Journal for Educational Research Online
Journal für Bildungsforschung Online
Volume 12 (2020), No. 2, 190–224
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German university student's reasons for dropout: Identifying latent classes

Abstract

The reasons for students discontinuing studies in university courses are manifold and often represent a combination of different factors. Theoretical work and empirical findings have already conceptualized various factors relevant to dropouts, but little is known about the interplay of these factors. The present paper deals with this topic and analyses how different classes of dropouts can be defined on the basis of the reasons for their termination. The study draws on data from the National Education Panel Study (NEPS), Starting Cohort 5 – first semester students, which asked drop-outs about the reasons for their drop-out with a 24-item Reasons for Dropout Questionnaire (RDQ). Longitudinally, the important reasons for dropout at the beginning of studies related to the student's relationship to the study program or institution, but they do not correspond to important reasons at the end, which mainly relate to socio-economic reasons. In addition, most dropouts occur at the beginning of studies and then steeply decline over time. A latent class analysis revealed 12 specific profiles of students that are mainly characterized by different combinations of reasons for dropout. These classes correspond to other contextually relevant constructs beyond the RDQ, such as performance and socio-economic-factors, academic self-concept and the intention to dropout. Such profiles should be considered for targeted interventions.

Keywords

Dropout; University; Latent class; NEPS

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Gründe für den Studienabbruch deutscher Universitätsstudierender: Analyse latenter Klassen von Studienabbrechern

Zusammenfassung

Die Gründe für Studienabbrüche in Universitätsstudiengängen sind mannigfaltig und stellen dabei oft ein Zusammenspiel verschiedener Faktoren dar. Theoretische Arbeiten sowie empirische Befunde konzeptualisieren bereits verschiedene Faktoren, die für Studienabbrüche relevant sind; allerdings ist bisher wenig über das Zusammenspiel dieser Faktoren bekannt. Die vorliegende Arbeit behandelt dieses Thema und analysiert, wie sich verschiedene Klassen von Studienabbrechern an Hand der Gründe für ihren Abbruch definieren lassen. Die Studie greift auf Daten des Nationalen Bildungspanels (NEPS), Startkohorte 5 – Erstsemester zurück, das Studienabbrecher mit einem 24-Item Fragebogen zu Gründen für ihren Studienabbruch befragt hat. Im Zeitverlauf bezogen sich die primären Gründe für den Studienabbruch zu Beginn des Studiums auf die Beziehung des Studierenden zum Studiengang oder zur Institution und veränderten sich hin zum Ende des Studiums auf hauptsächlich sozioökonomische Gründe. Darüber hinaus erfolgen die meisten Studienabbrüche zu Beginn des Studiums und nehmen im Laufe der Zeit stark ab. Eine latente Klassenanalyse konnte 12 spezifische Profile von Studienabbrechern identifizieren, die überwiegend aus der Kombination von verschiedenen Abbruchgründen bestehen. Diese Klassen korrespondieren mit anderen kontextuell relevanten Konstrukten jenseits des Fragebogens, wie z.B. Leistung, sozioökonomischen Faktoren, akademischem Selbstkonzept und der Intention zum Studienabbruch. Solche Profile sollten für zielgerichtete Interventionen berücksichtigt werden.

Schlagworte

Studienabbruch; Universität; Latente Klassenanalyse; NEPS

1. Introduction

The rate of student dropout in formal higher education for the past 50 years has been a concern both in Germany and internationally. One aspect of this concern is the lack of qualified professionals to occupy important positions in industry (Kruppe & Baumann, 2019). Initiatives in Germany have targeted reducing the number of student dropouts as a strategy to increase the number of professionals who can enter the labor market (see e.g. "Wege zu mehr MINT-Absolventen", Brossardt, 2012).

Among OECD countries in 2005 an average of 31 % of students completed their studies without their first degree. German students fared better with only 23 % unable to obtain their first degree before completion (OECD, 2008). In 2006

the German educational system undertook a major reform through the Bologna process to introduce the degree qualification framework and phase out the diploma system (Keeling, 2006). While the effects of the reform process on dropout rates were unclear to some (Horstschräer & Sprietsma, 2015), others suggested that there was a strong rise in dropouts following the changes (Heublein, 2014). Heublein (2014) found that on average 28 % of German bachelor students in 2010 and 2012 completed their studies without their first degree. These dropout rates differ between subject areas, with it being notably higher for STEM (Science, Technology, Engineering, & Mathematics) subjects (see Heublein & Schmelzer, 2018; Isphording & Qendrai, 2017; Xianglei & Mathew, 2013). Differences in dropout rates between STEM and Non-STEM subjects have been criticized by German governmental authorities (e.g. Bayerischer Oberster Rechnungshof, 2019, p. 216).

The reasons why students choose to discontinue their studies are important guidelines to dictate how university policies are made to address the issue of student dropout. Isphording and Wozny (2017) point out two opposing perspectives for institutional accountability. On the one hand, should the reasons for student dropout lie within the sphere of influence of the university institutions, such as poorly organized study programs or a lack of academic support for students, then the institutions would be responsible to ameliorate the causes. This stance was also suggested by the Bayerischer Oberster Rechnungshof (2019). On the other hand, if reasons for dropout are outside of the institution's control, such as a student's educational background or socio-economic status of the parent's home, then broadening access to education will disadvantage the university (Isphording & Wozny, 2017). This paper will first theoretically conceptualize the phenomenon of dropout before an analysis of how reasons for dropout develop longitudinally, an investigation into the need for a multi-causal model of dropout and the identification of distinct latent classes of dropout students: The paper will conclude by contextualizing the latent dropout classes using relevant indicators for dropouts.

2. Conceptualizing dropout

The phenomenon of dropout can be seen from either the perspective of the university institution who loses a student or from the perspective of the student who abandons pursuing a qualification. On the one hand, the institution's main aim is to retain their students (Tinto, 2006) or avoid the conditions which cause student attrition (Bean, 1980; Ishitani, 2006). On the other hand, students are interested in their persistence within the higher education system until their degree completion (Berger & Braxton, 1998; Cabrera, Nora, & Castaneda, 1993). The definition of dropout to an institution can be at odds to that of their students who leave to complete their degree in another university institution. This study will define a dropout as students who had an initial educational goal to complete at least a bachelor's degree, but who did not achieve it (Berger, Ramirez, & Lyons, 2012). Furthermore,

the dropout status may be temporary as a student could re-enter the system and then dropout again several times on their path to graduation. Naturally, students may make corrections to their choice of study subject, their institution or both as their experience within their studies changes their perspectives (Seidman, 2012). In order to avoid these conceptual issues our study limited the definition of dropout to study first-time dropouts only, without considering students who return to their studies.

2.1 Theories and models of dropout

Spady (1971), Tinto (1975), and later Bean (1980) started investigating dropout as the retention of students became a priority within the 1970's. Spady's (1971) *Undergraduate Dropout Process Model* became the foundational literature for understanding student dropout and retention. According to the model, students need to integrate into the institution's social and academic systems in order to foster strong relationships with peers and faculty, thus motivating the student to persist was an essential task of the university. Failure to integrate was then theoretically analogous to the withdrawal process seen within the suicide phenomenon espoused by Durkheim (1997), which is a view shared by Tinto (1975). According to Spady (1971), social integration is influenced by the student's normative congruence to the institution and support from friendships while academic integration is influenced by grades and intellectual development.

Tinto (1975) further elaborated on Spady's model (1971) with his *Student Integration Model,* which is the most widely cited model of student dropout. Tinto expanded on the description of social and academic integration, and how student's attributes, such as their family background, skills and abilities, influence their goals and commitment to their institution. Tinto's model has been criticized for placing most of the responsibility on the student's inability to integrate, and less regard on external factors (Cabrera et al., 1993).

Bean's *Student Attrition Model* (1980) departed from Spady (1971) and Tinto's model (1975) through the criticism of Durkheim's (1997) suicide theory, claiming that it did not present enough evidence to support this connection. Bean's Model is based primarily on Price's law of employee turnover in work organizations (Price, 1977). The claim states that students would dropout for analogous reasons as employees leaving a company. Bean also argued that student satisfaction closely links to organizational determinants. Analogous concepts such as employees' "pay" or "wages" correspond to student's grade point average (GPA). In Bean's model the dropout outcome is dependent on performance indicators, socio-economic status variables and organizational determinants, while institutional commitment and satisfaction are intervening variables.

Another contribution provided by Bean (1985) was the concept of dropout intention which serves as an early-warning sign for dropout students before they actually decide to dropout (Cabrera et al., 1993). Despite the predictive strength of

dropout intention, students do still leave university despite having no intentions to dropout. Such students "can be accurately specified after the fact, but not predicted" due to the nature of their reasons for dropout, such as illness or family crisis (Bean, 1985, p. 36)

2.2 Dropout within the German university context

Theoretical concepts espoused by Tinto (1975) and Bean (1980) were developed for students on North American campuses which do not directly relate to the German university context (Heublein & Wolter, 2011). The most comprehensive study of dropout within Germany was conducted by Heublein and colleagues in the winter through to the summer semester in 2007/2008 (Heublein et al., 2010) and again in the summer semester 2014 (Heublein et al., 2017). Heublein, Hutzsch, Schreiber, Sommer and Besuch (2010) implemented a study on students reasons for dropout based on problem-centered interviews from a representative sample. A variety of reasons for dropout were identified and analyzed, which yielded eight factors including (1) performance requirements being too high, (2) financial issues, (3) failing intermediate and final exams, (4) a lack of motivation to study, (5) inadequate study conditions (6) professional reorientation, (7) family or personal problem situations and (8) dropping out due to illness. Performance problems, a lack of motivation to study and financial problems were found to be the dominant reasons for dropout.

