CampusPanelPaper 2

Social status reproduction in tertiary education: The interaction between individual information seeking behavior and institutional standardization

Volker Lang
Steffen Hillmert
Social status reproduction in tertiary education: The interaction between individual information seeking behavior and institutional standardization

Abstract

We analyze the role of the standardization of learning environments in conjunction with information seeking behavior related to course achievement as a mechanism of social status reproduction in tertiary education. We develop a formal model of educational achievement and status reproduction in tertiary education based on general production theory. We hypothesize that both the field-of-study level standardization of learning environments and individual information seeking behavior have a positive effect on course achievement. Furthermore, we expect that these effects depend negatively on each other and are only relevant for less standardized academic tasks. Given the comparative advantage of students of higher social origin with respect to developed information seeking skills, we also expect an influence of the social background through these skills on educational achievement in less standardized learning environments. Taken together, these hypotheses form a differential asset conversion mechanism. They predict that social reproduction within tertiary education differs between more and less standardized learning environments. We test and verify our hypotheses using a novel dataset designed to investigate specific mechanisms of social inequality within tertiary education, the CampusPanel. Our results highlight the heterogeneity of social status reproduction processes and the importance of considering the interrelations between micro-level mechanisms and their contexts.
Introduction

In this paper we investigate how field-of-study-specific learning environments in combination with individual information seeking behavior influence social status reproduction within tertiary education. It is well known that tertiary education is a key mediator of the status attainment process (see Sewell et al., 1970). It increases the chance of reaching a high social class position (see Breen/Jonsson, 2005) and achieving the related socio-economic premiums (see Hout, 2012), e.g., higher earnings. It has also been shown that decisions about types of tertiary education and field-of-study choices are selective on social background (see Reimer/Pollak, 2010; van de Werfhorst/Luijkx, 2010). Higher secondary graduates with a higher socio-economic status (SES) more frequently decide to take longer courses of study (see Trivedi, 2013). They also choose more often to study classic professions providing not only good employment prospects (see Arcidiacono et al., 2012) but also higher social prestige (see van de Werfhorst et al., 2003) as well as arts and humanities (see Goyette/Mullen, 2006). Furthermore, higher secondary graduates with a higher SES more frequently enroll in elite tertiary institutions (see Davies/Guppy, 1997; Duru-Bellat et al., 2008). Socially selective type-of-tertiary-education decisions and field-of-study choices thus mediate the influence of the parental background on the social status attainment process (see Jackson et al., 2008). On top of these (secondary) choice effects, selection procedures into tertiary education are often based on university entrance diploma (UED) grades or scores of standardized entrance tests. Due to (primary) SES effects they are also associated with social selectivity (see Carnevale/Rose, 2003), and such regulations contribute to a concentration of students with a higher SES in fields of study with excess demand (see Alon/Tienda, 2007; Briggs, 2001; Karen, 2002). Phenomena of social selectivity in tertiary education are not limited to questions of access, but they include selective dropout and typical mobility patterns and trajectories (see Tinto, 1993; Hillmert/Jacob, 2010). Course achievement is a primary determinant of these patterns including successful graduation and finally the status attainment process. Specific institutional contexts of the chosen tertiary education, especially the learning environments specific to the field of study, potentially mediate social origin effects on status attainment (see Alon, 2009) leading to different course achievement and conditional pathways (see Goldrick-Rab, 2006). In this paper we investigate a differential asset conversion mechanism (see Hodges, 1992; Nash, 1990; Bourdieu/Passeron, 1977)\(^1\) with respect to social background effects on course achievement in tertiary education: The field-of-study specific standardization of learning environments and its interaction with individual information seeking behavior for course assignments. This mechanism consists of two steps: First, students with higher SES have, on average, better information seeking skills. Second, course achievement increases with the standardization of learning environments and the effect of individual information seeking on course achievement decreases with this standardization. Our data used for this study exhibits typical tendencies: The mean of parental ISEI is above average in the classical professions: Theology, law, and especially medicine. It is also above average in the fields with the largest excess demand using UED based selection procedures: Economic sciences, medicine and

\(^1\) A differential asset conversion mechanism is an explanatory factor focusing on differences in fit between assets acquired in an origin context and demands in a destination context (see Hodges et al., 1992). A classical example from Bourdieu's work is the demand for the cultural habits of upper classes in elite institutions which lower classes did not learn while growing up, and therefore they often struggle trying to conform with the cultural norms in such institutions (see Bourdieu, 1984).
psychology. However, the specified differential asset conversion mechanism obviously operates independent of the classical choice and selection mechanisms into tertiary education. Pearson's $r$ between the mean of parental ISEI within a field of study (indicating social selectivity in educational choice preferences) and the selectivity of admission in this field (measured by mean differences in UED grades before and after admission) is .43**, and Pearson's $r$ between those indicators and the mean perceived degree of standardization of learning environments on the field-of-study level is .22 and .08, respectively. This low correlation is also visible in Figure 1, displaying the standardization scale of learning environments central to our study. These independencies suggest that the standardization of learning environments is a contextual property often operating behind the backs of actors, and hence it can be expected to be a vantage point for institutional provisions.

**Figure 1:** Perceived degree of standardization of learning environments by field of study

![Figure 1: Perceived degree of standardization of learning environments by field of study](image)

Source: Own calculations based on CampusPanel, wave "a" (n=2,223)

Section 2 summarizes the further state of research on our topic. In Section 3 we develop a formal model of educational achievement and status reproduction in tertiary education based on general production theory. From this model our hypotheses to address the following set of research questions are deduced: First, how is achievement in tertiary education influenced by the standardization of learning environments and individual information seeking behavior? Second, how is the effect of this individual behavior moderated by the contextual property standardization of the learning environment? Third, how do these relationships mediate social status reproduction within tertiary education? Section 4 describes the operationalization of

---

2 While Figure 1 indicates the independence between the standardization scale of learning environments and social selective educational choice mechanisms, it also gives an impression of the degree of standardization of learning environments of different fields of study in our sample. But since these results are also the product of place-of-study-specific institutional characteristics, they cannot be interpreted as solely properties of the respective fields of study. Based on our study, we make generic claims (and deduce generic hypotheses) related to the properties of the used standardization scale of learning environments, but not with respect to the assignment of degrees of standardization to specific fields of study.
our concept as well as the methods and data used. In Section 5 the results of our mechanism test are presented, while Section 6 concludes and discusses further implications.

State of Research

Studies based on multilevel variance decompositions point towards a positive influence of SES as well as institutional factors like student-to-instructor ratios on success rates in tertiary education (see Attewell et al., 2011; Berg/Hofman, 2005). Since tough procedures of admission to tertiary education – in combination with primary effects – tend to create positively selected groups among low-SES students, these studies also show that the strength of the SES effect on success rates decreases with the selectivity of admission procedures. In addition, tertiary success rates are influenced by motivational factors as well as by the satisfaction with the course of study and with the own academic performance (see Brandstätter/Farthofer, 2003).

Other analyses show a strong impact of selective admission procedures on further academic performance in terms of grade attainment (see Delaney et al., 2011). Net of this selection effect, these analyses find a moderate positive impact of SES on grade attainment, and this impact decreases over the course of studies. Even in contexts with a comparatively low level of social inequality like Norway, this moderate SES effect, net of selection into tertiary education, is present (see Hansen/Mastekaasa, 2006). Hansen and Mastekaasa's study also shows that the gap shrinks with the cultural capital possessed by low-SES parents. Furthermore, research finds that motivation (see Lizzi/Wilson, 2013), time management and other self-regulation practices (see Britton/Tesser, 1991; Kitsantas, 2002; Richardson/Abraham, 2013) as well as the conscientiousness of students (see Kappe/Flier, 2012) influence grade attainment comparably much stronger than general academic ability test scores. In principle, research so far also demonstrates that investments in study time – used as an indicator of effort – influence academic performance positively (see Stinebrickner/Stinebrickner, 2004). However, the same studies also clarify that self-assessments of these investments have to be interpreted very cautiously when taken as effort indicators, since academic performance and overestimations of study time investments are negatively correlated. This relationship between actual performance and self-assessment is also present for academic achievement in general (see Buckelew et al., 2013). Moreover, such mismatches between expected and actual competencies as well as achievement are an important predictor of tertiary education drop-out and decisions to change fields of study (see Stinebrickner/Stinebrickner, 2011). In addition, analyses show that the correlation between different academic achievements over a course of study is mediated by growing self-efficacy with respect to academic performance (see Diseth, 2011).

