

Chapter 2

Informational Environments and College Student Dropout

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Introduction

Problems of informational environments are ubiquitous in life. Heterogeneous informational environments and aspects of lacking or distorted information play a major role for the generation of relevant social problems. This can be the case, for instance, if different environments—such as peers, institutions, and digital media or offline sources—present conflicting information to the individual, complicating cognitive adaption. In this paper we discuss the example of students who prematurely leave college. Student dropout from institutions of higher education has been a common phenomenon for many years. It has also been increasingly regarded as a problem for society as it typically entails negative individual and collective consequences. With regard to individual costs, potential qualification deficits and prolonged training careers are the most obvious risks. With regard to collective costs, a high degree of dropout means a misallocation of resources for the institutions of higher education, and these institutions do not adequately fulfill their qualification function in society.

We use the example of leaving college and conceptualize it as being characterized (also) by information problems. We argue, first, that deficits in the

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individual processing of information represent an essential part of the process leading to dropout. Second, we look at the heterogeneity of relevant informational contexts. Specific institutions (such as different academic programs) may provide different environments, and different types of students may have different levels and configurations of information. The complexity of available information due to the interplay between different information contexts can lead to cognitive conflicts with detrimental outcomes since the environment can hardly be changed in our example (see Buder et al., Chap. 3 in this volume). Finally, information strategies may be actively used for promoting academic success. On the basis of this concept, we ask how specific aspects of informational environments and informational behavior mediate the process of academic dropout.

Our paper is structured as follows: We first provide a basic concept of college dropout as an individual process with a special emphasis on informational aspects. The following section discusses various information-related predictors of college dropout. We then test the derived hypotheses using specifically collected student data. After a brief description of our data base and empirical methods, we present and discuss our empirical results. We conclude with a number of practical suggestions.

Integration into College and Problems of Information

Following the seminal work of Tinto (1993), relevant determinants of college dropout are neither exclusively individual nor purely environmental. Rather, college careers can be regarded as status passages among different communities—e.g., between school and college but also between family and former peers and new personal networks of fellow students—where multiple problems of adjustment have to be solved. We can regard academic dropout as a process of increasingly lacking integration. Deficits become manifest in two major areas, referring to *intellectual* or *academic* integration and to *social* integration. Academic integration is achieved predominantly via academic performance. Negative feedback in the form of low grades or failed examinations reduces the level of individual confidence in academic success. Social integration is achieved through personal ties with peers. Lacking or unsatisfactory contacts with fellow students or relevant others will again decrease the subjective likelihood of success and increase the likelihood of dropout.

We can imagine having manifest indicators for integration in these two dimensions such as academic grades or measurements of personal friendship networks. While the lack of academic performance may be regarded as a legitimate reason for college dropout, this is much less the case for lacking social support. However, even the first aspect is not without ambiguity. For example, the personal level of achievement may in fact be unclear to individuals when they receive only diffuse feedback about their level of performance. An adequate processing of information is therefore a necessary link between individual academic potential and performance and the biographical consequences that follow from them. This example also

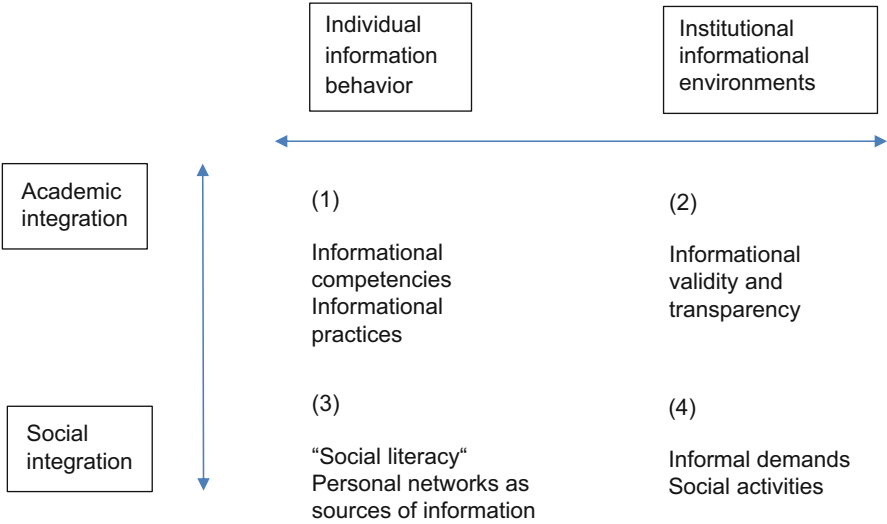


Fig. 2.1 Informational aspects relevant for college integration

suggests a high degree of *insecurity* that is typically involved in higher education, starting with basic issues of organization and including questions of biographical insecurity. We therefore focus on mediating processes between potential deficits in academic and social integration and the individual intentions or decisions to leave academic training.

As illustrated in Fig. 2.1, various aspects of information are involved in processes of integration into the college system and possible forms of disintegration. Ideal-typically speaking, we can distinguish two dimensions: on the one hand, institutional and individual characteristics, and, on the other hand, aspects relevant primarily for *academic* integration and aspects relevant primarily for *social* integration. Regarding the institutional side, not only the college system itself, but also specific educational institutions and even specific programs and courses represent specific informational environments. For individuals, information is a necessary resource for advancing their college careers. The institutional and the individual side are closely connected, and a high risk of dropout may result from a mismatch between these two sides of the ubiquitous information problems. A dichotomization of the two dimensions results in four ideal types of informational aspects that are related to the integration into college. Let us have a brief look at each of them:

1. *Individual aspects of academic integration:* Adequate informational competencies and practices are the basis for individual learning. In particular, they may compensate for existing deficits in individual knowledge.
2. *Institutional aspects of academic integration:* It is the core function of educational institutions to provide not only adequate substantive information (about the content of the subject or organizational details), but also to measure and

to certify individual performance. Of course, this implies that this information should be objective, reliable and valid, and the procedures should be transparent and comprehensible.