The *Model for Student Dropout Processes*, developed by Heublein and colleagues (Heublein et al., 2010; Heublein et al., 2017), describes three phases: the pre-study phase, the study phase and the decision to drop out. The pre-study phase involves the relatively stable traits and background-characteristics that the student brings to the study condition. In contrast, the study phase is a dynamic process explained by the complex interplay between internal and external factors during the study situation. While internal factors are the concrete expression of students within their study situation, such as study behaviors, study motivation and performance, external factors are the environmental conditions outside of their control, such as living conditions and alternatives to the current studies, which affect student's individual study situations. A student's dropout decision is therefore rarely due to only a single reason but rather an idiosyncratic combination of factors that accumulate to reinforce their decision to drop out.

Klein and Stocké (2016) agree that multi-causal models, such as that espoused by Heublein et al. (2010), are theoretically necessary to understand the complex nature of dropout but argue that most German language dropout studies frequently use inappropriate methods of analysis to understand the significance and explanatory power of individual factors. Klein and Stocké (2016) also identified evidence that German university dropout factors are time-variant, specifically contrasting the early and late stages of studies.

Furthermore, many comparisons have been made with US-American studies, which should not be directly related to the German university context without certain reservations (Heublein & Wolter, 2011)

2.3 Factors affecting dropout

Understanding the impact of individual dropout factors is of great importance when deciding which factors to include in a study of dropout. A traditional type of predictor for dropout are *performance indicators*, such as high school GPA and standardized test scores (Robbins et al., 2004). High school GPA has been found to better predict college graduation compared to standardized colleague admission tests (e.g. Scholastic Aptitude Test, SAT, Galla et al., 2019) because the latter heavily focus on students' cognitive abilities over a short time-frame, while high school GPA illustrate a students' competencies over a longer time period and also captures non-achievement factors related to success, such as students' attitude, behavior, effort and their ability to self-regulate.

Individuals' subjective thoughts about their abilities could also influence university students' dropout (Robbins et al., 2004). For example, a student's poor academic self-concept, which relates to their thoughts and feelings in reference to themselves as an academic object, can hinder the expression of their abilities. A student's opinion about their subjective likelihood to complete a degree (Esser & Stocké, n.d.) or, conversely, their intention to dropout (Bean, 1985) are also strong predictors of student's goal commitment.

Another important traditional dropout predictor is *socio-economic status* which can indicate barriers for students to successfully earn a degree (Robbins et al., 2004; Caldas & Bankston, 1997). Robbins and colleague's meta-analysis shows a small effect of financial supports on university students' retention. Socio-economic barriers do not only include financial indicators but is also related to parents' social status (Caldas & Bankston, 1997). A lower socio-economic status has shown evidence to reduce the likelihood to reach degree completion among first generation university students (Robbins et al., 2004). Ishitani (2006) found that several variables to affect dropout across years in a 6-year study. Ma and Cragg (2013) also indicate differences in the impact of dropout factors over time.

Robbins et al. (2004) concluded that a multidimensional model is necessary to understand the complex interplay of all the factors that influence dropout. However, existing literature on the dropout phenomenon (Bean, 1980; Berger & Braxton, 1998; Cabrera et al., 1993; Spady, 1971; Tinto, 1975) has predominantly used "variable-centered" approaches (see Muthén & Muthén, 2000) that focus on relationships amongst university dropout factors. These variable-centered methods, such as path analysis, factor analysis or structural equation models, require arbitrary cutoffs to discover factor structures common to the entire sample and do not consider the interplay between factors amongst classes of individuals. Comprehensive typologies of student's reasons for dropping out have been sugge-

sted (Griesbach, Lewin, Heublein, & Sommer, 1998) and attempts to create typologies using person-centered approaches have been made, albeit with data that lacks additional predictors to contextualize the classes (Voelkle & Sander, 2008).

3. Research question

This paper will follow such a person-centered approach and delve into the dropout phenomenon by conducting a latent class analysis (LCA). First the development of dropout factors will be discussed longitudinally before focus turns to the multi-causal aspect of dropout. Finally, the interplay between the reasons for dropout that form distinct latent classes of student dropouts are described using both the item means and other contextually similar variables. The research questions are therefore:

RQ1: How far can students' reasons for dropout be distinguished longitudinally?
This first research question is rather exploratory. However, literature presents the evidence points to the unique effects of several variables that predict dropout vary over time (Ishitani, 2006, Ma & Cragg, 2013, Klein & Stocké, 2016). Some dropout factors such as false expectations would be expected to drop out early. Other factors such as the broader socio-economic issues, which include family and financial problems, are less clear when they will dropout out according to the literature.

RQ2: How far can single reasons explain students' dropout?
The broader literature suggests that single reason for dropout, such as performance problems cannot entirely explain the variance amongst dropouts (Voelkle & Sander, 2008). The presence of a combination of factors is expected rather than single, stand-alone reasons for dropout (Robbins et al., 2004).

RQ3: How far can latent dropout classes be distinguished by their reasons for dropout?
Based on our theoretical background presented by Heublein et al. (2010) and Heublein et al. (2017) we expect that several classes can be identified with different reasons for dropout, and that these may reflect several combinations of dropout factors.

RQ4: How far can latent dropout classes be distinguished by contextual variables?
We expect differences between the classes to be further enhanced using variables that are contextually similar to salient dropout factors such as performance and socio-economic indicators (Robbins et al., 2004). An advantage of using contextual variables within NEPS are that they were collected early on in the course of

studies, which mitigate issues regarding causality from retrospectively investigating reasons for dropout in RQ3.

4. Methods and procedure

4.1 Sample

The sample analyzed is a cohort of first year university students from the National Education Panel Study (NEPS) studied from 2010 to 2016 (SC5: 10.0.0, Blossfeld et al., 2011). Students completed the Reasons for Dropout Questionnaire (RDQ) if they indicated that they had either temporarily discontinued or abandoned their studies during one of the regular interview episodes. The data set comprises of a total of 1461 responses. 74 responses came from students who had already answered the RDQ once before. Only the first response was retained from every unique dropout. After correcting for purposely unanswered responses by males regarding pregnancy, we removed all missing values and maintained 1353 dropouts. Finally, we identified nine outliers as scoring three standard deviations above the median of all items. The outliers were subsequently removed and remaining 1344 (43 % male; 57 % female) student's responses for subsequent analyses.

4.2 Measures

4.2.1 Reasons for dropout

The Reason for Dropout Questionnaire (RDQ, Cronbach's α = .77, see FDZ-LIfBi, 2018, pp. 1272–1295) consists of 24 items which were adapted from Heublein et al. (2010) questionnaire version with 31 items. All items are rated on a six-point Likert scale, ranging from 1 (*plays no role at all*) to 6 (*plays a very important role*), based on the extent to which students think it is an important reason for their dropout.

4.2.2 Intentions for dropout

Intentions to dropout was measured by five items (Cronbach's α = .85) from Trautwein, Köller and Watermann (2004). Three items focused on dropping out from university and two items focused on changing the particular study field. All items are rated on a four-point Likert scale, ranging from 1 (*does not apply at all*) to 4 (*applied completely*), based on how strongly students have the intention to dropout such as "I will complete these studies no matter what". Items were reverse coded as appropriate.

4.2.3 Academic self-concept

Academic self-concept is based on four items (Cronbach's α = .83) from Dickhäuser, Schöne, Spinath and Stiensmeier-Pelster (2002). All items are rated on seven-point Likert scale, ranging from 1 (*low*) to 7 (*high*), based on how students would describe themselves in terms of their studies.

4.2.4 High school Grade Point Average (GPA)

High school GPA was collected using the German 1.0 to 5.0 scale where a 1.0 is a higher score.

4.2.5 Subjective likelihood of graduation

Subjective likelihood of graduation is one item used to ascertain how likely students think that they will complete the degree program and graduate (Esser & Stocké, n.d.).

4.2.6 Socio-economic status

The "HISEI Score" was calculated following an approach used in a PISA study (OECD's Programme for International Student Assessment) by choosing the higher value of the two parents International Socio-Economic Index of Occupational Status (ISEI-08; Ganzeboom, 2010). The ISEI-08 has a range from 10, being the less prestigious occupations, up to 90 (Ganzeboom & Treiman, 1992).

In addition, students' financial background was measured by one item, asking how well students do get by with the money they have in an average month rated on a five-point Likert scale, ranging from 1 (*very poor*) to 5 (*very good*).

4.2.7 Study satisfaction

Study satisfaction was measured by one item and rated on a ten-point Likert scale, ranging from 0 (*completely dissatisfied*) to 10 (*completely satisfied*), asking how far the students was satisfied with higher education.