With a focus on the standardization of learning environments as a determinant of academic performance, our analysis adds another twist to this series of studies. We move beyond institutional-level indicators related to the conventional view on mechanisms of choice and selection into tertiary education as outlined above (see also Section 1). In general, the standardization of learning environments can be conceptualized as consisting of two strongly interrelated aspects: One dimension is concerned with the formal regulations of an educational context, e.g., the standardization of the curricula of degree programs. The other one is related to the interaction practices within an educational context, e.g., the standardization of the types of information sources that are typically used and the styles of
communication that regarded as professional (see Knorr Cetina, 1991, for an application of this concept to research practices in different fields). On the individual level, information seeking skills are the essential asset facilitating productive interaction with learning environments (see Castells, 1996). Therefore, it is plausible that information seeking behavior is a central source of variation in academic performance within a specific learning environment. By information seeking behavior we mean information search behavior in the sense of Wilson (1999). This kind of behavior consists of two parts: First, strategic search activities, and second, evaluations. Both parts are integrated by documentation activities. In addition, information seeking behavior implies activities clarifying the personal information needs. Together these activities form the active part of human information behavior (see Case 2012; Wilson, 2000). Additionally, it is reasonable to assume that the standardization of learning environments is of primary importance with respect to the effect of information seeking on grade attainment (see also Section 3). Accordingly, previous research demonstrates that the intensity of information seeking among tertiary students decreases with the standardization of academic tasks to be conducted (see Scouller, 1998; Speth/Brown, 1990) as well as with the standardization of the learning environments that students are confronted with (see Vermetten et al., 1999; Whitmire, 2002).

Moreover, with respect to the relation between SES and individual information seeking skills, studies show that these skills are a human capital asset primarily learned outside the classrooms of the formal institutions of primary and secondary education (see Becker, 2000; Tondeur et al. 2011), especially if these skills are related to digital informational environments (see Attewell/Battle, 1999; van Deursen/van Diepen, 2013). Hence, information seeking skills tend to be comparatively strongly influenced by informal learning opportunities (see Attewell et al., 2003; Hargittai, 2010) like access to new digital technology in the parental household in early age (see Prensky, 2001; Wood/Howley 2012). Research shows that such opportunities are more frequent if the parental SES is high (see Chaudhuri et al., 2005; Lang/Hillmert, 2013), making the related informational skills comparatively strongly dependent on the social background (see Dimaggio et al., 2004).

Regarding the information seeking skills of tertiary students, recent research has moved beyond the generational dichotomy between the digital-immigrant old and the digital-native young, regarding tertiary students as comparatively young and well-educated, and hence, tech and information savvy (see Bennett/Maton, 2010). Concerning university students’ digital technology skills and usage as a precondition for adequate information seeking behavior in today’s widely digitalized tertiary educational learning environments, SES has a positive effect mediated by experience and (lower) anxiety (see Bozionelos, 2004). In addition, students’ task motivation influences their online activity (see Correa, 2010). In accordance with the studies on informal learning opportunities summed up above, undergraduate students report that social practices in family life shape a set of attitudes and behaviors that can be described as technological identities which influence information seeking behavior in academic life (see Goode, 2010). Furthermore, there are indications that tertiary educational institutions rather perpetuate than reshape these technological identities. Therefore, new informational services find higher acceptance among higher-SES students (see Grosch/Gidion, 2011).

With respect to specific information seeking skills for academia, a series of studies in US and Canadian contexts have shown that a large majority of higher secondary graduates, i.e., depending on secondary-school type, 80 up to 95% of the population enter tertiary education
with less than proficient skills, measured with standardized tests (see Gross/Latham, 2012; 2009; Mittermeyer, 2005). Furthermore, as in the abovementioned case of other academic competencies, especially undergraduate students with less than proficiency are at risk of overestimating their skills and therefore not taking the information seeking training they need. While improvements in information seeking skills with experience over the course of studies can be found regularly (see Callinan, 2005), also students entering post-graduate studies often lack basic information seeking skills evaluated in standardized tests (see Conway, 2011).³ Regarding institutional assistance in developing information seeking skills, a long term assessment of a program over 5 cohorts of college freshmen with pre- and post-assistance standardized tests demonstrated that basic library use instructions helped to improve information seeking skills, especially if the skills had to be used in academic work in the term consecutive to the instructions (see Fain, 2011). Moreover, although students ascribe superior quality to the information sources provided by their tertiary educational institutions, e.g., the university library, in comparison to open access online sources like Wikipedia, they at the same time think that these sources are comparatively hard to access and that they have a low usability (see Colón-Aguirre/Fleming-May, 2012). Analyses show that students’ choices of information sources are very sensitive with respect to accessibility and usability, since students often use satisficing strategies to minimize cognitive effort in seeking information for academic tasks (see Warwick et al., 2009). Overall, this research indicates a potential for improvement in the students’ information seeking behavior through institutional provisions in pre-tertiary as well as during tertiary education. We will come back to this result in our final discussion (see Section 6). Beforehand, we will analyze the current state with respect to its implications regarding social status reproduction.

Theory

In the following, we set up a formal model of the differential asset conversion mechanism underlying social status reproduction within tertiary education based on the general framework of production theory, and we deduce hypotheses to test this mechanism. Therefore, first, the expected effects of the standardization of learning environments and individual information seeking behavior on students’ course achievement as well as their interaction are specified. In a second step, these expected effects are integrated with expectations about SES effects within tertiary education in order to explicate the differential asset conversion mechanism of interest. The chosen specifications imply that we expect course achievement to improve with the degree of standardization of learning environments and with the intensity of information seeking. We also hypothesize that the effect of individual information seeking on course achievement is moderated by the degree of standardization of the learning environment on the field-of-study level, precisely, that it is inversely related to this contextual factor. Regarding SES effects we expect that information seeking skills of students increase with parental SES if the relationship with the respective parent is good, making the necessary parental resources accessible (see Coleman, 1988). Drawn together these hypotheses imply that the social status reproduction mechanisms within tertiary education differ with the standardization of learning environments due to differential asset conversion.

³ E.g., in Conway’s (2011) study 59% of the post-graduates could not select the best method to search for a journal article in a multiple-choice list, 48% could not find a book chapter in a library catalogue, and one third could not identify the Boolean operator “and” as a tool to narrow down a database search.
A central step in the status reproduction process is educational attainment. Between levels of the educational attainment this relation is described by a sequence of educational choices (see Breen/Goldthorpe, 1997) or a single ordinal educational choice (see Cameron/Heckman, 1998). Within an educational level, attainment consist of certified academic tasks (e.g., taking an exam) leading to credentials (see Collins, 1979) and a set of intermediate educational choices (e.g., which courses to attend). In this paper, we are interested in the former as a micro-mechanism of educational attainment. In general, these academic tasks can be conceptualized as a production process inducing course achievement, typically with grades as a measure of output. Through this process, input factors like human capital (e.g., competencies, experiences, which we can also label as incorporated cultural capital, or personality attributes like motivation), effort or social capital (i.e., relations with others granting access to their capitals) are transformed into institutionalized cultural capital (see Bourdieu, 1986). Some of these inputs are more in line with meritocratic principles (see Furlong/Cartmel, 2009) than others (e.g., effort more than popularity). In this regard, our focus is to identify how strongly certain input factors depend on SES in the sense of primary or secondary (choice) effects (see Boudon, 1974). Such input factors qualify as drivers of social status reproduction within tertiary education.

Assuming independent effects of the inputs, the relationship between course achievement indicated by grades \((g)\) and input factors \((x_j)\) can be characterized by a Cobb-Douglas production technology (see Cobb/Douglas, 1928):

\[ g = a(\prod_{j=1}^{l}x_j^{\beta_j})\exp(e), \quad e \sim F(0,\sigma) \quad (1) \]

with scaling parameter \((a)\), factor specific elasticities of grades \((\beta_j)\) and a random component \((e)\) with zero expected mean and a fixed standard deviation. By taking logarithms, \((1)\) is transformed into a linear additive formulation:

\[ \ln(g) = \ln(a) + \sum_{j=1}^{l}\beta_j\ln(x_j) + e \quad (2) \]

Given grades are scaled like a normal output quantity - the more, the better - a positive elasticity of the inputs is expected, \(\beta_j = (\partial\ln(g)/\partial\ln(x_j))(\partial\ln(x_j)/\partial\ln(g)) > 0\). Such an elasticity can be interpreted as a percent change in input leading to a percent change in output (i.e., in the grade).\(^5\) Heterogeneities between production processes are incorporated into \((2)\) by defining a set of situational shifters \(z_k\) with elasticities \(y_{kr}\) and related differential effects of input factors are modeled by a set of two-way interactions \(\eta_{jk}\).\(^6\)

\(^4\) This assumption implies that inputs can neither be characterized as substitutes nor as complements. This is not too restrictive, since dependencies between inputs or on contexts can be incorporated into \((2)\) by interaction terms (see Christensen et al., 1973), as we do in the case of information seeking behavior and the degree of standardization on the field-of-study level. In such a specification, negative interactions indicate substitutability and positive interactions complementarities. Furthermore, if the set of inputs is completely specified, the Cobb-Douglas technology can be regarded as a special case of the CES-technology (see Arrow et al., 1961) with substitution elasticity zero as long as \(\sum_{j=1}^{l}\beta_j = 1\) holds.