3. *Individual aspects of social integration*: Besides Tinto (1993), many sociologists have emphasized that focusing on academic achievement alone provides a very incomplete picture of school life, including aspects of individual advancement, status, and satisfaction. Rather, aspects of “adequate” behavior and inter-personal relationships play a crucial role (Bourdieu, 1996; Coleman, 1961). To be successful within a specific institution, individuals need to be competent in also correctly reading the signs of informal rules of behavior (“hidden curriculum”). Social origin is a well-known predictor for observable differences in this regard. There is no clear borderline towards academic achievement. Social resources that individuals can draw upon may again compensate for existing deficits in individual knowledge. For example, personal social networks may also be used as sources of information about academic questions.
4. *Institutional aspects of social integration*: Social integration is by no means a purely individual phenomenon, but the specific environments may appear to individuals as either more friendly or more hostile in social terms. In this sense they may pose informal demands on students that are not immediately obvious to them but that need to be decoded. In this sense, the lack of information can also be a decisive factor in mechanisms leading to college dropout. On the other hand, institutions of higher education increasingly offer activities that are explicitly designed to facilitate social integration—and hence, potential exchange of information—among their students, for example in the form of special freshmen weeks.

Determinants of Student Dropout (Intentions)

Subsequent to the analytical distinctions developed in the previous section, we now ask about the role of various predictors of dropout (intentions). Using comprehensive survey data (see the next section) we can cover several aspects of the conceptual model presented.

Informational Competencies and Behavior

In the current “information age” (Castells, 2011), students in higher education are expected to acquire appropriate knowledge by familiarizing themselves quickly with new information and evaluating it (Tippelt & Schmidt, 2006). This also involves the use of modern information and communication technology (ICT) for different study-related tasks such as doing research, writing, presenting, or using the computer for communication (Stauder, 2013). Depending on the theoretical back-

ground, terminology for skills related to such tasks include “media competence,” “information literacy,” or “digital competence” (for an overview see Gutiérrez & Tyner, 2011; Zylka, Müller, & Martins, 2011). We use the term “media competence” as it is often understood as an aspect of general communication competence that enables a person to orientate oneself in a mediatized world and to get to know the world actively with the assistance of media (Baacke, 1996). However, little is known about the relevance of media competence for student attrition. There is a strong consensus about the necessity of using digital media effectively (Hesse, Gaiser, & Reinhardt, 2006; Kerres & Voß, 2006; Schmidt-Hertha & Strobel, *in press*) and about the potential of digital media for learning (Meister & Meise, 2010). Studies have shown a regular increase in digital media use among students (e.g., the HISBUS studies carried out in Germany: Kleimann, Göcks, & Özkilic, 2008, or the ECAR study in the USA: Smith, Salaway, & Caruso, 2009). An interrelation between media competence and student dropout seems plausible when considering the significance of information research and the necessary evaluation of sources in many study programs (HRK, 2012). At the same time the spread of a broad range of online learning arrangements in higher education programs and online communication require a higher level of media literacy from both students and university staff (Schäffer, 2015). However, studies have also shown that the majority of students use online platforms and social media for making and sustaining social contacts, but to a much lesser extent for activities directly related to university such as learning (Madge, Meek, Wellens, & Hooley, 2009; Margaryan, Littlejohn, & Vojt, 2011).

Hence, the general use of digital media has to be distinguished from specialized skills relevant for university. Empirical studies have found that only the latter is correlated with academic success (Tien & Fu, 2008), while a general impact of ICT use on students’ learning is disputed (Cox & Marshall, 2007). Following Baacke (1997), we can distinguish between different facets of media competence, such as skills for using software or information resources related to the field of study, the ability to reflect critically on media content, and a general open-mindedness for digital media. Given the omnipresence of digital content in contemporary academic life, we expect study-related media competencies to be positively related to academic success (and thus negatively to dropout). This is also true with regard to the ability to critically evaluate content that, according to several studies, many undergraduates still lack (Timmers & Glas, 2010). No significant “digital divide” can be found within our sample with regard to the general use of digital media. For instance, nine out of ten respondents report to have a Facebook account and a similarly high proportion uses search engines such as Google to prepare for examinations or homework. A general rejection of ICT might therefore have negative effects on both social integration and the ability to find relevant information or to deal with study-related tasks that are organized online. On the other hand, we do not expect extensive use of digital media to have a positive effect on academic integration. As previous research suggests, spending a large amount of time online is usually not accompanied by an increase in study-related activities (Madge et al., 2009).

A related central concept in our analysis is information behavior, understood as strategic search for and evaluation of information (Wilson, 1999). Knowing where to look for information and being able to determine which information is valuable and whether it comes from trustworthy sources are central competencies required in academic life. Studies using standardized tests of information seeking competencies have shown that many students enter university with insufficient skills (Gross & Latham, 2012). Obviously many students are unaware of academic databases or search engines and any more advanced form of search queries. Evaluation-related competencies can manifest themselves, for example, in the ability to differentiate between information found in an academic journal as opposed to information found on a random blog. We look at two factors related to information behavior: Consultation of online versus offline sources when preparing a paper and self-reported behavior with regard to the evaluation of sources. We expect critical reflection on sources of information found on the internet to be positively correlated with academic integration and thus negatively with dropout. For types of sources, we cannot postulate a general superiority of online over offline sources, or vice versa. Moreover, today only few students rely exclusively on offline information. Therefore, doing research in the library or actively seeking advice from the lecturer in addition to using Google or Wikipedia may increase the chances of finding valuable information, which in turn may positively affect academic success.

However, there are probably significant differences between subject groups (Grosch & Gidion, 2011). In accordance with the theory of situated cognition (Greeno, 1998), we expect that there is a strong link between media-related skills and information strategies and specific contexts of application. For instance, learning environments are typically thought to be less standardized in humanities and social sciences as opposed to the natural sciences and medicine, which induces the need for “deep-learning” strategies (Baeten, Kyndt, Struyven, & Dochy, 2010). A simple Google search may thus suffice in one context while a more sophisticated search strategy is needed in another. The effectiveness of online versus offline search strategies can also be related to subject-specific differences on whether the relevant publications can mostly be found online, or, as in the humanities, still in books (Engels, Ossenblok, & Spruyt, 2012). This suggests that doing research online as opposed to going to the library does not have equal effects across all academic fields.

Informational Transparency and Sense of Fairness

The idea that the fairness of grading procedures should affect dropout intentions stems from the role of grades in determining the students’ perceived probability of success. The better the grades a student receives, the greater the chances that they will at some point successfully graduate from university. Conversely, students who continue to receive exceedingly poor grades can take this as an indicator that their

chances to succeed are too low to justify further investments, thus increasing the viability of alternative pathways.