4.2.8 Field of study

Eight study subject domains were classified according to the German Statistics Office (Destatis, 2018).

4.3 Statistical analysis

This paper will apply an LCA, which is a statistical method that identifies individuals with distinct typologies or systematic diverging patterns of responses to a set of input variables, to classify subgroups of student dropout. LCA is a type of finite mixture model of distributions which constructs classes by maximizing the homogeneity within, while also maximizing the heterogeneity between each subgroup (Baudry, Raftery, Celeux, Lo, & Gottardo, 2010; Collins & Lanza, 2009). LCA has an advantage over other traditional "variable-centered" approaches by not relying on cutoffs to identify classes. For this study we are interested in grouping students with similar reasons for dropout together. For the LCA, we applied the *MCLUST* package (Fraley, Raftery, Scrucca, Murphy, & Fob, 2018) using the R Studio statistical software (R Core Team, 2019).[1]

Significant differences amongst classes on contextual variables are measured using means and confidence intervals (Field, Miles, & Field, 2019).

5. Results

5.1 Sample characteristics

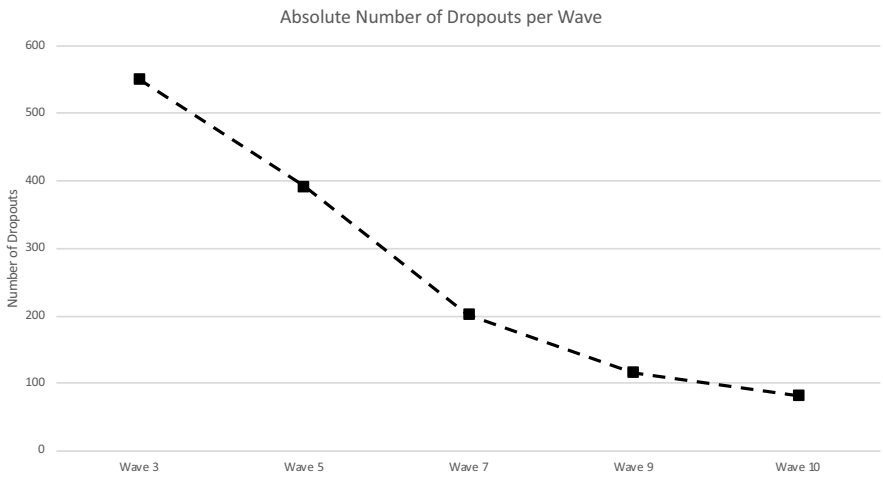
The sample consisted of 1344 students (57 % female) with a mean age of 26.8 years at first dropout (*SD* = 5.7; *min* = 21; *max* = 67). Considering that the NEPS panel had an oversampling of women (60 % women in the full sample; see Ertl & Hartmann, 2019), the proportion of female students is less than expected. Dropouts mainly distribute across four main Destatis (2018) subject groups: Linguistic and cultural studies (25 %), Law, economics and social science (23 %), Mathematics and natural science (25 %) and Engineering (17 %; see Supplement D).

5.2 Research question 1: Longitudinal effects amongst of reasons for dropout

Figure 1 shows a continuous decline in dropout numbers longitudinally from 551 in wave three down to 82 in wave ten.

1 According to Haughton, Legrand, and Woolford (2009), *MCLUST* "performs latent class cluster analysis on continuous data" (p. 88). Although other authors like Collins and Lanza (2010, p. 6) would label that latent profile analysis, we will further keep the term of latent class analysis.

Figure 1: Absolute numbers of dropout students per wave. Exact numbers can be found in Supplement A1.



We furthermore could observe a slight decline of students' intention to drop out from 1.96 in wave two to 1.61 in wave eight in the dropout students' cohort which was far less developed in the total cohort (see Supplement A2). Looking now at the impact of the different reasons for dropout, we find several reasons have significantly higher impact on early dropouts in wave three, especially the relation between the student and the study program/institution, specifically: *study requirements*, *overcrowded lectures*, *anonymity in the university*, and *false expectations* (see Table 1). In contrast reasons that have a higher impact at the end of the study course relate more to the students' life circumstances, specifically, the need for *earning money quickly*, *family reasons, incompatibility of degree course and employment,* and *illness*.

5.3 Research question 2: Multi-dimensional reasons for dropout

Descriptively, the number of students who provide a single major reason for dropout with no other moderately important reason are relatively few (53 cases; 4 %). The cases with a single major reason for dropout mostly provide reasons such as illness, studying abroad or family-based reasons. The trend is similar for cases with both two and three major reasons, where both groups each indicated 28 students whose predominant reasons for dropout related to either family reasons, including child care and pregnancy, or illness. Table 2 gives an overview of all the reasons that students indicated for one, two and three major reasons for dropout.

Table 1: Means, standard deviations, *t*-test results, and effect sizes comparing early (wave 3) and late (wave 10) dropout students on RDQ. Information for mean per wave can be found in Supplement E.

	Early (Wave 3)		Late (Wave 10)						
	M	*SD*	*M*	*SD*		*t*	df	*p*	*d*
Perform req.	2.67	1.60	2.55	1.59	—	0.64	106.92	.52	.08
Study req.	2.96	1.62	2.51	1.56	▶	2.42	108.88	.02	.28
Exam mat.	2.98	1.66	2.73	1.66	—	1.29	106.71	.20	.15
Fail exam	2.69	1.97	3.15	2.04	◀	-1.88	104.58	.06	.23
Lecture supp.	2.72	1.58	2.51	1.64	—	1.05	104.47	.30	.13
Study org.	2.72	1.54	2.62	1.73	—	0.48	101.01	.63	.06
Overcrowded	2.26	1.53	1.70	1.33	▶	3.54	115.64	.00	.38
Anonymity	1.91	1.31	1.56	1.03	▶	2.75	123.38	.01	.27
Practical work	3.25	1.78	2.95	1.83	▶	1.37	105.24	.17	.17
Practical relev.	2.81	1.70	2.70	1.90	—	0.52	101.19	.60	.07
Interest in sub.	3.41	1.86	3.11	1.78	▶	1.44	109.00	.15	.16
Interest in prof.	2.43	1.69	2.20	1.49	—	1.31	114.26	.20	.14
False expec.	3.50	1.73	2.91	1.71	▶	2.90	107.20	.01	.34
Fin problems	2.27	1.67	2.67	1.81	◀	-1.87	102.39	.06	.24
Earn money	1.79	1.41	2.28	1.79	◀	-2.35	96.63	.02	.33
Pregnancy	1.23	1.01	1.35	1.27	—	-0.87	96.74	.38	.12
Child care	1.39	1.22	1.46	1.31	—	-0.47	103.01	.63	.06
Fam reasons	1.87	1.64	2.39	1.87	◀	-2.36	100.30	.02	.31
Personal suit.	2.64	1.52	2.53	1.55	—	-0.59	105.71	.56	.07
Incompatibility	2.14	1.61	2.65	1.88	◀	-2.35	99.43	.02	.31
Job offer	2.21	1.73	1.99	1.58	—	1.18	112.27	.24	.13
Lack opportun.	2.02	1.53	1.93	1.39	—	0.61	113.72	.54	.07
Illness	1.46	1.27	2.06	1.87	◀	-2.82	92.46	.01	.44
Abroad	1.17	0.77	1.17	0.81	—	0.01	103.51	.99	.01

Note. d = effect size measured in Cohen's *d;* Perform req. = Could not meet performance requirements for the studies; Study req. = Study requirements too high; Exam mat. = Extensive contents of study and examination; Fail exam = Did not pass examinations; Lecture supp. = Lack of support from lecturers; Study org. = Lack of organization of the studies; Overcrowded = Overcrowded lectures; Anonymity = Anonymity in the university; Practical work = Wanted to do practical work; Practical relev. = Lack of professional and practical relevance of the studies; Interest in sub. = Decrease interest in subject; Interest in prof. = Lack of interest in the professions possible with the degree obtained; False expec. = Wrong expectations in relation to the studies; Fin problems = Financial shortage; Earn money = Wanted/had to earn money as quickly as possible; Pregnancy = Pregnancy; Child care = Incompatibility of study and child care; Family reasons = Family reasons; Personal suit. = Doubt about personal suitability for the degree course; Incompatibility = Incompatibility of study and gainful activity; Job offer = Interesting job offer; Lack opportun. = Poor job opportunities in my field of study; Illness = Illness. Abroad = Study abroad or internship abroad.

Table 2: Outstanding items for cases with singular reasons for dropout. For only one outstanding item as reason for dropout please see Supplement I.