\(^5\) Consider the transformation of the expected output change \(g_1\) to \(g_2\) when comparing two input values \(x_{j1}\) and \(x_{j2}\) in \((2)\):

\[ \ln(g_1) - \ln(g_2) = \beta_j(\ln(x_{j1}) - \ln(x_{j2})) \iff \ln(g_1/g_2) = \beta_j(\ln(x_{j1}/x_{j2})) \iff g_1/g_2 = (x_{j1}/x_{j2})^{\beta_j}. \]

\(^6\) Of course, the set can be extended to incorporate higher-order interactions if necessary.
\[
\ln(g) = \ln(a) + \sum_{j=1}^{I} \beta_j \ln(x_j) + \sum_{k=1}^{K} \eta_k z_k + \sum_{i=1}^{I} \sum_{k=1}^{K} \gamma_{ik} \ln(x_j) z_k + e
\]  

If a situational shifter is defined in a log metric, the related elasticity can be interpreted in a similar way as an input factor, as a percent change in input inducing a percent change in output. If it is given in its original metric, instead, the related elasticity has to be interpreted as a unit change in input leading to a percent change in output.\(^7\)

Based on Section 1 and 2 we conclude that the degrees of standardization of learning environments and academic tasks are important situational shifters regarding the production of course achievement. Concerning the degree of standardization of academic tasks we can, e.g., think of exams as being more standardized in comparison to written assignments like term papers. In comparatively standardized learning environments and for comparatively standardized academic tasks the information sources to be used as well as the skills to be demonstrated are more transparent to students. Field-of-study contexts characterized by standardized learning environments and standardized academic tasks demand less individual informational effort. Therefore, given a comparable level of information seeking intensity students receive better grades for less standardized tasks in standardized learning environments. Since for more standardized academic tasks the information to be used is clarified independently of contexts like the learning environment, we expect no contextual standardization effect for such tasks. Given that the standardization of academic tasks is promoted by the standardization of learning environments, we also expect that the relative number of standardized tasks for educational achievement increases with it. Moreover, given a very standardized learning environment less standardized tasks are relatively unimportant for educational achievement. They are, e.g., only used for the evaluation of not-subject-specific soft skills and are graded indulgently. Hence, such grades for less standardized academic tasks in very standardized learning environments are comparatively good and independent of past performance.

**H1:** Grades improve with the degree of standardization of learning environments for less standardized academic tasks.

**H2:** Grading is independent of the degree of standardization of learning environments for more standardized academic tasks.

**H3:** Grades for less standardized academic tasks in very standardized learning environments are comparably good and independent of past performance.

Given the essential-asset character of information seeking behavior regarding learning environments (see Section 2), the elasticity of grades with respect to the intensity of this behavior is of special interest to us. In general, intensified information seeking leads to better knowledge regarding a task, which can be transformed into better performance and course achievement. But this effect is moderated by the degree of standardization of academic tasks. Since for more standardized academic tasks the information to be used is clearly defined, the returns to individual information seeking can be expected to be insignificant. We expect a positive elasticity of grades with respect to the intensity of information seeking only for less

\(^7\) Consider the transformation of the expected output change \(g_1\) to \(g_2\) when comparing two input values \(z_{k1}\) and \(z_{k2}\) in (2): \[\ln(g_1) - \ln(g_2) = \eta_k (z_{k1} - z_{k2}) \iff \ln(g_1/g_2) = \eta_k (z_{k1} - z_{k2}) \iff g_1/g_2 = (z_{k1} - z_{k2})^\eta_k.\] i.e., \(\eta_k\) is the exponent of an input difference and exponentiation with \(\eta_k\) results in the corresponding expected output ratio. To turn this ratio into a change in percent subtract one and multiply by 100.
standardized academic tasks. While this effect is related to differences in returns due to individual behavior, the one regarding H1 is induced by contextual differences in returns.

**H4:** Grades improve with the intensity of information seeking for less standardized academic tasks.

**H5:** Grading is independent of the intensity of information seeking for more standardized academic tasks.

Furthermore, we expect heterogeneities between production processes of course achievement with respect to the elasticity of information seeking. Precisely, we expect this elasticity to decrease with the degree of standardization of learning environments, i.e., $\beta_j|z_k^- - \beta_j|z_k^+ = \eta_{j,k} > 0$. In standardized learning environments it is more often straightforward to find the information which is expected to be used for a task at hand as well as additional information on how to evaluate it, so that the related returns to information seeking are lower. In consequence, we expect that the effect of the intensity of information seeking on course achievement is moderated by the degree of standardization of learning environments.

**H6:** The elasticity of the intensity of information seeking with respect to grades decreases with the degree of standardization of a learning environment.

With respect to other production factors known to be important to educational achievement in tertiary education like past performance, experience and motivation we also expect positive elasticities regarding grades. Evaluation practices often take account of the development of competencies, i.e., expectations of instructors regarding demonstrated abilities of senior students are higher than those regarding freshmen. Hence, we expect weak effects of experience on grades in comparison to other input factors. Additionally, standardized academic tasks like exams have more in common with the tasks students had to conduct during pre-tertiary education, and this commonality induces higher returns to skills acquired during that phase. Therefore, we expect a stronger elasticity of grades with respect to past performance for more standardized academic tasks in comparison to less standardized ones.

**H7:** Grades improve more strongly with pre-tertiary performance for more standardized academic tasks in comparison to less standardized ones.

To incorporate the Cobb-Douglas technology to a sequential production process:

\[
\ln(g_{m=1}) = \ln(a_{m=1}) + \sum_{j=1}^J \beta_m \ln(x_j) + \sum_{k=1}^K \eta_{m>1,k} \ln(y_{m>1,k}) + \sum_{k=1}^K \eta_{m=1,k} \ln(z_k) + \epsilon_{m=1}
\]

\[
\ln(y_{m>1}) = \ln(a_{m>1}) + \sum_{j=1}^J \beta_m \ln(x_j) + \sum_{k=1}^K \eta_{m>1,k} \ln(y_{m>1,k}) + \sum_{k=1}^K \eta_{m=1,k} \ln(z_k) + \epsilon_{m>1}
\]

with $Y = \{y = 2, \ldots, M\}$ a subset of inputs $X = \{x = 1, \ldots, J\}$. Within a system of M equations like (4), dependencies of the input levels on SES as well as on each other can be described. As in the case of direct elasticities, indirect effects base on (4) can be interpreted as a percent (or unit) change in input leading to a percent change in output (e.g., in the grade) given the input is (not) log-scaled.

Previous research indicates that the digital technological and information seeking skills of children and students increase with parental SES due to the low degree of institutionalization of formal informational education and more provisions regarding informal learning.
opportunities in higher SES households (see Section 2). Additionally, in particular information seeking skills regarding educational tasks are better learned given active guidance by instructors (e.g., parents). Therefore, while higher parental SES is a necessary precondition for the development of information seeking skills given a low degree of institutionalization, it only becomes a sufficient condition if it is accessible through social capital (i.e., if the relationship with the respective parent is good). Hence, we expect an improvement of the intensity of information seeking as a consequence of these skills with parental SES only if this sufficient condition is met.

H8: Information seeking skills increase with parental SES if the relationship with the respective parent is good.

H9: Information-seeking skills are independent of parental SES if the relationship with the respective parent is not good.

Furthermore, we know from other studies that the pre-tertiary performance of students increases with parental SES. Taken together hypothesis 4, 6 and 8 constitute a differential asset conversion mechanism that implies the following indirect effects of parental SES on course achievement in tertiary education: Grades for less standardized academic tasks improve with parental SES through the elasticity of the intensity of information seeking with respect to parental SES, given a good relationship with the respective parent. This indirect effect of parental SES decreases with degree of standardization of learning environments. If hypotheses 3 and 7 are additionally taken into account, our model implies that the social status reproduction mechanisms within tertiary education differ with respect to the degree of standardization of learning environments: While in less standardized contexts social status reproduction is induced by the effect of parental SES on information seeking skills, it is due to the influence of parental SES on pre-tertiary educational performance in more standardized environments. In the following (Section 4 and 5) our model is operationalized, the differential asset conversion mechanism is tested and the expected effects are quantified.

4. Methods and operationalization

To test our hypotheses we use a novel dataset designed to investigate specific mechanisms of social inequalities within tertiary education in detail, the Student Panel of the ScienceCampus Tuebingen (CampusPanel; see Lang/Hillmert, 2014). For wave "a" of the CampusPanel 2,411 undergraduate and graduate students (excluding Ph.D. students) participated in an online survey during winter term 2013. They reported on their information seeking behavior with respect to specific course assignments, the type and subjective assessment (especially of the grading) of the respective assignments, their past performance, their motivation and their socio-economic background as well as their perceptions regarding the standardization of the field of study they were enrolled in. This 10%-sample of students at the University of Tuebingen covers the complete range of fields of study typically offered at tertiary educational institutions. 869 of these students were freshmen who had so far taken no course assignment during their current program of study. A further 87 cases studied law, a field of study using a grading scheme at German universities which differs significantly from the other fields and is therefore not suitable for our analysis. 171 students, 12% of the remaining sample, had missing information on the dependent variable "grades" and were therefore excluded from our analysis. Given the potential sensitivity of grading information, this missing share is
rather low. The pattern of missing information is not systematic across fields of study and ranges from 4 to 18%. The remaining students constitute our final sample of 1,284 cases.\(^8\) Of these students, 898 reported on their grades and information seeking behavior regarding their last written assignment (e.g., a term paper) as an academic task and 386 gave information with respect to their last exam.\(^9\) Table 1 gives an overview of the sample distributions of the variables used in our study. The related abbreviations of the variable names are described below in the operationalization of the respective constructs.

\(^{8}\) For our analysis cases are weighted using sampling probability weights constructed based on the enrollment register of Tübingen university for winter term 2013 to take account of the slight overrepresentation of social science students in our sample. The weights are based on a sampling matrix of 18 areas of study crossed by 2\(^{nd}\), 3\(^{rd}\), 4\(^{th}\), 5\(^{th}\) as well as 6\(^{th}\) and above year of study. A replication of our analysis without weights indicating only minor differences is in the annex (see Table A1).

