Grassinger R (2023, online first) The importance of perceived quality of instruction, achievement motivation and difficulties in self-regulation for students who drop out of university. Br J Educ Psychol 00:1–15. https://doi.org/10. 1111/bjep.12590
- Wild S, Schulze Heuling L (2020, online first) Student Drop out and Retention: An Event History Analysis among Students in Cooperative Higher Education. International Journal of Educational Research 104. https://doi.org/10.1016/j.ijer. 2020.101687
- Wild S, Rahn S, Meyer T (2023) The relevance of basic psychological needs and subject interest as explanatory variables for student dropout in higher education a German case study using the example of a cooperative education program. Eur J Psychol Educ. Advance online publication: https://doi.org/10.1007/s10212-022-00671-4
- Wolter A (2016) Der Ort Des Dualen Studiums Zwischen beruflicher und akademischer Bildung: Mythen Und Realitäten. In: Faßhauer U, Severing E (eds) Verzahnung beruflicher und akademischer Bildung. Duale Studiengänge in Theorie Und Praxis. Bundesinstitut für Berufsbildung, Bonn
- Wolter A, Kerst C (2015) The 'academization' of the German qualification system: recent developments in the relationships between vocational training and higher education in Germany. Res Comp Int Educ 10(4):510–524. https://doi.org/ 10.1177/1745499915612188
- Ziegler A, Lange S, Bender S (2007) Überlebenszeitanalyse: die Cox-regression. Dtsch Med Wochenschr 132:e42–e44. https://doi.org/10.1055/s-2007-959039

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