	Items	Frequency
1	Family	40
2	Pregnancy	31
3	Child care	27
4	Illness	23
5	Abroad	13
6	Incompatibility	10
7	Practical work	10
8	Job offer	9
9	Fail Exam	8
10	Fin Problems	5
11	Earn money	3
12	Interest in sub.	3
13	Perform req.	3
14	Practical relev.	2
15	Study org.	1
16	Study req.	1
17	Lack Opportun.	1
18	False expec.	1
19	Anonymity	1
	Total	192

Note. Frequency = Frequency of outstanding reasons for dropout if a person named either one, two or three major reasons in the decision to dropout (of either 5 or 6 on the 1-6 RDQ scale), while all other items within the 24-item questionnaire have scores of less than 3; Family = family reasons, Pregnancy = pregnancy, Child care = incompatibility of degree course and child care, Illness = illness, Abroad = degree course abroad or internship abroad, Incompatibility = incompatibility of degree course and employment, Practical work = wanted to do practical work, Job offer = interesting job offer, Fail exam = did not pass examinations, Fin prob. = financial problems, Earn money = wanted/had to earn money as quickly as possible, Interest in sub. = loss of interest in subject, Perform req. = unable to meet performance requirements for the degree course, Practical relev. = Lack of professional and practical relevance of the studies, Study req. = course requirements too high, Lack opportun. = poor job opportunities in my field of study, False expec. = Wrong expectations in relation to the studies, Anonymity = Anonymity in the university.

5.4 Research question 3: Description of the classes by RDQ means scores

Analysis of the data revealed that the best solution related to a 12-class model (Fraley & Raftery, 1998; see Supplements B, C1, C2). Comparisons amongst the 12 classes yielded three sub-groups based on class size. Three large classes with between 200-350 cases, four medium classes with between 90-110 cases and five

small classes with between 20-40 cases were classified. Class descriptions are ordered according to class sizes and based on items with class mean scores of above 3.5 (see Supplement F). In the following, we will characterize these classes:

(1) Large classes (200-350 cases)

Class 1 (low interest/performance problems; n = 328; 24 %) is the largest class and presents a pattern of both performance problems and a low interest in studies, specifically *failing the exam* (M = 4.09; for all means see Supplement F), *false expectations* (M = 3.84), *low interest in subject* (M = 3.75) and *study requirements are high* (M = 3.61). In addition, Class 1 contains the largest number of males in the sample (n = 197, 34 % of the male sample) despite only comprising of 61 % males within the class. This class also has one of the youngest means for age at dropout of 25 years. Notably, Class 1 had the highest proportion of mathematics and natural sciences students, and engineering students (see Supplement D).

Class 4 (job needed; n = 249; 19 %) is the second largest class and indicates higher scores on the *financial problems* (M = 3.29), *incompatibility of degree course and employment* (M = 3.09) and *interesting job offer* (M = 3.18). Class 4 has 51 % females and an average age at dropout of 27 years.

Class 7 (low interest; n = 221; 16 % of the sample) is the third largest class. The main reasons include *low interest in subject* (M = 3.78; for all means please see Supplement F), *desire for practical work* (M = 3.47) and *false expectations* (M = 3.35). Furthermore, this class comprises of 64 % females and an average age at dropout of 25 years.

(2) Medium-sized classes (90-110 cases)

Class 2 (unsure; n = 103; 8 %) provides no clear reason for dropout according to RDQ mean scores. Overall, class 2 has the lowest scoring main reason for dropout and the lowest mean score for all reasons for dropout combined. The most prominent items are *low interest in subject* (M = 3.05), *desire for practical work* (M = 2.93) and *false expectations* (M = 2.80). Other reasons for dropout include *degree course abroad or internship abroad* (M = 2.72) and reasons related to performance problems (mean ranging from 2.46 to 2.54). This class consists of 66 % females and a mean age at dropout of 25 years.

Class 3 (ambiguous; n = 96; 7 %) provides a broad range of possible reasons such as *desire for practical work* (M = 3.94), *false expectations* (M = 3.58), *low interest in subject* (M = 3.52), but also indicate that *financial problems* (M = 3.55) and *illness* (M = 3.50) played a considerable role in the decision. Class 3 consists of 65 % females and an average age at dropout of 27 years.

Class 11 (illness; n = 102; 8 %) reported that *illness* (M = 3.32) was the primary problem and, to a moderate degree, also performance problems such as *failing the exam* (M = 2.84) are the main reasons for dropout. All other reasons for dropout play almost no role in this class' decision to drop out (M < 2.00). Class 11 consists of 66 % females with a mean age at dropout of 25 years.

Class 12 (family only; n = 93; 7 %), similarly to class six, reported *pregnancy* (M = 4.09), *family reasons* (M = 4.33) and *child care* (M = 3.77), while all remaining reasons play almost no role in this class' decision to drop out (M < 1.80). In addition, 15 % of this class were recorded as dropping out more than once, which is the highest percentage of any class. This class comprises of 81 % females and an average age at dropout of 30 years.

(3) Small classes (<40 cases)

Class 5 (challenged; n = 27; 2 %) reported several major reasons for dropout primarily related to *family issues*, specifically *child care* (M = 4.96) and *family reasons* (M = 4.44). In addition, they reported *incompatibility of degree course and employment* (M = 4.33), *financial problems* (M = 4.00) and *lack of support from lecturers* (M = 3.96). Class 5 has 66 % females and an average age at dropout of 30 years.

Class 6 (family plus; n = 24; 1 %) relates specifically to *family reasons* (M = 4.33), *pregnancy* (M = 4.29) and *child care* (M = 3.25) as well as *financial problems* (M = 3.04), whilst other reasons for dropout play a lesser role in the decision, i.e. other reasons for dropout have means below 3.00. This is the smallest class with 96 % females and an average age at dropout of 30 years.

Class 8 (going abroad; n = 26; 2 %) scored the highest on *degree course abroad or internship abroad* (M = 5.08) and *desire for practical work* (M = 3.73). This small class comprises of 65 % females and an average age at dropout of 26 years.

Class 9 (study requirements; n = 37; 3 %), presents multiple reasons for dropout including *too much exam material* (M = 3.62), *desire for practical work* (M = 3.46), and *illness* (M = 3.57). This class comprises of 70 % females and an average age at dropout of 32 years.

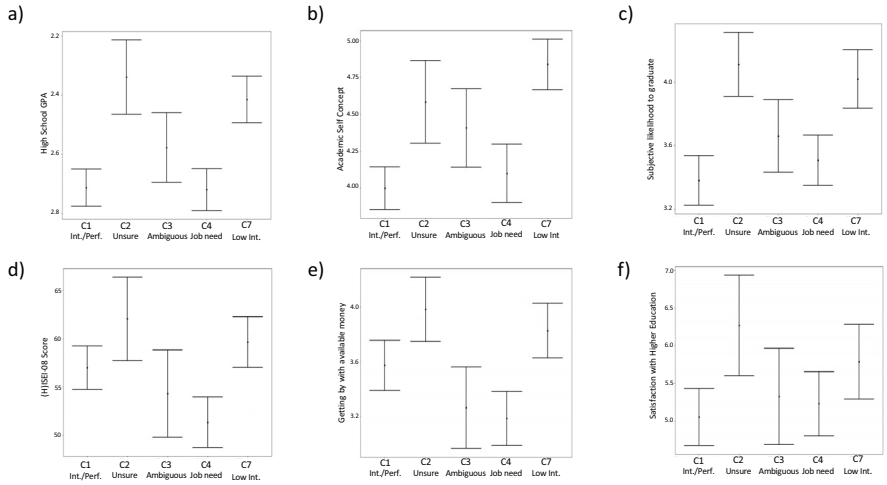
Class 10 (desire for alternative employment; n = 38; 3 %) students indicated the highest scores for the *desire for practical work* (M = 4.20) and *interesting job offer* (M = 3.79).

5.5 Research question 4: Class descriptions according to contextual variables

Research question 4 focuses on characterizing these classes using contextual variables associated with dropout. For these analyses, we only focus on five of the large and medium classes but exclude Class 11 (illness) and Class 12 (family only) because their reasons for dropout are less predictable.

Figure 2 shows the comparison of the five classes' scores on six contextual variables, some of which relate to performance and socio-economic factors.

Figure 2: Means and 95 % confidence intervals for students high school GPA (a), academic self-concept at wave 2 (b), their subjective evaluation of their likelihood to graduate (c), their parent's HISEI score (d), their estimation how far they're getting by with their money (e), and their satisfaction with higher education (f) for the Class 1 (low interest/performance problems), Class 2 (unsure), Class 3 (ambiguous), Class 4 (job needed), and Class 7 (low interest). All values can be found in Supplement H1-H6; Means and standard deviations for all classes could be found in Supplement G.



Notably, Class 1 (low interest/performance problems) as well as Class 4 (job needed) show significantly lower values regarding their high school GPA, their academic self-concept, and their subjective likelihood to graduate than Class 2 (unsure) and Class 7 (low interest), while Class 3 (ambiguous) is in between the former classes with partially overlapping confidence intervals. Socio-economic factors regarding parents' status (HISEI) and financial challenges showed comparable results between Class 2 (unsure) and Class 7 (low interest), as both classes' parents had a higher HISEI and less issues with money, while students of Class 3 (ambiguous) and Class 4 (job needed) indicated lower scores on these socio-economic factors. Class 1 (low interest/performance problems) presented moderate scores on the socio-economic factors which situates them between these four classes. Results regarding students' satisfaction with higher education are less clear, as Class 2 (unsure) shows the highest satisfaction, while Class 1 (low interest/performance problems) and Class 4 (job needed) report a noticeably lower satisfaction with higher education.