\(^{9}\) Questions with respect to exams were asked if no written assignment had been conducted yet.

Table 1: Descriptive statistics of the sample

<table>
<thead>
<tr>
<th>variable</th>
<th>mean</th>
<th>s.d.</th>
<th>median</th>
<th>min.</th>
<th>max.</th>
<th>units in models</th>
<th># missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>grade</td>
<td>1.86</td>
<td>.83</td>
<td>1.70</td>
<td>1</td>
<td>5</td>
<td>%</td>
<td>0</td>
</tr>
<tr>
<td>exam</td>
<td>.30</td>
<td>.46</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>yes vs. no</td>
<td>0</td>
</tr>
<tr>
<td>m. &amp; p.</td>
<td>.14</td>
<td>.34</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>yes vs. no</td>
<td>0</td>
</tr>
<tr>
<td>inf. beh.</td>
<td>99.61</td>
<td>15.11</td>
<td>100.65</td>
<td>47.67</td>
<td>134.31</td>
<td>10%</td>
<td>0</td>
</tr>
<tr>
<td>UED</td>
<td>2.02</td>
<td>.62</td>
<td>2</td>
<td>1</td>
<td>3.80</td>
<td>10%</td>
<td>0</td>
</tr>
<tr>
<td>tasks</td>
<td>9.05</td>
<td>9.86</td>
<td>6</td>
<td>1</td>
<td>50</td>
<td>10%</td>
<td>0</td>
</tr>
<tr>
<td>years</td>
<td>3.54</td>
<td>1.43</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>1 year</td>
<td>0</td>
</tr>
<tr>
<td>mot.</td>
<td>79.15</td>
<td>12.67</td>
<td>81</td>
<td>29.25</td>
<td>100</td>
<td>10%</td>
<td>43</td>
</tr>
<tr>
<td>women</td>
<td>.65</td>
<td>.48</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>yes vs. no</td>
<td>0</td>
</tr>
<tr>
<td>ISEI</td>
<td>65.37</td>
<td>17.64</td>
<td>70.34</td>
<td>11.01</td>
<td>88.96</td>
<td>10%</td>
<td>120</td>
</tr>
<tr>
<td>n. g. r.</td>
<td>.49</td>
<td>.50</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>yes vs. no</td>
<td>99</td>
</tr>
<tr>
<td>weight</td>
<td>.69</td>
<td>.39</td>
<td>.59</td>
<td>.17</td>
<td>2.60</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Own calculations based on CampusPanel, wave "a" (n = 1,284)

As already specified in the model definition in Section 3, we use grades for a certain assignment as indicator for our dependent variable course achievement in tertiary education. We measure grades using the grading scale typically used by German tertiary educational institutions. The estimated distribution of grades for our target population, differentiated by academic tasks and field-of-study clusters, is in the annex (see Figure A1). Formally, this ordinal scale is designed for a relative ranking of students ranging from 1 (very good) to 5 (not sufficient). In practice as well as in previous studies on educational achievement in tertiary education it is treated as a continuous indicator. Given the overall acceptable coverage of the scale (see Figure A1) we follow this convention, too. To facilitate a comfortable percent-change interpretation of our results based on the educational achievement production model outlined in Section 2, we log-transform and rotate the grading indicator before using it as dependent variable.

The standardization of the learning environments scale (abbr. f. std.) we use (see Figure 1) is conducted on the basis of the means of the perceived degree of formal standardization...
reported by students in each field of study. The formal and interaction practice aspects of the
standardization of learning environments are strongly related, and since the former can be
more reliably measured with a questionnaire, we use an indicator of the formal
standardization of learning environments for this scale.\(^{10}\) Answers were recorded using a
slider instrument ranging from 0 (not at all) to 100 (very much).\(^{11}\) The reliability of the
constructed scale on the field-of-study level is assessed using average mean deviations
(AMD) as a measure for single fields and intra class correlations (ICC) as overall measures.
The AMD of the mean and the logit-transformed hundredth of the mean are reported in the
annex (see Table A2).\(^{12}\) The largest AMD is 41\% (logit-transformed 32\%) larger than the
average indicating no relevant upward deviations in AMD for specific fields of study. The
overall one-parameter ICC of the perceived degree of standardization of learning
environments with respect to fields of study is .17(.04)\(***\). The related individual and
average ICC based on the minimum of 19 raters per field of study are .18(.03) and .80(.03),
respectively. These measures indicate an overall good fit of our scale.\(^{13}\) For our analyses this
standardization of learning environments variable is scaled in units of 10 percentage points
and centered on the weighted individual level mean of 73.09\%. To test H3 we additionally
construct an indicator for highly standardized learning environments with a mean perceived
degree of standardization of 90\% and above. This group includes the fields of study medicine,
molecular medicine and pharmacy (abbr. m. & p.).\(^{14}\) Regarding the differentiation between
more and less standardized academic tasks we use exams (abbr. exam) to indicate more
standardized tasks in comparison to written assignments like term papers. These indicators of
more standardized academic tasks and very standardized learning environments are
incorporated in our analyses as situational shifters.

Individual information seeking behavior for a course assignment (abbr. inf. beh.) is
conceptualized as consisting of three steps building on each other: 1.) defining personal
information needs, 2.) searching for information and 3.) evaluating it (see Section 2; Wilson,
1999). Regarding steps 2.) and 3.), we differentiate between documentation and other
activities; with respect to step one, we distinguish between social and individual activities.
Therefore, this concept of information seeking behavior results in 6 factors. The indicators for
the third to sixth factor (i.e., step 2.) and 3.)) are based on Timmers and Glas (2010), the
ones for the first and second factor (step 1.) were designed by ourselves.\(^{15}\) Originally the
indicators were used to assess information seeking behavior for written assignments, not
exams. All indicators ask about a specific behavior and are measured using a slider

---

\(^{10}\) In the survey students were asked: “How much are studies in your field at your university determined by study
regulations and schedules?” [“Inwieweit ist Ihr Fachstudium an Ihrer Hochschule durch Studienordnungen bzw. -
verlaufspläne festgelegt?”]

\(^{11}\) To construct this scale, the information of all 2,223 students reporting on this indicator was used.

\(^{12}\) Logit-transformed AMD are calculated since the slider instrument is truncated at 0 as well as 100 and for some
fields of study observations are clustered at the upper end of the instruments scale. Using AMD as reliability
measures based on continues slider instruments is less problematic than using them with discrete rating
instruments, since the probability of random agreement between raters decreases with the number of answer
categories.

\(^{13}\) These individual and average ICC calculations are based on a bootstrap sampling procedure with 400 replications.

\(^{14}\) There is also a discontinuity between these three very standardized fields and the less standardized ones (see
Figure 1). The difference between the lower bound of this very standardized group, molecular medicine, and the
next less standardized one, physics, is 7.26%-points.

\(^{15}\) The indicators for step 1.) differ between written assignments and exams, while those for step 2.) and 3.) are the same.
instrument ranging from 0 (not at all) to 100 (very detailed, step 1.); very often, step 2.) and
3.)].

Hence, measurements of behavioral intensity are generated through this procedure. Starting with four to eight indicators for each of the six factors, we constructed a short scale
consisting of two factors based on two pretests and related confirmatory factor analyses
based on structural equation modeling (CFA-SEM). Two measurement models were fitted
separately for more and less standardized academic tasks. For less standardized academic
tasks, written assignments, the theoretically expected factor structure differentiated by types
of written assignments is exactly reproduced by CFA-SEM based on our sample (see Figure A2
in the annex). For more standardized tasks we settle for a more parsimonious solution using
only four factors and in addition a single indicator (see Figure A3 in the annex). For both
models all fit statistics used indicated a good approximation of the observed data structure
(results for exams in parentheses): RMSEA .019 (.026), CFI .988 (.986), TLI .984 (.977),
P(\chi^2>|\chi^2_{saturated}|) .050* (.188), average COD .804 (.785), lowest COD .624 (.728). Based on
these measurement models, a one-dimensional factor score representing information seeking
intensity is constructed. This factor score is scaled to a mean of 100 and a standard deviation
of 15 separately for more and less standardized academic tasks. The field-of-study level
mean factor scores of information seeking intensity range from 96.12 to 107.06 (see Figure
A4 in the annex). With 10.94 score points, this range is about 2/3 of a standard deviation
indicating a low variation in information seeking intensity between fields of study, and hence
facilitating our analyses of differential effects. For our analyses this score is log-transformed,
centered and scaled in units of 10%. To test H6 an interaction term between this measure of
information seeking intensity and the standardization of learning environments scale is
constructed.