However, it is not enough to view grades as a product. Rather, it is important to consider the procedures from which the grade resulted. At its core, the most basic function of the grading process is to take an input in the form of student knowledge and assign a quantitative measure to it. Thus, grades should ideally reflect student knowledge. But if the grading process is not fair, this function is impeded (Burger & Groß, 2016). The strategy of investigating the fairness of a procedure rather than the fairness of an outcome goes back to the works of Thibaut and Walker (1975) and Leventhal (1980) on procedural justice. We distinguish two aspects of procedural justice: control-related procedural justice and validity-related procedural justice.

Control-related procedural justice addresses the extent to which students can participate in the grading process. In the present context, *process control* implies that students are given a voice during the grading process, for example by deciding on the grading criteria together with the instructor. *Decision control* refers to influencing the grade itself (Colquitt, 2001). In turn, *correctability* means that students should have the option to appeal a grading decision they consider to be erroneous (Leventhal, 1980). The more students can get involved in the grading process, the greater their responsibility for the final results. The very existence of this possibility is enough to reassure students that they can still be successful even if they have trouble in future assignments. If, on the other hand, all power lies with the instructor, students can feel that they are kept from receiving the grades they themselves feel they deserve. Since this increases uncertainty regarding the probability of success, it is expected that low control-related procedural justice increases dropout intentions.

In contrast to that, *validity-related* procedural justice does not address questions of student involvement, but rather the extent to which grading procedures are capable of producing valid results. We define grading to be fair with regard to validity-related procedural justice if it fulfills three criteria: bias suppression, consistency, and accuracy. These criteria are important elements of Leventhal's (1980) definition of procedural justice. A procedure can be said to be *free of bias* if it is not guided by self-interest. Applied to the grading process, this means that instructors must not base their grading decisions on their personal sentiments toward individual students, regardless of whether this would result in better or in worse grades. *Consistency* requires that instructors judge the quality of a student's work according to dependable standards. This means that similar efforts should be awarded similar grades. *Accuracy* demands that instructors need to gather all the information necessary to make an informed decision with regard to the grade. The further grading procedures deviate from these ideals, the lower the match between student knowledge and grade. Since these aspects of instructor conduct cannot be influenced by the students, a lack of control-related procedural justice increases uncertainty with regard to the probability of success. Therefore, it is expected that it increases dropout intentions whereas high levels of validity-related procedural justice signal that students are likely to receive an appropriate return on their investments.

Social Integration and Personal Networks

It has long been acknowledged that social networks can be a crucial resource for the formation of human capital (Coleman, 1988). This is not only true for labor market outcomes (Granovetter, 1973), but also earlier in the life-course for educational success (Sacerdote, 2001; Zimmerman, 2003). For both secondary as well as tertiary education, studies have shown that interacting with high-achieving co-students can positively affect academic achievements (Hanushek, Kain, Markman, & Rivkin, 2003; Lavy, Paserman, & Schlosser, 2012; Lomi, Snijders, Steglich, & Torló, 2011). When preparing for examinations or writing homework, friends, roommates, or learning partners can, for example, explain difficult theories or recommend literature (Hasan & Bagde, 2013). This helps to close knowledge gaps and should be positively related to grades, which in turn are associated with lower risks of dropout.

Besides these peer effects, which are directly related to academic performance, social integration can also be important with regard to more informal aspects of college life. Being part of a larger social network increases the chances that information flowing through this network is received (Calvó-Armengol, Patacchini, & Zenou, 2009). This could be information on organizational issues, but also on, say, available jobs as a student assistant. Since the transition to university often involves relocating to another city, off-campus activities such as finding flats or hobbies are also easier in case of successful social integration. Thus, we expect personal networks to be associated with decreased chances of student dropout.

Further Determinants

In addition, several factors have long been established as determinants of student attrition. Studies show the relevance of intellectual capabilities, study motivation, and self-efficacy of students for success in higher education but also underline the meaning of fit between students and study program as a critical factor for student attrition (Heublein & Wolter, 2011; Pascarella & Terenzini, 1983; Kolb, Kraus, Pixner, & Schüpbach, 2006; Robbins et al., 2004; Sarcletti & Müller, 2011; Stinebrickner & Stinebrickner, 2014). In addition, social background has long been related to dropout rates (Bean, 1980; Wolter, Diem, & Messer, 2014). On the other hand, social background appears to be of lower relevance for success in tertiary education because selectivity with regard to parental education or status typically matters more in earlier stages and transitions of education (Hillmert & Jacob, 2010).

Socio-demographic and other factors need to be considered since they could also be correlated with our main variables of interest; for instance, media competencies might be stronger among high-achieving students. Besides, we focus on subject group-specific differences that may, as described above, matter for factors such as media use as well as for dropout rates. Differences in dropout rates may stem from, among other factors, differences in admission procedures between study

courses. Where these are very selective, students typically show better performance (Delaney, Harmon, & Redmond, 2011) and lower dropout rates (Scherfer & Weber, 2014). Several pitfalls of research into student dropouts can also be related to differences in administrative regulations and practices between faculties and study programs. For instance, some study programs with no restrictions of admission are known to attract students who do not intend to graduate in the respective program, but rather intend bridging the time gap until their application for another course is decided upon. These types of dropout are usually not associated with the factors in our model and can thus complicate empirical analysis into the causes of dropout based on standardized surveys.

Data, Measurements, and Methods

We use data from *CampusPanel* (Burger, 2015; Lang & Hillmert, 2014) that we collected at a large German university. This online survey focused on various aspects of academic behavior as well as biographical information. Our sample consists of students from all academic programs at the Bachelor and Master level. Around 3,800 students participated in the first wave, carried out in the winter term of 2013/2014. Of those, around 700 took part in a follow-up panel survey in mid-2015.

Our measurement of dropout is twofold. First, we use dropout intentions as stated in the first wave of the survey as the main dependent variable for our analyses. We construct a scale consisting of three items (validated by confirmatory factor analysis). A list of all items along with descriptive statistics can be found in the Appendix. Second, we want to compare these findings to an analysis of actual dropouts instead of intentions. We therefore investigated whether first-wave participants were still active in their study course in summer 2015, around 1.5 years after the first survey. The panel participants provided us with the information of whether they were still enrolled, or had already graduated, dropped out, or changed subjects. In addition, we gathered administrative data from the university's register on some of the first-wave participants who did not participate in the second wave. This was only possible for a sub-sample of participants since not all gave their student e-mail addresses and agreed to be contacted again. In total, we have information on the status of 1,478 first-wave participants 1.5 years after the study. Among them, 127 left the university without a degree, another 102 changed their major subject but remained within the university, 150 graduated, and the remaining 1,099 were still enrolled in their previous study program. Here, we define dropout as leaving the university without a degree, and hence we have 127 "actual dropouts" in our sample. There are some ambiguities about this definition that necessarily arise when defining dropout. For instance, from the view of a particular study program, changing a subject within university could also be interpreted as a "dropout," whereas from the viewpoint of society, leaving college but subsequently enrolling at another college might not be viewed as dropping out since the respective person is still in tertiary education (as opposed to, say, the labor market). Since we

have incomplete information on study course changes and current status after de-registration from university, we work with the definition given above.