6. Discussion

The aim of the study was to shed light on the dropout phenomenon using a person-centered approach to reveal latent classes of dropout students based on their reasons for dropout. Therefore, the paper first presented information about dropouts and reasons for dropout longitudinally before looking into the issue of multi-causality of dropouts. The latent class analysis revealed 12 classes and the follow up analysis disclosed that they further distinguish with respect to contextual variables. We will now discuss the respective results in detail:

6.1 Longitudinal effects

Regarding longitudinal effects, we could see that most students drop out very early and their numbers constantly decline over time. Of the four reasons for early dropout, two of them relate to study conditions, namely *anonymity in the university* and *over-crowdedness*. These reasons may occur due to lower social integration with their peers which weakens their institutional and goal commitments, and puts them at greater risk to dropout (Tinto, 1975). A further reason, *false expectations*, was highlighted by Klein and Stocké (2016) as a potential indicator of information deficits that students have prior to entering their studies, which to a lesser extent also relates to *study requirements*. Class 1 (low interest/performance problems) could be a prototype class for early dropout, as it embodies more early dropout reasons than any other classes. Positive social participation with faculty or student counselling could be utilized to produce positive effects on students' intention to dropout and prevent withdrawal behavior from the educational system.

The reasons which significantly impacted later dropout included *earn money quickly*, *incompatibility of degree course and employment*, *family reasons*, and *illness*. The two former reasons encompass an increased financial burden both in the immediate sense, that money needed to be earned quickly, as well as the future employment opportunities which the current studies may not afford them. Dropout in this sense is potentially related to socio-economic factors within the family, which ties into another late impact reason, namely *family reasons*. Heublein and Wolter (2011) cited that gainful employment alongside studies may lead students to dropout early. However, students who did not acquire gainful employment parallel to their studies may redirect their focus to finding full-time work to alleviate some of their financial burdens. Family and employment-related dropout as described by Class 6 (family plus), Class 10 (desire for alternative employment), or Class 12 (family only) could represent prototypes of late dropout. Finally, *illness* is a crisis which cannot be predicted (Bean, 1985) but the results suggest that it sets in at the later stages of studies.

6.2 Multi-dimensional reasons for dropout

Research questions 2, 3, and 4 applied a person-centered approach that analyzed reasons for dropouts among sub-groups, leading to 12 latent classes of dropout students. RQ2 illustrated that 53 cases (4 %) represent a mono-causal dropout which implies a marginal significance. This trend also applies for the two- and three-reason combinations which represents a further 8 %.

The LCA provided three classes that are possibly distinguishable by only a single dropout factor, specifically Class 8 (going abroad), Class 11 (illness) and Class 12 (family only), who together represent 17 % of the sample. However, as mentioned previously, both Class 11 and Class 12 had a low intention to dropout which theoretically made their dropout far less predictable (Bean, 1985). These results support the need for a multi-dimensional model to understand the majority of the dropout phenomenon (Robbins et al., 2004) and provides evidence for following a multi-causal approach such as an LCA (Muthén & Muthén, 2000).

Focusing on the majority of the sample, the classes reveal that the three largest classes each emphasize a loss of interest in their subject and false study expectations as their major reasons for dropout. This corresponds to previous findings related to information deficits that students experienced prior to the start of studies, which then leads to false expectations (Klein & Stocké, 2016; Brandstätter, Grillich, & Farthofer, 2006). While Class 7 (low interest), Class 1 (low interest/performance problems) and Class 4 (job needed) each indicated a loss of interest in their subject and false study expectations as major reasons for dropout, Class 1 also indicated performance problems while Class 4 indicated finance problems. These three classes together account for 60 % of the total sample and raise questions about how these patterns develop. The issue may stem from a lack of quality career counselling or inappropriate choice of study courses, which are causes that develop in the pre-study phase according to Heublein et al. (2010). Alternatively, these students may have chosen to study their subject for reasons other than being interested in the contents of their studies, which corresponds to previous findings by Heublein et al. (2017). Although these three classes appear to have lost interest in their study subject, they did not indicate a loss of interest in later profession as playing as great a role in their decision to drop out. This suggests a disconnect between their experiences within their studies and their future career roles. These students may decide to vocationally re-orientate to more practical work, which is both pulled by the attractiveness of practical and gainful employment and pushed by the failures experienced within the higher educational system (Griesbach et al., 1998). Heublein et al. (2017) noted how students desired to move away from the primarily theory-based higher education system to do more practical and relevant work. Hence, these students may likely switch their study field, or join the labor market without completing their studies.

Performance indicators did not manifest a stand-alone dropout class. Other than a very small sample of single-reason dropouts in RQ1 (see Table 2), who only indicated failing an exam, performance indicators alone do not explain why drop-

out occurs (Voelkle & Sander, 2008). The two largest classes indicated how performance problems combined with either low interest in the study subject expressed by Class 1 (low interest/performance problems), or socio-economic burdens expressed by Class 4 (job needed). Such differences could be verified by RQ4 which uncovered that both Class 1 and Class 4 reported a less beneficial performance background and, additionally, Class 4 had a less beneficial socio-economic background when compared to that of Class 7 (no interest), who had both a superior performance and socio-economic background.

A different pattern can be seen by Class 11 (illness; n = 102; 8 %) and Class 12 (family only; n = 93; 7 %) that present a remarkably similar profile according to contextual variables investigated. Both indicate a low intention to dropout reflected by a high subjective likelihood to complete a degree. They both reported high academic self-concepts and relatively average high school GPA compared to other classes. Most importantly, they represent classes whose reasons for dropout are outside the influence of university institutions (Isphording & Wozny, 2017; Klein & Stocké, 2016) and cannot be predicted as the nature of their reasons for dropouts are in response to a personal crisis (Bean, 1985). Their decision to drop out are not a failure on either the part of the institution nor the student. These students had no intention to dropout but rather may have less perceived control over their academic success (Respondek, Seufert, Stupnisky, & Nett, 2017). Reducing obstacles for students with family duties and providing support at the appropriate times may be a promising way to alleviate the challenges facing Class 12.

6.3 Conclusion

The results of this study broadly support Heublein et al. (2017) synopsis that the available dropout models were limited in their ability to only explain certain groups of students, and that various reasons for dropout are needed to encompass the full scope of the dropout phenomenon. The introduction of latent class analysis as a method to identify various subgroups of dropouts can overcome this limitation in a practical and generalizable manner. Using LCA, as opposed to factor-based methods, has solved some issues but also illuminated further complexity within the dropout phenomenon. Previous dropout models needed to be separated by demographics such as gender (Spady, 1971), or special groups such as non-traditional students (Bean & Metzner, 1985) to grasp at least some homogeneity within dropout subgroups. Within our study the LCA approach has the advantage of being able to classify subgroups based on their primary reasons for dropout as well as demographic differences (Collins & Lanza, 2009). Using LCA to allow multiple predictors to interplay amongst classes appears to provide more easily identifiable and generalizable groups with clearer interpretations within other educational purposes (see Ertl, Luttenberger, & Paechter, 2014; Luttenberger, Aptarashvili, Ertl, Ederer, & Paechter, 2014; Quirk, Grimm, Furlong, Nylund-Gibson, & Swami, 2016).

The results of this study go further than the well-established models espoused by Spady (1971) and Tinto (1975). In our analysis, only one class (Class 5: challenged), representing 2 % of the sample, distinguished a lack of lecturer support as a reason for dropout. In addition, other items related to social integration within the institution, such as *overcrowded lectures* and *anonymity in the university* played only a minor role in distinguishing any of the classes, although they did present a significant impact on early dropout amongst the sample as a whole (see Supplement E and Table 1). This may be due to the structure of German universities that do not combine academic and social life on campus, which is often typical of North American campus universities (Heublein & Wolter, 2011). This situation also provides an alternative perspective to the universal role of institutional commitment as espoused by Tinto (1975).

A peculiarity within our study, which corresponded to previous literature, was the proportion of classes who indicated a *lack of interest in the study subject* and *false study expectations* (Heublein et al., 2017). This finding was cited as evidence for an information deficit at the start of studies (Klein & Stocké, 2016). Whether this is an artifact of the relatively recent reform within the German education system or of poorly counselled students is unclear.

6.4 Limitations

The sample of dropouts who answered the reason for dropout questionnaire does not exhaust the total number of dropouts from this panel study. As is customary within dropout research, many of the students left the panel study without any information about why they discontinued their studies. For this reason, there may be individuals who could have produced further latent classes. The possibility of further other classes is supported by existence of the "unsure" class, which may be an indication that the reason for dropout which specifically affected them was not mentioned within the list of 24 items.

Lastly, a dropout can become a non-dropout once they re-enter the educational system at any time, either continuing studying the original subject or switching to a new one. Tracking and understanding why students depart from an institution therefore remains a difficult yet important task within dropout research.

7. Significance

Identifying students who are at risk of prematurely ending their studies and providing them with the appropriate intervention has been the goal of research into the dropout phenomenon. A clearer understanding of not only the factors which lead to dropouts but the interplay between these dropout factors can provide valu-

able information to keep institutions accountable to their students while pointing out to areas for effective management of at-risk students.