Our indicator of past performance, relevant for H3 and H7, are university entrance diploma
grades (abbr. UED) obtained during upper-level secondary education. If an additional
educational qualification, e.g., a vocational training certificate, has been achieved after the
UED and prior to entering tertiary education, the grade of this qualification is used instead. As
in the case of tertiary grades for course assignments, our dependent variable, the scale of
these grades ranges from 1 (very good) to 5 (not sufficient), and hence we also log-transform
and rotate this variable. For our analysis it is additionally centered on the weighted individual-
level mean and scaled in units of 10%. Regarding individual level control variables we use
indicators for experience with academic tasks as well as motivation to study and differentiate
between female and male tertiary students (abbr. women). Experience with academic tasks

---

16 Regarding step 1.), students were asked for example: "At the beginning of my work for this written assignment I
collected information regarding which scientists or other experts had already worked on my topic." ["Zu Beginn der
Anfertigung dieser schriftlichen Ausarbeitung habe ich mich darüber informiert, welche WissenschafterInnen oder
andere ExpertInnen bereits in dem von mir zu bearbeitenden Themengebiet gearbeitet haben."] With respect to
step 2.): "While preparing this written assignment [or: exam] I adapted my questions when I found little or
insufficient information." [Bei der Anfertigung dieser schriftlichen Ausarbeitung [or: Vorbereitung dieser Klausur]
habe ich meine Fragen angepasst, wenn ich wenig oder keine Informationen gefunden habe." Concerning step 3.):
"While preparing this written assignment [or: exam] I tried to differentiate clearly between facts and opinions." ["Bei
der Anfertigung dieser schriftlichen Ausarbeitung [or: Vorbereitung dieser Klausur] habe ich versucht zwischen
Faktendarstellungen und Meinungsbeurteilungen deutlich zu unterscheiden."]

17 Paper type as a background variable influencing information seeking intensity is indicated by the log-transformed
number of pages. The log-transformation is applied since we expect decreasing marginal returns with respect to
information seeking intensity for this background variable.

18 In addition, we constructed several indicators of effort with respect to the specific academic task based on self-
reported investments of time. The common procedure was to use residuals of a regression of these investments on
is indicated by the number of academic tasks already conducted (abbr. tasks), differentiated between more or less standardized ones, and by the year of study (abbr. year), truncated at 6th or more years. In accordance with the model lined out in Section 3, the indicator "number of tasks" is log-transformed for our analyses. Additionally, it is centered on the weighted individual level mean and scaled in units of 10%. The indicator "years of study" is used as a linear situational shifter and is mean centered, too. Motivation to study (abbr. mot.) is measured using an established expected-utility based concept differentiating between intrinsic, extrinsic and altruistic motives (see Simeaner et al., 2011). Assuming independent effects of these motives, the mean of the respective indicators is used.\(^\text{19}\) Answers regarding these indicators were recorded using a slider instrument ranging from 0 (not useful) to 100 (very useful). For our analyses this motivation-to-study indicator is also log-transformed, centered and scaled in units of 10%. With respect to contextual control variables, we use the share of more standardized academic tasks on the field-of-study level (abbr. f. exam) since we expect it to be strongly related to the standardization of learning environments. This share was calculated based on the reported number of exams taken divided by the number of total number of academic tasks conducted.\(^\text{20}\) In our analyses this contextual variable is centered and scaled in units of 10 percentage points.\(^\text{21}\) For the mediation analysis implied by our model, SES is indicated by parental ISEI (see Ganzeboom/Treiman, 2003) using the 2008 scale and assuming (perfect) substitutability between parental SES in case of two parents. This ISEI is calculated based on the parental occupations reported by the students and uses the maximum of the ISEI of both parents. In our path model the ISEI indicator is log-transformed, centered and scaled in units of 10%. To test H8 and H9, a situational shifter indicating a bad relationship with the parent who has the higher SES is constructed (abbr. n. g. r.). The quality of the relationship with parents is reported using a slider instrument ranging from 0 (not good) to 100 (very good), resulting in a distribution with heavy negative skewness indicated by a mode of 100 (33% of the sample).\(^\text{22}\) For our analyses this variable was dichotomized by constructing an indicator separating the distribution at the median. A maximum likelihood based multilevel variance decomposition shows a gross ICC of the field-of-study level with respect to grades in tertiary education of .068(.023)***. The net ICC conditional on the covariates mentioned above is .060(.025)*** indicating a low share of (conditional) variance due to differences between fields of study overall. Given this low (conditional) variance a modeling strategy using a common offset on the field-of-study level is an efficient solution. Therefore, we use a contextual model (see Rohwer/Blossfeld, 2010)

\(^\text{19}\) We also tried an alternative specification assuming (perfect) substitutability and hence using the maximum of these indicators. However, the mean-based specification performed better in our analyses.

\(^\text{20}\) To construct this indicator, the information of all 2,411 students reporting on these questions was used.

\(^\text{21}\) Moreover, the following additional contextual control variables related to the mechanisms of choice and selection into tertiary education (see Section 1) have been constructed and used in our analyses: The mean SES on the field-of-study level indicated by the mean of highest parental ISEI and the differences between mean UED grades before and after admission in the various fields of study. The former is calculated on the basis of the reported parental occupations of 2,188 respondents to our survey, the later is based on register data of the University of Tuebingen for winter term 2013. For these contextual indicators no effects on grading were found conditional on the individual level variables.

\(^\text{22}\) Students were asked: "How good is your relationship with your mother [or: father, respectively]?" ["Wie gut ist Ihre Beziehung zu Ihrer Mutter [or: Ihrem Vater]?"]
with clustered standard errors on the field-of-study level instead of a multilevel random effects model to test our contextual hypotheses. All of the models presented in Section 5 are estimated by (pseudo) maximum likelihood assuming normal distributed errors, i.e., $e_m \sim \mathcal{N}(0, \sigma)$. They are specified in a nested structure with respect to the final path model (see Section 3, Equation 4 and Section 5, Figure 2). In case of missing values in the control variables (see Table 1, mot. 3% missing values, ISEI 9% and n. g. r. 7%) an expectation maximization algorithm is used during the maximum likelihood estimation to approximate the joint distribution of the data including the missing information.

### Results

Table 2 presents log-linear regression models of grades in tertiary education on inputs based on Equation 3 to test H1 to H7 differentiated by types of academic tasks (written a. vs. exam) and between highly standardized and other learning environments (m. & p. vs. all except m. & p.). $^{23}$ Model 1 reports the gross effects of the contextual standardization of learning environments and individual information seeking intensity on grades. Model 2 adds a set of control variables: On the individual level the grade of the university entrance diploma (abbr. UED; effects measured in units of 10%) indicating past performance, the number of respective academic tasks already conducted (abbr. tasks; units of 10%) and the year of study (abbr. year; units of 1 year) indicating experience with academic tasks, the motivation to study (abbr. mot.; units of 10%) and an indicator for female students (abbr. women). On the field-of-study level the share of exams in all academic tasks (abbr. f. sha.; units of 10 percentage-points) indicating the relative importance of standardized academic tasks (see Table 1 for further details on these control variables). $^{24}$ Model 3 adds an interaction term between the standardization of learning environments and information seeking intensity to test H6.

Regarding H1 our tests indicate support for a positive elasticity of grades for less standardized academic tasks with respect to the standardization of learning environments. They show a net effect of a 4.7% improvement in grades for written assignments given an increase in the degree of standardization of the learning environments by 10 percentage points (see Model 2). The respective net effect is 4.8% (see Model 1). As expected no such contextual effect is present for standardized academic tasks, exams, validating H2 and demonstrating that the effect of the contextual standardization of learning environments is moderated by the standardization of the academic task conducted. Furthermore, our data shows a Pearson's r of .61*** between the degree of standardization of learning environments and the share of standardized academic tasks on the field-of-study level. This result demonstrates that standardized academic tasks are more often used in standardized learning environments. Taken together, these outcomes imply that the effect of the standardization of learning environments on grades for less standardized academic tasks increases with the prevalence of these tasks. In consequence, we expect that less standardized tasks are of minor importance in highly standardized learning environments (see H3), and are hence graded indulgently. Evidence validating this hypothesis is provided by the

$^{23}$ Coefficients that are not significantly different on 90% confidence level are constrained to be equal.

$^{24}$ Additional control variables regarding effort on the individual level as well as SES composition and admission selectivity on the field-of-study level have been tested, but no substantially relevant or significant effects were found with respect to these controls (see Section 4 for further details).
comparatively good average net grades for less standardized academic tasks in medicine and pharmacy as well as by the independence of these grades with respect to past performance in these highly standardized fields. The net geometric mean grade for written assignments in medicine and pharmacy is 1.08 on a scale ranging from 1 (very good) to 5 (not sufficient) (see Model 2). The difference of .39 in comparison to net geometric mean grade in an averagely standardized learning environment is significant on the 99%-confidence level. Overall, these results support our hypotheses regarding the contextual effects of the standardization of learning environments on achievement in tertiary education.

Turning to our individual level hypotheses about the effects of information seeking intensity on tertiary educational performance, H4 and H5 are validated: For a 10% increase in the intensity of information seeking the grades for written assignments improve by 3.6% gross (see Model 1) and 2.4% net (see Model 2), indicating a positive elasticity of grades for less standardized academic tasks with respect to information seeking. Moreover, as hypothesized we find no evidence for an effect of information seeking intensity in the case of more standardized academic tasks, indicated by exams. These results show that the effect of the individual information seeking on educational achievement is moderated by the standardization of the academic task conducted, too. Given the negative dependency of the effects of information seeking and of the standardization of learning environments with respect to the standardization of academic tasks, we further expect an interaction between the effects of individual information seeking and the contextual standardization of learning environments (see H6). This moderation hypothesis is supported by Model 3, indicating a decrease in the elasticity of grades for less standardized academic tasks with respect to information seeking intensity by 2.3% if the standardization of the learning environment increases by 10 percentage points. As theoretically expected, this results implies that information seeking on the individual level and the standardization of learning environments on the contextual level are substitutes with respect to educational achievement for less standardized academic tasks. Figure 2 quantifies this relationship by showing that the elasticity of grades for written assignments with respect to information seeking decreases from 7.2% to around 0 over the observed range of standardization of learning environments excluding the highly standardized field-of-study contexts of medicine and pharmacy.