Our central predictors are operationalized as follows. For information behavior, we asked participants to name the sources they consulted when preparing their most recent written assignment. Usage of Google or Wikipedia was classified as “internet sources” while going to the library or asking the lecturer for additional material was termed “traditional sources.” In addition, we constructed an index “evaluation of information,” which was made up of three items measuring self-reported behavior with regard to the evaluation of URLs or sources, and the date of information found online as well as the differentiation between facts and opinions. A factor “online activity” was constructed using questions about twitter usage, blog authorship, total hours spent online per day, and number of memberships in social networks. For “media competence,” we asked respondents to rate their own skills in doing research with library catalogs, using online databases for literature, working with text-processing tools, and using online search engines. A factor “critical attitude towards media” was constructed to capture negative attitudes towards digital technologies in general. High values on this scale mean that respondents think digital communication is too impersonal, internet content is mostly expendable, or that they sometimes feel “swamped” by all the information found online or scared of technology in general. All indices were constructed using factor scores from principal components analysis and were scaled to have mean of zero and standard deviation of one. The two measures of justice were each measured on a three-item scale. “Control-related procedural justice” refers to the perception that professors give the opportunity to voice opinions on grades, and influence or object to them. By contrast, factor scores for “validity-related procedural justice” are high if respondents think their professors are unbiased, consistently use the same standards for grading, and give grades that best reflect students’ state of knowledge. We furthermore included an index “satisfaction with performance” consisting of three items measuring overall satisfaction with one’s own performance as well as comparisons with previous expectations. For “social integration,” we asked whether participants felt they had successfully made contacts with other students, still retain those contacts, and whether they know classmates who they can discuss study-related questions with. As measures of “pre-enrollment information,” students were asked how well they felt informed about study contents, requirements for examinations, and workload prior to enrolling in their present study program. Finally, we asked whether participants felt graduating was an important step to reach their goals in life (dubbed “educational aspirations”).

A number of socio-demographic and other control variables were included in the analysis. The most recent grade obtained for a written assignment was used as a proxy for academic performance. Since many studies find that high school grades predict success in university, we also asked for the university entrance diploma (German *Abitur*) grade average. Gender, migration background, and parental education were included as socio-demographic variables. Migration background is operationalized through parents’ country of birth and is coded 1 if one or both parents (or the respondents themselves) had migrated to Germany

and 0 for all others. Parental education is a measure of whether or not respondents come from an academic family background and counts the number of parents with a degree in tertiary education. An important aspect is the number of semesters the respondent has already studied at the time of answering the questionnaire, since it is well known that dropouts occur more often at an earlier stage during studies. We also asked whether participants had completed an apprenticeship before going to college, i.e. whether they were previously enrolled in Germany's dual vocational training system. Finally, respondents were asked whether they already had an internship during their current study course. Having had work experience (either before or while studying) might affect dropout intentions because these students might have a better idea of what they could do instead if they give up on their studies.

We used ordinary least squares (OLS) regression models to estimate the impact of our predictors on dropout intentions and binary logit models to analyze actual dropouts. Missing data (with the exception of actual dropouts where the available sample was much smaller) were multiply imputed using the software MICE (Van Buuren & Groothuis-Oudshoorn, 2011) available for R (R Core Team, 2013). Each model was separately estimated in ten multiply imputed datasets and the results were averaged using Rubin's (1987) rules. In addition, we carried out split-sample analyses with regard to academic performance and subject group. For performance, a median-split was executed based on grades. Three subject groups are evaluated separately to explore whether the impact of our predictors differs by field of study. These are "language and cultural studies," "mathematics and natural sciences," and "law, economy, and social sciences," as defined by the German Statistical Office. While each of these aggregations still encompasses a heterogeneous group of study majors, the differences between these groups are arguably large enough to be able to uncover mediating effects by the learning environment.

Empirical Results

We start by giving results for *dropout intentions* and then compare the findings to predictors of actual dropout. Table 2.1 displays the regression results where groups of three of our main variables of interest are sequentially added to the models, while socio-demographic and other control variables are included in all models.

The first column (Model 1) introduces indices of information behavior as correlates of dropout intention. As expected, evaluation of information is negatively associated with dropout intentions. Thus, if students critically reflect on sources of information found while doing research on the internet, they are less likely to consider leaving university. This can be interpreted as showing an interrelation between the internalization of standards of academic practice and academic integration. On the other hand, it does not seem to make a difference whether students predominantly search online or offline for study-related information. Relying primarily on traditional (offline) sources has a small positive effect on dropout intentions, but this effect vanishes in the full model. Among the control

Table 2.1 Predictors of dropout intention—linear regression models

	Dependent variable: dropout intentions				
	(1)	(2)	(3)	(4)	(5)
Intercept	−.320*** (.091)	−.259** (.092)	−.054 (.088)	−.157 (.090)	−.088 (.080)
<i>Information behavior</i>					
Evaluation of information	−.204*** (.019)				−.070*** (.018)
Internet sources	.002 (.017)				−.013 (.015)
Traditional sources	.039* (.019)				.002 (.017)
<i>Media competencies and use</i>					
Media competence		−.092*** (.016)			−.003 (.015)
Online activity		.210*** (.017)			.125*** (.015)
Critical attitude towards media		.118*** (.016)			.087*** (.015)
<i>Justice perceptions</i>					
Control-related procedural justice			−.019 (.017)		−.026 (.016)
Validity-related procedural justice			−.156*** (.016)		−.136*** (.015)
Satisfaction with performance			−.354*** (.017)		−.273*** (.017)
<i>Social integration and information</i>					
Social integration				−.190*** (.016)	−.106*** (.015)
Pre-enrollment information				−.145*** (.016)	−.064*** (.015)
Educational aspirations				−.183*** (.016)	−.134*** (.015)
<i>Control variables</i>					
Grades	−.110*** (.024)	−.133*** (.023)	−.028 (.027)	−.120*** (.022)	−.041 (.024)
University entrance grade average	−.056** (.020)	−.046* (.019)	−.064*** (.019)	−.023 (.020)	−.027 (.018)
Gender (female)	−.051 (.040)	−.026 (.041)	−.098* (.040)	−.020 (.037)	−.088** (.034)
Migration background	.037 (.047)	−.006 (.047)	.007 (.048)	.054 (.045)	−.019 (.042)