This study both built on previous models of student dropout, specifically Spady (1971), Tinto (1975), Bean (1980) and for the German context (Heublein et al., 2010; Heublein et al., 2017), while also advancing on this research by identifying latent classes of students dropping, and thereby revealing two essential aspects. Firstly, dropout research from the North American context has only limited power to explain dropout phenomena in Germany. Constructs like social integration that were seen as essential by Spady (1971) and Tinto (1975) may only play a marginal role in distinguishing between dropout classes. The second aspect relates to the increased value in contrasting between variable-centered and person-centered approaches. The patterns shown by the latent class analysis allow variables to independently impact each subgroup in a different way, which can reveal classes with opposing impacts from the same variable. For example, classes of students characterized by low interests in their study subject and false study expectation also displayed an inclination for practical work despite the fact that these three items belong to two separate factors in previous analyses (Heublein et al., 2010; Heublein et al., 2017). In addition, classes with a low interest in their study subject did not strongly indicate a low interest in the profession, despite these two items representing one factor in these studies.

While variable-centered approaches give indications of the overarching effects of dropout factors (Bean, 1980; Heublein et al. 2010; Heublein et al., 2017; Spady. 1971; Tinto, 1975), this study was able to quantitatively identify specific student profiles that provide a starting point for designing targeted and practical interventions. Confirming the existence of these classes using models with specific and directed combinations of dropout variables, such as performance and socio-economic background factors, could further disclose the development of specific subgroups of dropout students.

Acknowledgments

This paper uses data from the National Educational Panel Study (NEPS): Starting Cohort First-Year Students, doi:10.5157/NEPS:SC5:10.0.0. From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

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Appendix

Supplement A1: Absolute frequency of dropout students per wave

Wave	Frequency
3	551
5	392
7	202
9	117
10	82

Supplement A2: Descriptive statistics of dropout students' intention to dropout per wave

	Dropout students		Whole sample	
Wave	*M*	*SD*	*M*	*SD*
2	1.96	0.83	1.49	0.59
4	1.84	0.81	1.45	0.53
6	1.72	0.77	1.45	0.53
8	1.61	0.70	1.43	0.53

Note. Dropout students refer to all students who answered the RDQ; The whole sample refers to all other cases who answered the Intention to Dropout Questionnaire within the NEPS dataset.

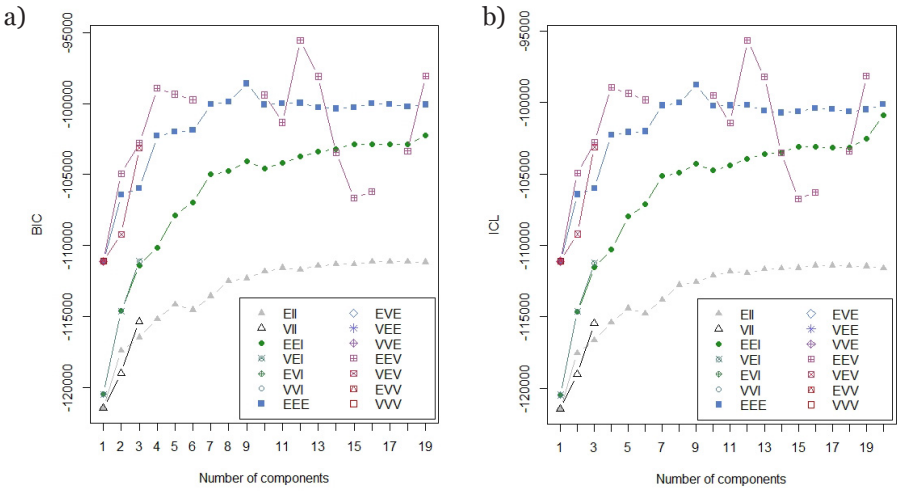
Supplement B: Quality indicators for solutions with the different classes: Summary of model fit indices among different classes.

K	df	Model	BIC	ICL	LL
1	324	Multiple Models[a]	-111107.30	-111107.30	-54386.68
2	625	EEV	-104936.30	-104937.80	-50217.11
3	926	EEV	-102772.30	-102786.90	-48050.98
4	1227	EEV	-98937.59	-98947.44	-45049.51
5	1528	EEV	-99340.98	-99361.60	-44167.09
6	1829	EEV	-99741.00	-99811.60	-43282.99
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	3033	EEV	-99405.42	-99485.13	-38778.74
11	3334	EEE	-101334.60	-101445.20	-38659.20
12	3635	EEV	**-95543.74**	**-95638.94**	-34679.68
13	3936	EEV	-98088.78	-98193.24	-34868.09
14	4237	EEE	-103463.00	-103539.90	-36471.08
15	4538	EEE	-106656.80	-106742.70	-36983.88
16	4839	EEE	-106184.30	-106270.70	-35663.52
17	NA	NA	NA	NA	NA
18	5441	EEE	-103342.50	-103417.10	-32074.38
19	5742	EEV	-98070.36	-98126.43	**-28354.20**

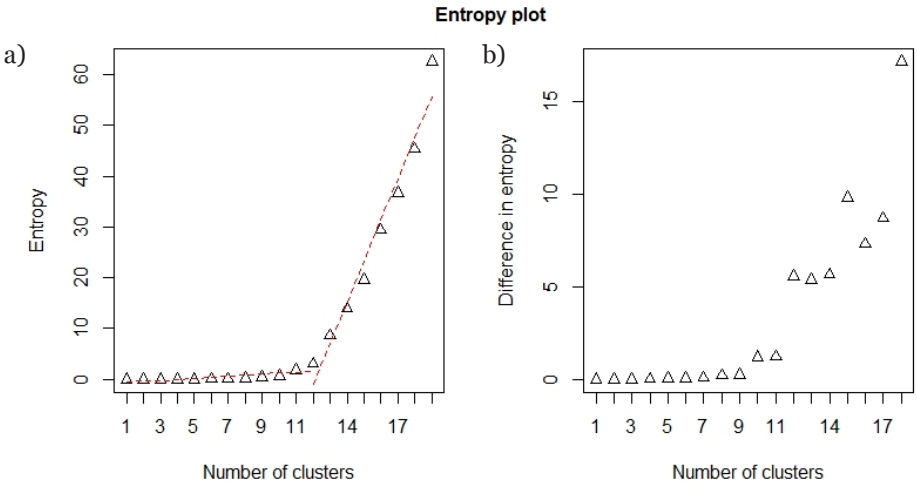
Note. K = number of classes; BIC = Bayesian Information Criterion; ICL = Integrated Complete-data Likelihood; LL = log-likelihood; Bolded values indicated "best" fit for each respective statistic. EEV refers to ellipsoidal, equal volume and equal shape. EEE is ellipsoidal, equal volume, shape, and orientation. NA represents that model does not provide solution according to the classes numbers we requested.

[a]Multiple models match with both model EEV and EEE.

Supplement C1: Chart based on BIC (a) and ICL (b) criterion for the best models among different number of classes.



Supplement C2: Entropy charts for solutions with a different number of classes



Note. (a) Entropy values for the K-cluster combined solutions. (b) Differenced between successive entropy values. An elbow in the plot (a) suggests 12 clusters.

Supplement D: Characteristics about classes size, gender and age and study subject at dropout in profiles. Absolute numbers and line percentages (in brackets) unless noted otherwise

	Classes												Total [% of total]
	1	2	3	4	5	6	7	8	9	10	11	12	
Classes size (%)	328 (24)	103 (8)	96 (7)	249 (19)	27 (2)	24 (1)	221 (16)	26 (2)	37 (3)	38 (3)	102 (8)	93 (7)	1344 [100]
Gender (%)													
Male	197 (34)	34 (6)	34 (6)	122 (21)	9 (1)	1 (1)	80 (14)	9 (1)	11 (2)	21 (4)	42 (7)	17 (3)	577 [43]
Female	131 (17)	69 (9)	62 (8)	127 (17)	18 (2)	23 (3)	141 (18)	17 (2)	26 (4)	17 (2)	60 (8)	76 (10)	767 [57]
Age at Dropout													
Mean (*SD*)	25 (4)	25 (6)	27 (5)	27 (5)	30 (7)	30 (7)	25 (4)	26 (5)	32 (9)	30 (8)	30 (9)	30 (7)	1339 [99]
Median	24.50	24	25	26	28	28.50	24	24	28	26	26	28	
Range	21-59	21-62	22-47	21-53	23-48	22-45	21-48	22-49	23-52	23-52	22-67	22-56	
Mean Wave for Dropout	4.76	5.10	5.51	5.31	5.15	6.13	4.75	5.35	5.46	5.66	5.45	5.53	
Study Domain (%)													
Linguistic and cultural studies	44 (13)	38 (11)	25 (7)	59 (17)	11 (3)	6 (1)	69 (20)	11 (3)	13 (4)	13 (4)	25 (7)	33 (10)	347 [26]
Law, economics and social science	54 (18)	16 (5)	20 (7)	56 (18)	7 (2)	8 (3)	61 (20)	7 (2)	14 (5)	12 (4)	25 (8)	26 (8)	306 [23]
Mathematics, natural sciences	111 (33)	25 (7)	25 (7)	65 (19)	6 (2)	3 (1)	46 (14)	4 (1)	3 (1)	7 (2)	29 (9)	14 (4)	338 [25]
Engineering	101 (44)	13 (6)	15 (7)	52 (24)	.	2 (1)	23 (10)	2 (1)	7 (2)	3 (1)	6 (2)	6 (2)	230 [17]
Human medicine/health sciences	4 (8)	4 (8)	3 (5)	4 (8)	.	4 (8)	10 (19)	.	.	3 (5)	12 (22)	9 (17)	53 [4]
Veterinary medicine	.	1 (50)	.	.	.	.	.	.	.	.	.	1 (50)	2 [1]
Agricultural-, forest- and nutrition sciences	10 (32)	2 (6)	3 (10)	6 (20)	1 (3)	.	3 (10)	1 (3)	.	.	3 (10)	2 (6)	31 [2]
Sports	2 (15)	1 (8)	2 (15)	1 (8)	2 (15)	.	4 (31)	1 (8)	.	.	.	.	13 [1]
Arts, aesthetics	.	3 (16)	3 (16)	5 (26)	.	1 (5)	4 (21)	.	.	.	1 (5)	2 (11)	19 [1]