25 Model 2 even indicates a negative net effect of past performance on grades in these fields, a result exceeding our expectations with regard to H3. However, this result is not robust to the weighting scheme we use (see Table A1 in the annex) and therefore has to be interpreted with caution.
### Table 2: Log-linear regression models with weights: Effects of inputs on grades in %

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Δ% (c.s.e.)</td>
<td>z-value</td>
<td>Δ% (c.s.e.)</td>
<td>z-value</td>
<td>Δ% (c.s.e.)</td>
</tr>
<tr>
<td>field of study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>all except m. &amp; p.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. &amp; p.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>type of task</td>
<td>written a.</td>
<td>exam</td>
<td>written a.</td>
<td>exam</td>
<td>written a.</td>
</tr>
<tr>
<td>f. std.</td>
<td>4.7%(2.6)</td>
<td>1.76*</td>
<td>-9%(3.6)</td>
<td>-26</td>
<td>4.8%(2.3)</td>
</tr>
<tr>
<td>inf. beh.</td>
<td>3.6%(9)</td>
<td>3.86***</td>
<td>-1.6%(1.0)</td>
<td>-1.48</td>
<td>4.4%(3)</td>
</tr>
<tr>
<td>f. std. *</td>
<td>3.6%(9)</td>
<td>3.86***</td>
<td>-1.6%(1.0)</td>
<td>-1.48</td>
<td>4.4%(3)</td>
</tr>
<tr>
<td>UED</td>
<td>2.7%(6)</td>
<td>4.59***</td>
<td>4.6%(8)</td>
<td>5.58***</td>
<td>-1.0%(4)</td>
</tr>
<tr>
<td>tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.3%(1)</td>
<td>2.42**</td>
<td>.6%(1)</td>
<td>8.75***</td>
<td>.4%(1)</td>
</tr>
<tr>
<td>year</td>
<td>3.0%(8)</td>
<td>3.71***</td>
<td>9.3%(3.2)</td>
<td>2.94***</td>
<td>3.0%(8)</td>
</tr>
<tr>
<td>mot.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1%(9)</td>
<td>2.47**</td>
<td></td>
<td></td>
<td>2.1%(9)</td>
</tr>
<tr>
<td>women</td>
<td>-6.3%(2.4)</td>
<td>-2.68***</td>
<td>-18%(1.5)</td>
<td>-12.77</td>
<td>-6.3%(2.4)</td>
</tr>
<tr>
<td>f. exam</td>
<td>-6.5%(3.1)</td>
<td>-2.08**</td>
<td></td>
<td></td>
<td>-6.5%(3.1)</td>
</tr>
<tr>
<td>E(geometric mean)</td>
<td>1.56***</td>
<td>2.18***</td>
<td>1.27***</td>
<td>1.83***</td>
<td>1.47***</td>
</tr>
<tr>
<td>N</td>
<td>839</td>
<td>270</td>
<td>59</td>
<td>116</td>
<td>839</td>
</tr>
<tr>
<td>group R2</td>
<td>.037</td>
<td>.004</td>
<td>.064</td>
<td>-0</td>
<td>.115</td>
</tr>
<tr>
<td>log-likelih.</td>
<td>-5212.6574</td>
<td></td>
<td></td>
<td></td>
<td>-5160.9340</td>
</tr>
<tr>
<td>Wald-test vs. prev.: χ²</td>
<td>25.12***</td>
<td>169.41***</td>
<td></td>
<td></td>
<td>4.71**</td>
</tr>
</tbody>
</table>

*Source:* Own calculations based on CampusPanel, wave “a” (n = 1,284)

*Legend:* ***: P(Z>|z|) < .01; **: P(Z>|z|) < .05; *: P(Z>|z|) < .1; or P(Χ>χ²) for Wald Tests
Figure 2: Direct effect of a 10% increase in information seeking intensity (with 95%-CIs)

In these special contexts with respect to less standardized academic tasks we find an unexpected 3.8% elasticity of grades with respect to information seeking. At first sight this result is inconsistent with the other results and our theory regarding more standardized learning environments. However, further consideration with respect to the grade distribution for written assignments in medicine and pharmacy (see also Figure A1) indicates that this result is due to a strong negative signal associated with information seeking in these contexts: Given students demonstrating an average level of information seeking for a written assignment in medicine or pharmacy get the top grade of 1.08 independent of their past performance, there is not much room for individual improvement, and hence failing to show this average level of information seeking is associated with some of the few positions in the slim right tail of the respective grade distribution. On a theoretical level, the results regarding written assignments in highly standardized learning environments can also indicate that these tasks are not subject-specific, e.g., tasks on soft skills for which information beyond the standardized curriculum has to be used and searched for. Regarding the control variables we find the expected positive elasticities of grades with respect to past performance, experience and motivation in most contexts (see Models 2 and 3). In addition, male students get better grades than female students conditional on the other covariates. Furthermore, grades for exams decrease by 6.5% if the share of these standardized academic tasks on the field-of-study level increases by 10 percentage points, indicating that exams become tougher if they are more prevalent. Given that this prevalence of standardized tasks and the standardization of learning environments are strongly correlated, this result is in line with our theoretical expectations: Exams are the assessment instrument of choice in more standardized learning environments, and are hence grade less indulgently then other academic tasks.

In preparation of our further analyses of differential SES effects on performance in tertiary education we hypothesized that the positive elasticity of grades with respect to past
performance is stronger for more standardized tasks (see H7). This moderation hypothesis is supported by our data: The difference in effects of UED grades on tertiary educational achievement is 1.9%** in Model 2 and 2%** in Model 3. Our mediation hypotheses, H8 and H9, and related SES effects are tested in Model 4 (see Figure 3). Model 4 incorporates the analyses so far into a log-linear path model based on Equation 4. It consists of Model 3, an equation for information seeking intensity indicating the respective skills and two further background equations, one for the motivation to study and one for UED grades indicating past performance. The information seeking skills equation differentiates between more and less standardized academic tasks, while for the other two background equations the coefficients are constrained to be equal across groups. In Figure 3 the difference in the grouping structure between the part replicating Model 3 and the background equations is indicated by a dashed line.

H8 and H9, concerning the influence of SES on information seeking skills, are validated for less standardized academic tasks: Given a good relationship with the respective parent, these skills increase by .8%*** for written assignments if the highest parental ISEI is increased by 10% (see Figure 3, Model 4). As expected, no elasticity of these skills with respect to highest parental ISEI is present if the relationship with the respective parent is not good. The effect of -.3% is not significant. H8 and H9 are not supported for more standardized academic tasks. Since no returns to information seeking intensity regarding educational achievement can be expected for this type of academic tasks (see Model 3), this is rational. Based on these results we can calculate the moderation of the indirect effect of SES on educational achievement through information seeking skills by the contextual standardization of learning environments (see Figure 4). We calculate this effect for a comparison of two typical socio-economic backgrounds: A student whose parent (with the highest SES of both parents) is a teacher (ISEI 69) and one whose parent is a clerk (ISEI 40). The grades of the teachers offspring are up to 3.2%*** better for less standardized academic tasks in less standardized learning environments due to her 72.5% higher SES's positive effect on information seeking skills (see Figure 4). This dependence on SES decreases to about 0 with the increase of the standardization of learning environments over the observed range. This varying indirect effect constitutes the differential asset conversion mechanism outlined in Section 3: While students from higher background learn the information seeking skills needed in less standardized learning environments through informal learning opportunities, students from lower background lacking these opportunities have lower information seeking skills resulting in a decrease in educational performance. In addition, we find that information seeking skills for written assignments improve with the experience regarding academic tasks, indicating a positive development of these skills over the course of study. Furthermore, we find an interesting path indicating that information seeking skills also depend on SES due to the influence of ISEI on the motivation to study, mediated by UED grades (see Figure 3, Model 4). However, the indirect effect associated with this path is not significant and quantitatively unimportant.
In line with previous studies, SES also effects tertiary educational performance positively through an increase in past performance: The UED grade improves by 1.3% if the parental ISEI is increased by 10% (see Figure 3, Model 4), resulting in a positive indirect effect on grades of 1.9%*** for less standardized academic tasks if a student with a teacher as parent is compared to one with a clerk as parent. The respective effect for more standardized tasks is 3.3%***. Moreover, we find that UED grades as well as the motivation to study increase if the student is a woman, and that the motivation to study is also higher if the relationship with the respective parent is good.
**Figure 4:** Indirect effect of SES on grades for less standardized tasks through information seeking behavior (with 95%-CIs), assuming a good relation with parents (Exemplary comparison: Parent is a teacher (ISEI 69) vs. a clerk (ISEI 40))