(continued)

Table 2.1 (continued)

	Dependent variable: dropout intentions				
	(1)	(2)	(3)	(4)	(5)
Parental education	.017 (.023)	.0003 (.023)	.003 (.021)	.014 (.023)	.020 (.020)
Semesters studied	.031*** (.005)	.031*** (.005)	.018*** (.005)	.014** (.005)	.018*** (.004)
Apprenticeship before college	-.208*** (.059)	-.220*** (.059)	-.254*** (.055)	-.175** (.057)	-.136** (.052)
Internship during studies	.159*** (.040)	.158*** (.040)	.165*** (.039)	.131*** (.038)	.078* (.034)
Observations	3816	3816	3816	3816	3816
R ²	.078	.104	.208	.164	.286

Note: Ordinary least squares regression coefficients (standard errors in parentheses) are presented. Subject group dummies are not shown. For coding of variables and data sources see Appendix
^{*} $p < .05$, ^{**} $p < .01$, ^{***} $p < .001$

variables, grades show negative correlations with dropout intentions in all models. High school grade average shows a negative effect as well in most models, albeit with a smaller effect size. Both variables are coded such that high values mean better grades; hence, the results suggest that better academic performance is associated with lower dropout intentions, as expected. Gender, migration background, and parental education are not significantly correlated with intentions to leave college. These intentions tend to become more pronounced the more time a respondent has already spent in his study program. Students who completed vocational training before coming to university appear to be more motivated to stay in their study program. By contrast, work experience through an internship during their studies increases the likelihood that participants consider dropping out of college.

In Model 2, predictors related to media competence and media use were introduced into the analyses while retaining the control variables of the first model. As expected, a positive self-assessment regarding ICT skills was associated with lower dropout intentions. By contrast, extensive use of online applications such as social media, twitter, and blogs was positively related to plans of leaving college. This finding surely requires further exploration, but it might show that usage of digital media is not per se associated with better academic integration, if it does not come with specific study-related ICT skills. Being opposed to media altogether, on the other hand, tends to be accompanied by higher dropout intentions as well.

Regarding the impact of justice perceptions, only validity-related procedural justice positively affects intentions to stay in university (see Model 3). That is, students who perceive the grading process to be fair and their professors to be unbiased are less likely to consider leaving college prematurely. Control-related procedural justice – the perception of being able to influence grades and voice objections—is apparently not important for the decision to drop out of a study program. Satisfaction with their own performance turns out to be the best predictor

of students' dropout intentions. This factor mediates the effect of grades, which is reduced once satisfaction with performance is entered into the models. This suggests that even if grades are below average, but a student is still satisfied with his or her performance, dropout intentions are usually low. Generally, however, satisfaction with performance is greater if grades are better.

Finally, Model 4 shows a considerable effect of social integration on dropout intentions of the expected sign. This effect is independent of grades, i.e. contacts with classmates do not primarily lower dropout intentions through peer effects on academic performance, but can apparently rather be attributed to the non-academic benefits of social networks on campus. Dropout intentions are also lower if students felt well informed about their study course regarding contents, workload, and terms of examinations before enrolling. In addition, educational aspirations, i.e. the ascription of importance to obtaining a degree, tend to go hand in hand with fewer thoughts about leaving college.

Do these patterns differ by field of study? Figure 2.2 replicates the analyses shown in Table 2.1, full model (5), separately for three subject groups. Note that around 14% of students belong to neither of these groups (among them students of medicine) and were dropped for these analyses. The plots show effect size and 95% confidence intervals for each predictor on dropout intentions within the respective field of study. The same stepwise regressions were estimated as in Table 2.1 (i.e., only three factors of interest entered the analysis at a time together with all control variables; the plots show the combined results). Overall, the findings are surprisingly stable across subject groups. A few notable differences can be highlighted. For instance, media use and ICT competencies seem to be less strongly related to dropout intentions in law, economics, and social sciences compared with the other study majors. In particular, online activity has no effect at all for this group while it does for the other two. Grades also seem to matter less for students of law, economics, and social sciences (although high school grade average still exerts a significant effect). Most other factors, in particular information behavior, justice perceptions, and social integration are virtually identical in their effects on dropout intentions across fields of study.

We also explored whether our findings differ for high- versus low-performing students. For instance, one might expect justice perceptions with regard to the grading process to be less of a concern the better the individual's grades are. Similarly, a high level of social integration could be more important as a motivation to stay in university for students with lower academic success rates. However, as Fig. 2.3 shows, this is not the case. We did a median-split with regard to both grades and high-school grade average such that the upper panel of Fig. 2.3 only comprises above-average students with regard to both measures of performance, while the lower panel shows results for below-average performers only. As the results suggest, most of the effects found in the full sample equally hold for students with stronger or weaker performances. This is true for most of our factors of interest such as media competences, justice perceptions, social integration, and satisfaction with performance. With regard to evaluation of information, the coefficient is higher for low-performing students, suggesting they can benefit more from adopting strategies