Supplement E: Means of RDQ items per wave

Wave	Perform.req.	Study req.	Exam mat.	Fail exam	Lecture supp.	Study org.	Overcrowded	Anonymity	Practical work	Practical relev.	Interest in sub.	Interest in prof.	False expec.	Fin problems	Earn money	Pregnancy	Child care	Fam reasons	Personal suit.	Incompatibility	Job offer	Lack opportun.	Illness	Abroad
3	2.67	2.96	2.98	2.69	2.72	2.72	2.26	1.91	3.25	2.81	3.41	2.43	3.50	2.27	1.79	1.23	1.39	1.87	2.64	2.14	2.21	2.03	1.46	1.17
5	2.56	2.77	2.71	2.77	2.44	2.53	2.11	1.67	3.25	2.70	3.05	2.09	2.91	2.21	1.78	1.33	1.46	2.03	2.24	2.11	2.29	1.82	1.60	1.41
7	2.36	2.59	2.62	2.78	2.44	2.68	1.93	1.70	2.96	2.63	2.79	2.03	2.76	2.19	1.99	1.23	1.38	1.97	2.16	2.32	2.17	1.79	1.84	1.43
9	2.28	2.40	2.49	2.70	2.34	2.38	1.83	1.56	3.01	2.49	2.50	1.91	2.49	2.14	1.88	1.68	1.74	2.39	1.99	2.32	2.33	1.91	1.56	1.31
10	2.55	2.51	2.73	3.15	2.51	2.62	1.70	1.56	2.95	2.70	3.11	2.20	2.91	2.67	2.28	1.35	1.46	2.39	2.54	2.66	1.99	1.93	2.06	1.17

Note. Perform req. = performance requirements are high; Study req. = study requirements are high; Exam mat. = too much exam material; Fail exam = failing the exam; Lecture supp. = lack of support from lecturers; Study org. = lack of organization of the studies; Overcrowded = overcrowded lectures; Anonymity = anonymity at the institution; Practical work = desire for practical work; Practical relev. = lack of professional and practical relevance of the studies; Interest in sub. = low interest in subject; Interest in prof. = lack of interest in the professions possible with the degree obtained; False expec. = false expectations; Fin problems = financial problems; Earn money = earning money quickly; Pregnancy = pregnancy; Child care = childcare; Fam reasons = family reasons; Personal suit. = doubt about personal suitability for the degree course; Incompatibility = incompatibility of degree course and employment; Job offer = interesting job offer; Lack opportun. = poor job opportunities in my field of study; Illness = illness. Abroad = degree course abroad or internship abroad.

Supplement F: Means and standard deviations (in brackets) of the responses across the 24-item Reason for Dropout Questionnaire among the twelve dropout classes

Reasons for Drop-out Items	C1: low interest/ performance problems (n = 328)	C2: unsure (n = 103)	C3: ambiguous (n = 96)	C4: job needed (n = 249)	C5: challenged (n = 27)	C6: family plus (n = 24)	C7: low interest (n = 221)	C8: going abroad (n = 26)	C9: study requirements (n = 37)	C10: desire for alternative employment (n = 38)	C11: illness (n = 102)	C12: family only (n = 93)
Perform. req.	3.47(1.5)	2.46(1.6)	2.76(1.6)	2.76(1.6)	2.93(1.4)	2.29(1.4)	1.44(0.8)	2.46(1.3)	3.16(1.6)	1.73(1.3)	2.29(1.6)	1.45(1.0)
Study req.	3.61(1.4)	2.49(1.6)	3.30(1.6)	3.07(1.6)	3.67(1.7)	2.79(1.4)	1.72(1.1)	3.08(1.7)	3.30(1.4)	2.17(1.4)	2.16(1.6)	1.47(1.1)
Fail exam	4.09(1.8)	2.53(1.9)	3.08(1.9)	3.04(1.9)	3.04(1.9)	2.04(1.7)	1.15(3.9)	2.62(1.7)	2.68(1.8)	1.67(1.3)	2.84(2.2)	1.29(1.0)
Exam mat.	3.35(1.5)	2.54(1.7)	3.39(1.5)	3.09(1.6)	3.85(1.6)	2.79(1.6)	1.87(1.3)	3.27(1.8)	3.62(1.4)	2.27(1.5)	2.21(1.6)	1.80(1.4)
Lecture supp.	2.99(1.6)	2.29(1.4)	3.22(1.5)	2.83(1.5)	3.96(1.5)	1.87(1.1)	2.27(1.6)	3.12(1.8)	2.51(1.4)	2.40(1.6)	1.52(0.9)	1.23(0.7)
Study org.	3.00(1.5)	2.35(1.4)	3.37(1.4)	2.78(1.5)	3.07(1.6)	2.33(1.6)	2.55(1.7)	3.19(1.7)	2.54(1.5)	2.57(1.7)	1.78(1.3)	1.29(0.8)
Overcrowded	2.22(1.5)	1.57(1.1)	2.94(1.8)	2.46(1.6)	3.30(1.8)	2.12(1.6)	2.15(1.6)	2.62(1.8)	1.54(1.2)	2.00(1.4)	1.18(0.5)	1.03(0.2)
Anonymity	1.93(1.4)	1.58(1.2)	2.09(1.5)	1.79(1.3)	2.52(1.7)	1.58(0.9)	1.82(1.3)	2.00(1.1)	1.78(1.1)	1.87(1.5)	1.29(0.9)	1.00(0.0)
Practical work	3.46(1.7)	2.93(1.5)	3.94(1.7)	3.74(1.7)	3.52(1.6)	2.79(1.6)	3.47(1.9)	3.73(1.8)	3.46(1.7)	4.20(1.6)	1.00(0.0)	1.00(0.0)
Practical relev.	3.06(1.7)	2.54(1.5)	3.07(1.8)	3.01(1.7)	3.26(1.4)	2.46(1.6)	2.93(1.7)	3.31(1.9)	2.89(1.7)	3.12(1.6)	1.11(0.4)	1.32(0.9)
Interest in sub.	3.75(1.7)	3.05(1.8)	3.52(1.9)	3.15(1.7)	2.70(1.5)	2.75(1.9)	3.78(1.9)	2.81(1.5)	3.08(1.8)	2.06(1.5)	1.48(1.0)	1.45(1.0)
Interest in prof.	2.30(1.6)	2.10(1.6)	2.45(1.7)	2.18(1.5)	2.26(1.3)	2.92(1.8)	3.13(1.9)	1.96(1.5)	2.05(1.5)	1.34(0.8)	1.20(0.7)	1.18(0.7)
False expec.	3.84(1.5)	2.80(1.8)	3.58(1.6)	3.25(1.6)	3.22(1.4)	2.79(1.7)	3.35(1.9)	2.96(1.9)	3.08(1.6)	2.21(1.4)	1.55(1.1)	1.37(0.9)
Fin problems	1.87(1.3)	1.12(0.4)	3.55(1.9)	3.61(1.8)	4.00(1.8)	3.04(2.0)	1.38(0.8)	2.50(1.6)	3.00(2.0)	2.52(1.8)	1.54(1.3)	1.54(1.2)
Earn money	1.40(0.8)	1.00(0.0)	2.87(1.9)	3.29(1.7)	3.74(1.9)	2.04(1.6)	1.06(0.3)	2.31(1.7)	2.35(1.9)	2.33(1.6)	1.00(0.0)	1.18(0.7)
Pregnancy	1.00(0.0)	1.01(0.1)	1.00(0.0)	1.00(0.0)	2.44(2.1)	4.29(2.1)	1.00(0.0)	1.00(0.0)	1.00(0.0)	1.00(0.0)	1.00(0.0)	4.09(2.4)
Child care	1.02(0.1)	1.00(0.0)	1.03(0.2)	1.00(0.0)	4.96(1.5)	3.25(2.1)	1.01(0.1)	1.08(0.3)	2.86(2.0)	2.82(2.2)	1.25(0.9)	3.77(2.1)
Fam reasons	1.03(0.2)	1.77(1.3)	2.98(1.9)	2.03(1.5)	4.44(1.5)	4.33(1.8)	1.17(0.6)	2.08(1.7)	3.03(2.0)	2.50(1.8)	1.96(1.7)	4.72(2.0)
Personal suit.	2.83(1.5)	2.55(1.6)	2.84(1.6)	2.49(1.5)	2.81(1.4)	2.12(1.2)	2.33(1.5)	2.12(1.1)	3.08(1.4)	1.36(0.7)	1.43(1.0)	1.25(0.7)
Incompatibility	1.92(1.4)	1.02(0.2)	2.86(1.7)	3.09(1.9)	4.33(1.8)	2.75(1.8)	1.65(1.3)	2.66(1.8)	3.00(1.9)	2.97(1.8)	1.96(1.7)	1.58(1.3)
Job offer	2.06(1.6)	1.10(0.4)	2.65(1.7)	3.18(1.9)	3.07(2.0)	2.04(1.6)	2.50(1.9)	2.96(1.9)	1.00(0.0)	3.79(2.0)	1.00(0.0)	1.23(0.9)
Lack opportun.	1.31(0.6)	1.85(1.4)	2.30(1.7)	2.48(1.7)	3.04(1.9)	1.87(1.2)	2.68(1.8)	2.42(1.4)	2.22(1.7)	1.00(0.0)	1.07(0.3)	1.21(0.8)
Illness	1.00(0.0)	2.12(1.8)	3.50(1.6)	1.00(0.0)	3.07(2.1)	2.88(2.0)	1.01(0.2)	1.65(1.3)	3.57(2.2)	1.00(0.0)	3.32(2.4)	1.00(0.0)
Abroad	1.00(0.0)	2.72(2.3)	1.00(0.0)	1.03(0.2)	2.33(2.0)	1.08(0.3)	1.01(0.1)	5.08(1.4)	1.14(0.4)	2.37(2.2)	1.02(0.1)	1.00(0.0)