Based on the observed joint distribution of the standardization of learning environments and academic task types on the field-of-study level, the indirect SES effects on tertiary educational performance in Model 4 (see Figure 3) taken together predict an improvement of 3.4%*** in less standardized learning environments if a student with a teacher as parent is compared to one with a clerk as parent. This predicted total effect decreases to 2.5%*** with the increase of the standardization of learning environments over the observed range (see Figure 5). This difference of .9% is significant on the 90%-confidence level, indicating that less standardized learning environments are contexts slightly favoring higher SES students due to differential asset conversion with respect to information seeking (see also Figure 4). The respective indirect effect of SES on tertiary educational achievement through information seeking behavior is .9%** in less standardized learning environments and decreases to about 0 over the observed range. Given these total and indirect effects regarding social status reproduction through tertiary educational achievement, we can assess the relative importance of the differential asset conversion mechanism through information seeking: While about 27% of the total effect are mediated by information seeking behavior in less standardized learning environments, this mediated share decreases to about 0 with the increase of the standardization of learning environments over the observed range. These predictions support our fundamental expectation that social status reproduction mechanisms within tertiary education differ with the contextual standardization of learning environments. In less standardized learning environments social status reproduction works through the differential asset conversion mechanism validated in our analyses as well as through differences with respect to past performance and related skills known from previous studies, while it is solely due to the latter mechanism in more standardized learning environments.
Figure 5: Total effect of SES on grades vs. indirect effect of SES on grades through information seeking behavior (with 95%-CIs) (Exemplary comparison: Parent is a teacher (ISEI 69) vs. a clerk (ISEI 40))

Source: Own calculations based on CampusPanel, wave "a" (n = 1,109)

Summary and conclusions

Drawing on data from a specifically designed study, we have analyzed differences in the information behavior of students in tertiary education and their relevance for performance in various fields of study. Our analyses have led to a number of important findings: The effect of information seeking behavior on educational achievement is, for less standardized academic tasks, moderated by the standardization of learning environments. Moreover, this influence is mediated by students’ socio-economic background, given a good relationship with the parents. These links between social background, (tertiary) educational contexts and academic achievement constitute a differential asset conversion mechanism related to information seeking behavior, which induces social status reproduction within tertiary education.

These findings have a number of implications for research on status reproduction processes in education. The relevance of this differential asset conversion mechanism for social status reproduction within tertiary education is dependent on (meso-level) contexts. It decreases with the standardization of learning environments, so that the mechanisms driving social inequality within tertiary education differ between field-of-study contexts. Once again, our results indicate the importance of social contexts beyond the family background for the dynamics of social status reproduction. Our model of differential asset conversion may be a blueprint for a principal mechanism relating higher-level social contexts with social background influences, which can give analytical guidance to future research on the dynamics of social inequalities.
Going beyond sociological research, there are also a number of more practical implications. Given that the standardization of tertiary educational environments increases (cf. the Bologna Process in the EU), the relevance of differential asset conversion with respect to information seeking behavior as well as the relevance of information seeking for educational attainment in general may appear to decline. However, improvements in informational competencies are an explicit goal of (tertiary) education preparing graduates for a life in contemporary "knowledge societies". Many executives in charge of educational institutions will be aware of this potential mismatch between recent institutional developments and economic and societal affordances, and questions of informational skills will continue to be high on the political and administrative agenda.

On the other hand, there is obviously only a low correlation between the standardization of learning environments and the conventional choice and selection mechanisms operating within the educational attainment process. This indicates that the potential mismatch between institutional practices and societal affordances could be addressed by institutional provisions that do not significantly interfere with the established modes of individual choice in education. Still, such an effort would require formalizing and institutionalizing the learning and practicing of skills necessary for accessing and using information. At the same time, such a provision would probably decrease the potential for social background influences within (tertiary) education since it would equalize the access to and usage of the related informal learning environments.
Bibliography


Arcidiacono, Peter; Hotz, V. Joseph; Kang, Songman (2012): Modeling college major choices using elicited measures of expectations and counterfactuals, JOURNAL OF ECONOMETRICS 166/1, p.3-16.


Attewell, Paul; Battle, Juan (1999): Home computers and school performance, INFORMATION SOCIETY 15/1, p.1-10.


Attewell, Paul; Suazo-Garcia, Belkis; Battle, Juan (2003): Computers and young children: Social benefit or social problem?, SOCIAL FORCES 82/1, p.277-296.


Bennett, Sue; Maton, Karl (2010): Beyond the "digital natives" debate: Towards a more nuanced understanding of students' technology experiences, JOURNAL OF COMPUTER ASSISTED LEARNING 26/5, p.321-331.


Conway, Kate (2011): How prepared are students for postgraduate study? A comparison of the information literacy skills of commencing undergraduate and postgraduate information studies students at Curtin University, AUSTRALIAN ACADEMIC AND RESEARCH LIBRARIES 42/2, p.121-135.

Correa, Teresa (2010): The participation divide among "online experts": Experience, skills and psychological factors as predictors of college students' Web content creation, JOURNAL OF COMPUTER-MEDIATED COMMUNICATION 16/1, p.71-92.

Davies, Scott; Guppy, Neil (1997): Fields of study, college selectivity, and student inequalities in higher education, SOCIAL FORCES 75/4, p.1417-1438.

Delaney, Liam; Harmon, Colm; Redmond, Cathy (2011): Parental education, grade attainment and earnings expectations among university students, ECONOMICS OF EDUCATION REVIEW 30/6, p.1136-1152.


Diseth, Age (2011): Self-efficacy, goal orientations and learning strategies as mediators between preceding and subsequent academic achievement, LEARNING AND INDIVIDUAL DIFFERENCES 21/2, p.191-195.
Duru-Bellat, Marie; Kieffer, Annick; Reimer, David (2008): Patterns of social inequalities in access to higher education in France and Germany, INTERNATIONAL JOURNAL OF COMPARATIVE SOCIOLOGY 49/4-5, p.347-368.


Hargittai, Eszter (2010): Digital na(t)ives? Variation in Internet skills and uses among members of the "net generation", SOCIOLOGICAL INQUIRY 80/1, p.92-113.

Hillmert, Steffen; Jacob, Marita (2010): Selections and social selectivity on the academic track: A life-course analysis of educational attainment in Germany, Research in Social Stratification and Mobility 28/1, p.59-76.


Lang, Volker; Hillmert, Steffen (2014): CampusPanel User Handbook V1.0: Documentation for the Student Panel of the ScienceCampus Tuebingen (CampusPanel), wave "a".

Lang, Volker; Hillmert, Steffen (2013): Differential trends in households' connection to the Internet: An actor-centered explanation, working paper, under review.


Reimer, David; Pollak, Reinhard (2010): Educational expansion and its consequences for vertical and horizontal inequalities in access to higher education in West Germany, EUROPEAN SOCIOLOGICAL REVIEW 26/4, p.415-430.

Richardson, Michelle; Abraham, Charles (2013): Modeling antecedents of university students’ study behavior and grade point average, JOURNAL OF APPLIED SOCIAL PSYCHOLOGY 43/3, p.626-637.


Stinebrickner, Ralph; Stinebrickner, Todd R. (2004): Time-use and college outcomes, JOURNAL OF ECONOMETRICS 121/1, p.243-269.


Tondeur, Jo; Sinnaeve, Ilse; van Houtte, Mieke; van Braak, Johan (2011): ICT as cultural capital: The relationship between socioeconomic status and the computer-use profile of young people, NEW MEDIA AND SOCIETY 13/1, p.151-168.


Van de Werfhorst, Herman G.; Sullivan, Alice; Cheung, Sin Yi (2003): Social class, ability and choice of subject in secondary and tertiary education in Britain, BRITISH EDUCATIONAL RESEARCH JOURNAL 29/1, p.41-62.

Van de Werfhorst, Herman G.; Luijkx, Ruud (2010): Educational field of study and social mobility: Disaggregating social origin and education, SOCIOLOGY 44/4, p.695-715.


Warwick, Claire; Rimmer, Jon; Blandford, Ann; Gow, Jeremy; Buchanan, George (2009): Cognitive economy and satisficing in information seeking: A longitudinal study of undergraduate information behavior, JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY 60/12, p.2402-2415.