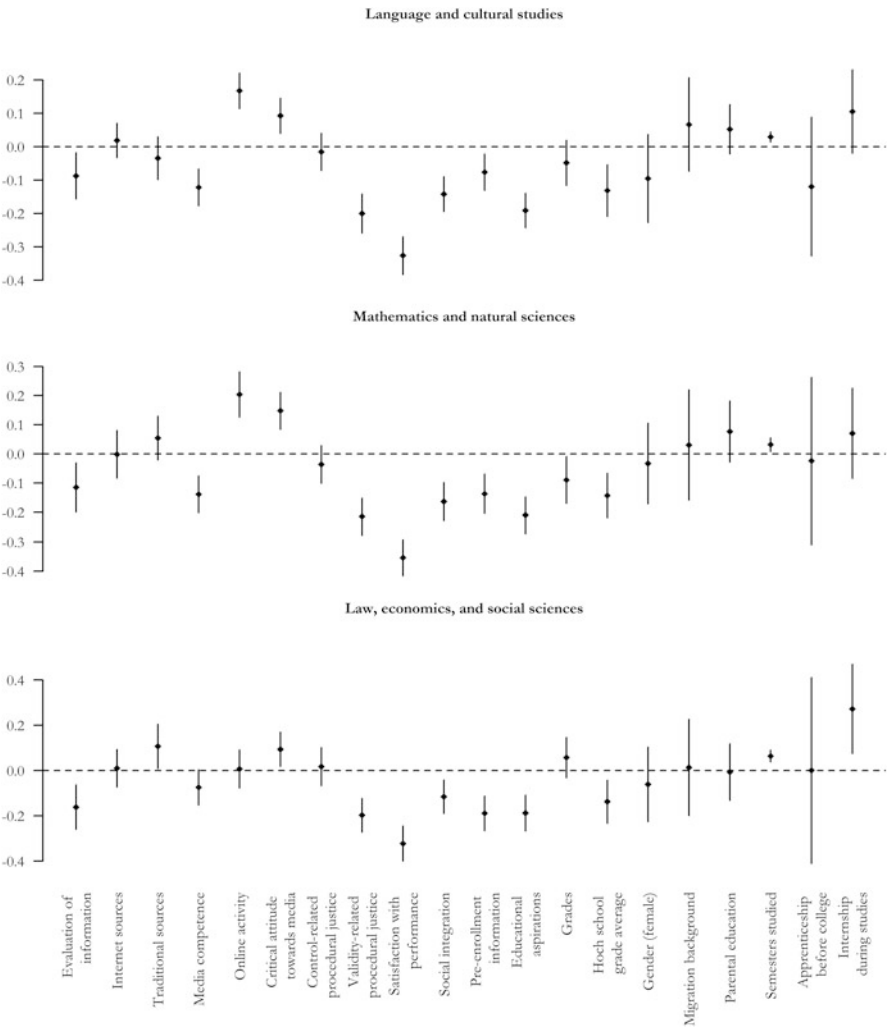


Fig. 2.2 Determinants of dropout intention by subject group. *Note:* Plot shows ordinary least squares estimates and 95% confidence intervals. For coding of variables, see Appendix

of critical reflection on sources of information. Higher performers, by contrast, can apparently be lured out of university with internships during studies, while this is not the case for other students.

Finally, we want to know whether our results hold not only for stated dropout intentions, but also for the prediction of actual dropouts. Table 2.2 replicates the analyses of Table 2.1 but with a binary dependent variable coded 1 for survey participants who had prematurely left college around 1.5 years after our survey. All in all, as the logistic regression results suggest, the prediction of actual dropouts

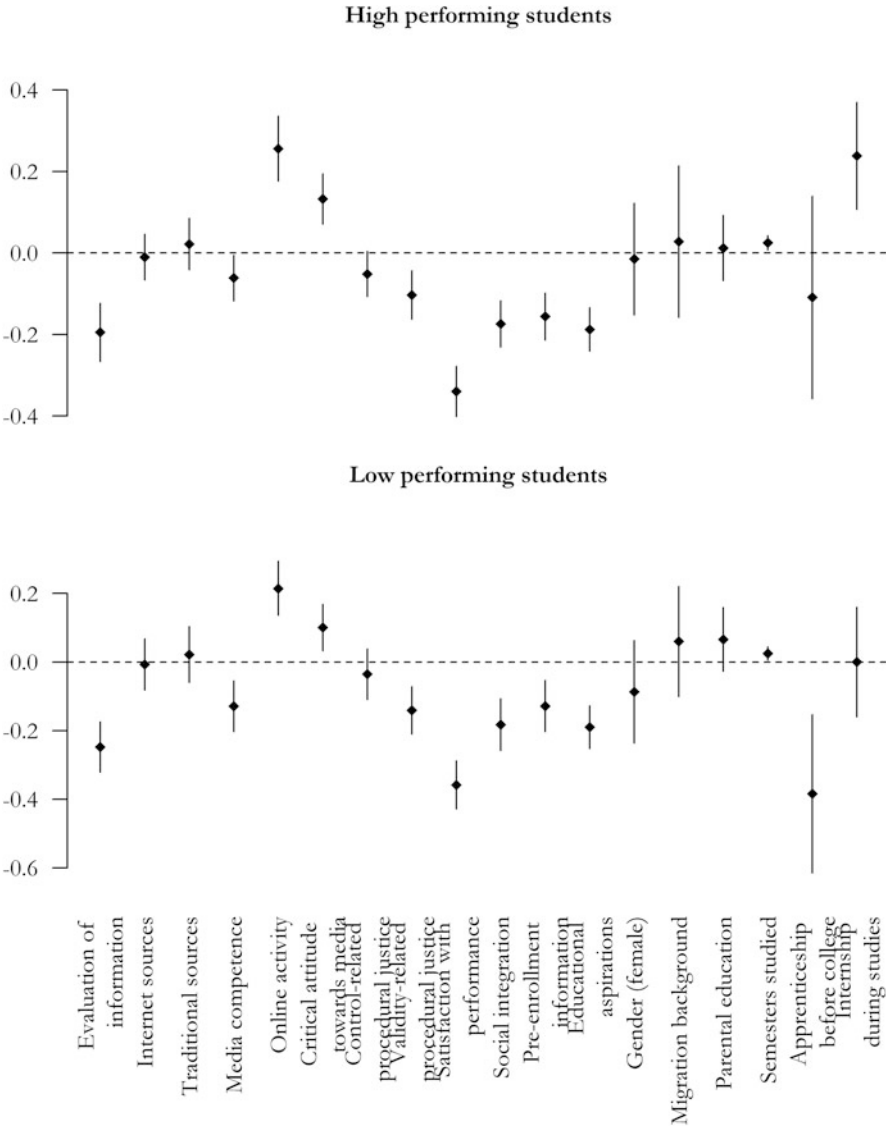


Fig. 2.3 Determinants of dropout intention by performance level. *Note:* Plot shows ordinary least squares estimates and 95% confidence intervals. For coding of variables, see Appendix

is much more difficult than the explanation of dropout intentions. Among the factors that were previously identified as important correlates of intentions to leave university, only a few are also significant predictors of dropouts. Most notably, perceptions of a fair grading process (validity-related procedural justice) and a high level of social integration are negatively associated with later dropout. We