Note. Mean scores calculated from six-point Likert scale anchored as 1 – plays no role to 6 – plays major role in decision to drop out. Perform req. = performance requirements are high; Study req. = study requirements are high; Fail exam = failing the exam; Exam mat. = too much exam material; Lecture supp. = lack of support from lecturers; Study org. = lack of organization of the studies; Overcrowded = overcrowded lectures; Anonymity = anonymity at the institution; Practical work = desire for practical work; Practical relev. = lack of professional and practical relevance of the studies; Interest in sub. = low interest in subject; Interest in prof. = lack of interest in the professions possible with the degree obtained; False expec. = false expectations; Fin problems = financial problems; Earn money = earning money quickly; Pregnancy = pregnancy; Child care = childcare; Fam reasons = family reasons; Personal suit. = doubt about personal suitability for the degree course; Incompatibility = incompatibility of degree course and employment; Job offer = interesting job offer; Lack opportun. = poor job opportunities in my field of study; Illness = illness. Abroad = degree course abroad or internship abroad.

Supplement G: Means and standard deviations for the contextual variables for all classes

		Large classes			Medium-sized classes				Small classes				
		1	4	7	2	3	11	12	5	6	8	9	10
Dropout Intentions[a]	*M*	2.17	2.16	2.03	1.72	2.11	1.49	1.56	1.63	2.14	2.11	2.03	1.63
	SD	0.85	0.87	0.90	0.81	0.87	0.67	0.67	0.63	0.79	0.76	0.69	0.55
High school GPA	*M*	2.71	2.72	2.41	2.34	2.58	2.54	2.46	2.76	2.44	2.29	2.55	2.24
	SD	0.57	0.57	0.59	0.64	0.58	0.65	0.60	0.52	0.73	0.69	0.63	0.69
Academic self-concept[b]	*M*	4.00	4.10	4.84	4.58	4.41	4.82	4.90	4.48	4.43	4.29	3.71	4.74
	SD	0.90	1.10	0.90	1.10	1.00	0.90	0.80	1.10	0.90	1.20	1.10	0.90
Subjective likelihood that student will graduate	*M*	3.38	3.51	4.02	4.11	3.66	4.23	4.16	3.93	3.56	3.69	3.10	4.09
	SD	0.97	0.90	0.93	0.81	0.85	0.86	0.77	0.62	1.21	0.75	0.88	0.75
HISEI score	*M*	57.01	51.36	59.68	62.07	54.32	56.72	54.24	54.32	52.96	58.54	51.92	53.32
	SD	20.30	51.36	59.68	20.80	21.85	19.15	20.09	20.12	20.97	22.22	19.15	18.03
Getting by with money	*M*	3.57	3.19	3.83	3.98	3.26	3.64	3.43	3.00	3.33	3.67	3.22	3.45
	SD	1.07	1.09	0.94	0.90	1.04	1.15	1.08	0.74	1.30	1.07	1.17	1.10
Higher education satisfaction	*M*	5.05	5.23	5.79	6.27	5.33	6.42	6.18	6.00	4.94	4.77	4.90	6.86
	SD	2.38	2.49	2.59	2.71	2.41	2.48	2.43	2.65	2.90	2.52	2.36	1.88

[a]Dropout intention was taken from wave 2. [b]Academic self-concept was taken from wave 2.

Supplement H1: Means and standard deviations and confidence intervals for students' high school GPA

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	183	1.3	3.8	2.65	0.58	0.04	2.56	2.73
C2: unsure	51	1.0	3.5	2.31	0.64	0.09	2.14	2.49
C3: ambiguous	48	1.0	3.7	2.58	0.60	0.09	2.41	2.75
C4: job needed	141	1.0	3.9	2.63	0.61	0.05	2.53	2.74
C7: low interest	110	1.0	3.7	2.35	0.60	0.06	2.24	2.46

Supplement H2: Means and standard deviations and confidence intervals for students' academic self-concept

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	147	1.00	6.00	4.00	0.89	0.07	3.86	4.14
C2: unsure	62	1.00	7.00	4.58	1.13	0.14	4.30	4.87
C3: ambiguous	52	2.50	7.00	4.41	0.98	0.14	4.14	4.67
C4: job needed	124	1.00	6.75	4.10	1.13	0.10	3.90	4.30
C7: low interest	99	2.75	7.00	4.84	0.87	0.09	4.67	5.01

Supplement H3: Means and standard deviations and confidence intervals for students' subjective likelihood to graduate

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	147	1	5	3.38	0.97	0.08	3.22	3.54
C2: unsure	62	2	5	4.11	0.81	0.10	3.91	4.32
C3: ambiguous	53	1	5	3.66	0.85	0.12	3.43	3.89
C4: job needed	126	1	5	3.51	0.90	0.08	3.35	3.67
C7: low interest	98	1	5	4.02	0.93	0.09	3.84	4.20

Supplement H4: Means and standard deviations and confidence intervals for students' parents HISEI

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	307	14.21	88.70	57.01	20.30	1.16	54.74	59.29
C2: unsure	89	14.21	88.70	62.07	20.80	2.21	57.75	66.40
C3: ambiguous	90	14.21	88.70	54.36	21.85	2.30	49.81	58.84
C4: job needed	228	11.74	88.70	51.36	20.12	1.33	48.75	53.97
C7: low interest	201	16.50	88.96	59.68	19.02	1.34	57.04	62.31

Supplement H5: Means and standard deviations and confidence intervals for students' estimation of getting by with available money

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	136	1	5	3.57	1.07	0.09	3.39	3.75
C2: unsure	59	2	5	3.98	0.90	0.12	3.75	4.21
C3: ambiguous	49	1	5	3.27	1.04	0.15	2.98	3.56
C4: job needed	118	1	5	3.19	1.09	0.10	2.99	3.38
C7: low interest	87	1	5	3.83	0.94	0.10	3.63	4.03

Supplement H6: Means and standard deviations and confidence intervals for students' satisfaction with higher education

Classes	*n*	Min.	Max.	*M*	*SD*	*SE*	Lower *CI*	Upper *CI*
C1: low interest/ performance problems	151	0	10	5.05	2.38	0.19	4.67	5.43
C2: unsure	63	0	10	6.27	2.71	0.34	5.60	6.94
C3: ambiguous	55	0	10	5.33	2.41	0.33	4.69	5.96
C4: job needed	131	0	10	5.23	2.49	0.22	4.80	5.65
C7: low interest	104	0	10	5.79	2.59	0.25	5.29	6.29

Supplement I: Outstanding single reasons for dropout

	Items	Frequency
1	Illness	14
2	Abroad	11
3	Practical work	5
4	Pregnancy	5
5	Incompatibilty	4
6	Job offer	4
7	Fam reasons	4
8	Fail exam	3
9	Lack opportun.	1
10	Interest in sub.	1
	Total	52

Note. Frequency = Cases present a single item with a score of either 5 or 6*, All other item scores are either 1 or 2 of the 1-6 RDQ scale. Illness = illness, Abroad = degree course abroad or internship abroad, Practical work = wanted to do practical work, Pregnancy = pregnancy, Incompatibility = incompatibility of degree course and employment, Job offer = interesting job offer, Fam reasons = Family reasons, Fail exam = failing the exam, Lack opportun. = Poor job opportunities in my field of study; Interest in sub. = low interest in subject.