Annex

**Figure A1:** Grade distribution in population by academic task and field-of-study groups

- **written assignments**  
  all fields except medicine and pharmazie

- **exams**  
  all fields except medicine and pharmazie

- **medicine and pharmacy**

*Source:* Own calculations based on CampusPanel, wave "a" (n = 1,284)
## Table A1: Log-linear regression models without weights: Effects of inputs on grades in %

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>∆% (c.s.e.)</td>
<td>z-value</td>
<td>∆% (c.s.e.)</td>
<td>z-value</td>
<td>∆% (c.s.e.)</td>
<td>z-value</td>
</tr>
<tr>
<td><strong>field of study</strong></td>
<td><strong>all except m. &amp; p.</strong></td>
<td><strong>m. &amp; p.</strong></td>
<td><strong>all except m. &amp; p.</strong></td>
<td><strong>m. &amp; p.</strong></td>
<td><strong>all except m. &amp; p.</strong></td>
<td><strong>m. &amp; p.</strong></td>
</tr>
<tr>
<td>f. std.</td>
<td>4.6%(2.6)</td>
<td>-1.2%(3.7)</td>
<td>5.3%(2.4)</td>
<td>-1.5(4.8)</td>
<td>5.6%(2.4)</td>
<td>-1.5(4.8)</td>
</tr>
<tr>
<td></td>
<td>1.78*</td>
<td>-.35</td>
<td>2.23**</td>
<td>-.32</td>
<td>2.31**</td>
<td>-.32</td>
</tr>
<tr>
<td>inf. beh.</td>
<td>3.5%(9)</td>
<td>-1.6%(1.3)</td>
<td>2.3%(8)</td>
<td>-1.8%(1.2)</td>
<td>2.7%(7)</td>
<td>-1.8%(1.2)</td>
</tr>
<tr>
<td></td>
<td>3.94***</td>
<td>-1.27</td>
<td>2.99***</td>
<td>-1.49</td>
<td>3.5**(4)</td>
<td>-1.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8.70***</td>
<td>-.42</td>
<td>3.5**(4)</td>
<td>-.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>type of task</strong></td>
<td><strong>written a.</strong></td>
<td><strong>exam</strong></td>
<td><strong>written a.</strong></td>
<td><strong>exam</strong></td>
<td><strong>written a.</strong></td>
<td><strong>exam</strong></td>
</tr>
<tr>
<td>f. std.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inf. beh.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mot.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. sha.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E(geometric mean)</td>
<td>1.57***</td>
<td>2.21***</td>
<td>1.08***</td>
<td>1.82***</td>
<td>1.45***</td>
<td>1.96***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log-likelih.</td>
<td>-7347.1326</td>
<td></td>
<td>-7278.139</td>
<td></td>
<td>-7275.2379</td>
<td></td>
</tr>
<tr>
<td>Wald-test vs. prev.: χ²</td>
<td>21.71***</td>
<td></td>
<td>100.91***</td>
<td></td>
<td>4.86**</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Own calculations based on CampusPanel, wave “a” (n = 1,284)

**Legend:** ***: P(Z>|z|) < .01; **: P(Z>|z|) < .05; *: P(Z>|z|) < .1; or P(X>χ²) for Wald tests
<table>
<thead>
<tr>
<th>field of study</th>
<th># of raters</th>
<th>AMD of mean</th>
<th>AMD of logit-transformed hundredth of mean</th>
<th>degree of standardization</th>
</tr>
</thead>
<tbody>
<tr>
<td>molecular medicine</td>
<td>22</td>
<td>8.07%</td>
<td>1.33</td>
<td>91.77%</td>
</tr>
<tr>
<td>medicine</td>
<td>243</td>
<td>8.22%</td>
<td>1.23</td>
<td>93.65%</td>
</tr>
<tr>
<td>pharmacy</td>
<td>51</td>
<td>11.12%</td>
<td>1.28</td>
<td>91.80%</td>
</tr>
<tr>
<td>educational science</td>
<td>164</td>
<td>12.13%</td>
<td>1.18</td>
<td>81.05%</td>
</tr>
<tr>
<td>medical engineering</td>
<td>46</td>
<td>12.75%</td>
<td>1.31</td>
<td>80.17%</td>
</tr>
<tr>
<td>psychology</td>
<td>86</td>
<td>12.80%</td>
<td>1.15</td>
<td>80.81%</td>
</tr>
<tr>
<td>rhetoric and philosophy</td>
<td>55</td>
<td>13.66%</td>
<td>1.25</td>
<td>78.35%</td>
</tr>
<tr>
<td>sociology</td>
<td>128</td>
<td>14.64%</td>
<td>.95</td>
<td>71.41%</td>
</tr>
<tr>
<td>biology</td>
<td>120</td>
<td>15.17%</td>
<td>1.33</td>
<td>78.38%</td>
</tr>
<tr>
<td>physics</td>
<td>43</td>
<td>15.45%</td>
<td>1.68</td>
<td>84.51%</td>
</tr>
<tr>
<td>sports sciences</td>
<td>34</td>
<td>15.74%</td>
<td>1.00</td>
<td>71.50%</td>
</tr>
<tr>
<td>economic sciences</td>
<td>124</td>
<td>15.90%</td>
<td>1.02</td>
<td>68.99%</td>
</tr>
<tr>
<td>political science</td>
<td>40</td>
<td>16.16%</td>
<td>1.13</td>
<td>73.80%</td>
</tr>
<tr>
<td>other languages</td>
<td>41</td>
<td>16.35%</td>
<td>1.10</td>
<td>67.49%</td>
</tr>
<tr>
<td>biochemistry</td>
<td>56</td>
<td>16.90%</td>
<td>1.06</td>
<td>67.96%</td>
</tr>
<tr>
<td>geography</td>
<td>34</td>
<td>16.93%</td>
<td>1.29</td>
<td>72.59%</td>
</tr>
<tr>
<td>chemistry</td>
<td>40</td>
<td>17.29%</td>
<td>1.70</td>
<td>80.18%</td>
</tr>
<tr>
<td>cognition science</td>
<td>50</td>
<td>17.29%</td>
<td>1.34</td>
<td>71.86%</td>
</tr>
<tr>
<td>German languages</td>
<td>96</td>
<td>17.43%</td>
<td>.99</td>
<td>65.44%</td>
</tr>
<tr>
<td>historical science</td>
<td>81</td>
<td>17.44%</td>
<td>1.05</td>
<td>56.78%</td>
</tr>
<tr>
<td>geology</td>
<td>75</td>
<td>17.84%</td>
<td>1.70</td>
<td>81.44%</td>
</tr>
<tr>
<td>cultural studies</td>
<td>19</td>
<td>17.91%</td>
<td>1.45</td>
<td>71.89%</td>
</tr>
<tr>
<td>science of art</td>
<td>30</td>
<td>18.33%</td>
<td>1.12</td>
<td>64.07%</td>
</tr>
<tr>
<td>media studies</td>
<td>58</td>
<td>18.94%</td>
<td>.95</td>
<td>53.38%</td>
</tr>
<tr>
<td>English language</td>
<td>105</td>
<td>18.99%</td>
<td>1.21</td>
<td>66.76%</td>
</tr>
<tr>
<td>Romance languages</td>
<td>38</td>
<td>19.57%</td>
<td>1.23</td>
<td>68.55%</td>
</tr>
<tr>
<td>mathematics</td>
<td>40</td>
<td>20.53%</td>
<td>1.25</td>
<td>62.68%</td>
</tr>
<tr>
<td>science of antiquities</td>
<td>22</td>
<td>21.26%</td>
<td>1.51</td>
<td>67.18%</td>
</tr>
<tr>
<td>computer science</td>
<td>75</td>
<td>22.24%</td>
<td>1.54</td>
<td>64.64%</td>
</tr>
<tr>
<td>law</td>
<td>125</td>
<td>23.11%</td>
<td>1.60</td>
<td>67.11%</td>
</tr>
<tr>
<td>theology</td>
<td>45</td>
<td>23.67%</td>
<td>1.57</td>
<td>58.73%</td>
</tr>
<tr>
<td>Asian studies</td>
<td>37</td>
<td>23.75%</td>
<td>1.66</td>
<td>70.14%</td>
</tr>
<tr>
<td>overall</td>
<td>2,223</td>
<td>16.80%</td>
<td>1.29</td>
<td>72.66%</td>
</tr>
</tbody>
</table>

*Source:* Own calculations based on CampusPanel, Wave “a” (n = 2,223)
Figure A2: CFA-SEM of information seeking intensity for written assignments

1.) defining need
- I1_1
- I1_3
- I1_5
- I1_6
- F1a
  - social
  - paper type

2.) searching
- I2_6
- I2_8
- I2_11
- F2a
  - docu

3.) evaluating
- I3_4
- I3_9
- I3_11
- I3_15
- F3a
  - docu

Model fit: $\chi^2 = -43905.971 \text{; RMSEA} = .019 \text{; P(RMSEA} <= .05) = \sim 1 \text{; CFI} = .988 \text{; TLI} = .984 \text{; } \chi^2_{saturated} = 74.414 \text{; P}(X^2>\chi^2_{saturated}) = .0504^*$

Source: Own calculations based on CampusPanel, Wave "a" (n = 898)
Legend: ***: P(Z>|z|) < .01; **: P(Z>|z|) < .05; *: P(Z>|z|) < .1; or P(X>\chi^2) for Wald test

Figure A3: CFA-SEM of information seeking intensity for exams

1.) defining need
- I1_1
- I1_5
- I1_3

2.) searching
- I2_6
- I2_8
- I2_11
- F2a
  - docu

3.) evaluating
- I3_4
- I3_11
- I3_15
- F3a
  - docu

Model fit: $\chi^2 = -12402.829 \text{; RMSEA} = .026 \text{; P(RMSEA} <= .05) = .93 \text{; CFI} = .986 \text{; TLI} = .977 \text{; } \chi^2_{saturated} = 27.65 \text{; P}(X^2>\chi^2_{saturated}) = .1876$

Source: Own calculations based on CampusPanel, Wave "a" (n = 386)
Legend: ***: P(Z>|z|) < .01; **: P(Z>|z|) < .05; *: P(Z>|z|) < .1; or P(X>\chi^2) for Wald test
Figure A3: Mean information seeking intensity by field of study

Overall mean 100; SD 15

Source: Own calculations based on CampusPanel, wave 4 (n = 1,284)