Table 2.2 Predictors of actual dropout—logistic regression models

	Dependent variable: dropout				
	(1)	(2)	(3)	(4)	(5)
Intercept	−2.365*** (.604)	−2.238*** (.604)	−2.264*** (.616)	−2.134*** (.606)	−2.040*** (.463)
<i>Information behavior</i>					
Evaluation of information	.118 (.122)				.114 (.099)
Internet sources	.224* (.106)				.157* (.079)
Traditional sources	.136 (.110)				.073 (.084)
<i>Media competence and use</i>					
Media competence		−.193 (.105)		.018 (.078)	−.193 (.105)
Online activity		−.296** (.096)		−.280*** (.077)	−.296** (.096)
Critical attitude towards media		−.062 (.107)		.059 (.086)	−.062 (.107)
<i>Justice perceptions</i>					
Control-related procedural justice			−.193 (.105)		.018 (.078)
Validity-related procedural justice			−.296** (.096)		−.280*** (.077)
Satisfaction with performance			−.062 (.107)		.059 (.086)
<i>Social integration and information</i>					
Social integration				−.186* (.090)	−.191** (.073)
Pre-enrollment information				−.018 (.095)	.014 (.076)
Educational aspirations				−.023 (.093)	.026 (.077)
<i>Control variables</i>					
Grades	−.069 (.132)	−.058 (.130)	−.011 (.144)	−.051 (.129)	−.015 (.106)
University entrance grade average	−.127 (.110)	−.150 (.108)	−.194 (.112)	−.137 (.109)	−.043 (.086)
Gender (female)	.004 (.209)	−.017 (.208)	−.176 (.209)	−.036 (.205)	.121 (.169)
Migration background	.082 (.245)	.011 (.251)	.055 (.249)	.092 (.246)	.105 (.196)

(continued)

Table 2.2 (continued)

	Dependent variable: dropout				
	(1)	(2)	(3)	(4)	(5)
Parental education	.113 (.129)	.123 (.129)	.125 (.129)	.117 (.129)	.086 (.101)
Semesters studied	-.162*** (.043)	-.153*** (.043)	-.175*** (.045)	-.156*** (.043)	-.117*** (.030)
Apprenticeship before college	-.166 (.398)	-.129 (.398)	-.158 (.399)	-.191 (.399)	-.392 (.330)
Internship during studies	-.174 (.223)	-.222 (.221)	-.170 (.228)	-.287 (.221)	-.010 (.177)
Observations	1478	1478	1478	1478	1478
Log Likelihood	-413.75	-414.82	-406.10	-414.69	-601.54
Akaike Inf. Crit.	857.50	859.65	842.20	859.39	1251.09

Note: Logit models with binary dependent variable. Predictors are lagged 1 year. Subject group dummies are not shown. For coding of variables and data sources see Appendix * $p < .05$, ** $p < .01$, *** $p < .001$

also find an effect from the usage of internet sources for the preparation of written assignments here, suggesting that relying (solely) on Google and Wikipedia for research might negatively affect academic integration. In addition, it is well known that many students quit university in an early phase of their studies, so it is not surprising that dropouts become less frequent the longer the respondents studied.

These findings point to the multi-faceted nature of dropouts. While low perceived fairness and poor social integration do predict later dropout behavior, there are probably many types of dropout that do not fit into the patterns we could cover with our survey questions. For instance, some students leave after having been accepted at another university, others are forcibly dropped from their course after failing a crucial test. In such cases, early warnings for dropout intentions need not necessarily have been visible in the initial survey. It should be noted that our reduced dataset for these analyses might not be representative for all dropouts, since half of our sample consists of panel participants. In particular, among those who could not be traced with administrative data and refused to be contacted again by our survey, former students who dropped out because of dissatisfaction or insufficient performances might be overrepresented. Furthermore, at the time of the first survey wave, many of those who failed very early in their studies might already have gone or been less motivated to take part in the survey.

Summary and Conclusions

Interpretation of Our Results and Recommendations

Informational environments can play an important role in the intention to leave college prematurely beyond academic performance and related factors, which have long been studied as predictors of student attrition. Our analyses indicate that even among students with good grades, poor social integration and perceptions of injustice regarding grading processes can induce dropout intentions and indeed lead to later dropout. Being well informed on the contents and requirements is also important for later motivation to continue in the chosen study course. These correlations can be found equally among students of the humanities, law, or social sciences as well as in the natural sciences.

Our findings also highlight the role of digital media use. Extensive online activities (i.e., the frequent use of Twitter, social networks, or blogs) do not contribute to higher academic integration per se, as our data suggest. Spending a lot of time online can in fact be associated with higher dropout intentions, a finding that calls for further investigation of the mechanisms involved. However, rejecting digital media altogether is also accompanied by poorer academic integration. Rather, possessing study-related media competencies and critically evaluating resources found on the internet are shown to be important in reducing dropout intentions.

Compared with the dropout intentions stated in our online survey, we find that actual dropouts as shown in the administrative records are harder to predict. This finding points to the diverse reasons for leaving university prematurely, many of which do not necessarily fit into the patterns of poor academic performance or low social integration. For instance, we saw that especially among well-performing students, work experience outside university as part of an internship can trigger motivation to leave college despite otherwise favorable views on the study course and life on campus in general. Many students also change their subject or continue their studies at another university for a variety of reasons. Informational environments can also play a role here, for instance through online research or information from social networks about specific contents of study courses elsewhere. Finally, many individual reasons that have their origins outside of university's reach (such as family or health-related issues) can influence motivation to stay in or leave college.

For faculty administrations and study programs that seek to understand and address dropout rates, we recommend paying attention to the multitude of facets the dropout phenomenon can have. This means that the specific situation of a study program must be taken into consideration. For instance, study programs with strict admission procedures are different from courses without entrance restrictions. Some programs are known to attract many students that ultimately seek to "bridge time" until, e.g., application processes for similar and more prestigious courses are decided upon. This situation obviously requires different measures compared with programs where most of the dropouts can be attributed to high performance requirements in examinations.

However, as we have demonstrated in our analyses, several factors are relevant for most fields of study. For instance, a poor level of information before enrollment is often followed by dropout intentions. This seems especially salient for the subject groups encompassing law, economics, and social sciences, but also for other major subjects. Quite often, students enter these programs without a full understanding of the requirements (e.g., with regard to mathematical skills) and contents of the course in question. Program directors may want to increase their efforts to communicate these contents to applicants or potentially interested high-school pupils. Putting great emphasis on fair and transparent standards of performance evaluations is also recommended since perceptions of unfair grading processes are a rather strong predictor of dropout intentions as well as actual dropouts.

Outlook: The Potential of (Digital) Media

Finally, as our findings show, media competencies can play a role in reducing dropout intentions. This seems to be the case for the natural sciences, but also for the humanities. To date, ICT skills are predominantly conveyed outside university. However, informational environments are not fixed. They can be actively changed, and electronic media play an increasing role in informational environments. Hence, there is considerable potential for the use of media in general and electronic media in particular in tackling problems of information in higher education contexts.

For example, the ever-increasing availability of books, journals, and other scholarly works on the internet should greatly facilitate research activities related to papers or examinations for students. With remote access to university library subscriptions from computers at home as well as from mobile devices, many offers are currently available anywhere and anytime. However, platforms such as JSTOR, SpringerLink, Google Scholar, or university library catalogs need to be better understood by students and they need to acquire the necessary skills to find and retrieve scientific content with these tools. The availability of sophisticated search engines and platforms specifically designed for academic purposes stands in contrast to prevailing research practices found among many freshmen (but also more advanced students) who often use rather simple search strategies. Moreover, with the increasing amount of information available online, being able to critically evaluate sources of information becomes more important. This is directly linked to learning about conventions prevalent in academia (e.g., citing scientific journals in essays rather than Wikipedia or random blogs), which can increase academic integration and hence prevent dropouts.

Appendix

Table 2.3 Definitions and descriptive statistics of the variables used in the analyses

Variable	Definition/item(s) used	Valid <i>N</i>	Mean	SD	Min	Max
Dropout	Administrative data: Participants who had left university without a degree at time of second wave	1,478	0.155	0.362	0	1
Grades	Grade received for last written assignment (reverse-coded: higher is better)	1,600	1.884	0.853	1.000	6.000
High school grade average	University entrance diploma grade average (“Abiturnote”, reverse-coded: higher is better)	2,904	2.056	0.609	1.000	3.800
Gender	0 = Male, 1 = Female	3,083	0.640	0.480	0	1
Parental education	Number of parents having tertiary education	2,143	0.859	0.826	0	2
Apprenticeship before college	Participant has completed an apprenticeship/ vocational training (“Ausbildung”) before going to university	3,062	0.092	0.289	0	1
Migration background	0 = Both parents were born in Germany, 1 = At least one parent was born abroad	2,542	0.191	0.393	0	1
Language and cultural studies	Major subject belongs into this group as defined by the German Statistical Office	3,816	0.343	0.475	0	1
Mathematics and natural sciences	Major subject belongs into this group as defined by the German Statistical Office	3,816	0.251	0.434	0	1
Law, economics, and social sciences	Major subject belongs into this group as defined by the German Statistical Office	3,816	0.168	0.374	0	1
Medicine	Major subject belongs into this group as defined by the German Statistical Office	3,816	0.100	0.301	0	1
Other subject group		3,816	0.036	0.186	0	1
Semesters studied	Number of semesters participant has been enrolled in current degree course at time of survey	3,304	4.235	3.758	0	50
Internship during studies	Already completed an internship during current course of studies (1 = No, 2 = Yes).	3,107	1.599	0.490	1	2

(continued)

Table 2.3 (continued)

Variable	Definition/item(s) used	Valid <i>N</i>	Mean	SD	Min	Max
Factor: evaluation of information	<ul style="list-style-type: none"> “While preparing my last written assignment I have: <ul style="list-style-type: none"> – paid attention to the URL/ source of an information to evaluate it – paid attention to the date when information I found on the internet was last edited – tried to differentiate between facts and opinions” 	3,816	0.000	1.000	–2.958	1.881
Factor: internet sources	<ul style="list-style-type: none"> “For my last written assignment I: <ul style="list-style-type: none"> – used Google – used Wikipedia” 	3,816	0.000	1.000	–2.755	1.202
Factor: traditional sources	<ul style="list-style-type: none"> “For my last written assignment I: <ul style="list-style-type: none"> – went to the library and did research there – consulted my lecturer” 	3,816	0.000	1.000	–2.169	1.775
Factor: control-related procedural justice	<ul style="list-style-type: none"> “My professors give me the opportunity to express my views on the grading” “My professors give me the opportunity to influence the grades I am given” “My professors give me the opportunity to object to the grade” 	3,816	–0.000	1.000	–2.239	3.093
Factor: validity-related procedural justice	<ul style="list-style-type: none"> “My professors consistently use the same standards for grading” “My professors are unbiased when grading” “My professors ensure that my grade best reflects the state of my knowledge” 	3,816	0.000	1.000	–3.721	1.775
Factor: satisfaction with performance	<ul style="list-style-type: none"> “I am satisfied with my study performance” “I have fully met my expectations regarding my academic performance” “My achievements in university are better than initially expected” 	3,816	0.000	1.000	–2.863	2.092
Factor: social integration	<ul style="list-style-type: none"> “I have a lot of contact with other students from my class” “I know many classmates whom I can discuss study-related questions with” “I managed to make good contacts with other students so far” 	3,816	0.000	1.000	–2.837	1.497

Factor: pre-enrollment information	<p>“How was your level of information before enrolling in your present degree course regarding:</p> <ul style="list-style-type: none"> – Study contents – Requirements for exams – Study-related workload” 	3,816	–0.000	1.000	–1.940	2.477
Educational aspirations	“Graduating is an important step to reach my goals in life”	3,108	5.856	1.334	1	7
Factor: online activity	<p>“Have you ever used Twitter?” (1 = Never, 5 = several times a day)</p> <p>“Have you ever written in a blog?” (1 = Never, 5 = Several times a day)</p> <p>“How many hours do you spend online on an average day?”</p> <p>“How many social networks are you a member of?”</p>	3,816	0.000	1.000	–1.094	4,928
Factor: media competence	<p>“How do you rate your skills in the following domains:</p> <ul style="list-style-type: none"> – Doing research with library catalogs – Using online databases for literature – Text-processing tools (Word, OpenOffice, LateX, etc.) – Using search engines on the internet” 	3,816	–0.000	1.000	–4.660	1.984
Factor: critical attitude towards media	<p>“Technology sometimes scares me”</p> <p>“Communication via computer and internet is too impersonal”</p> <p>“I sometimes feel swamped by the information flood”</p> <p>“Most offers on the internet are expendable”</p>	3,816	–0.000	1.000	–2.144	3.433
Factor: dropout intention (log)	<p>“I am seriously considering changing to another university”</p> <p>“I am seriously considering abandoning my course of studies”</p> <p>“I frequently thought about dropping out of university”</p>	3,816	0.545	0.441	0.065	1.888

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