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Explaining academic risk-taking: the role of motivation and locus of control

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Abstract
Academic risk-taking denotes the individual tendency to choose demanding rather than easy learning tasks that entail the risk of making a visible error and ultimately appearing less competent in front of others. Academic risk-taking has been shown to be beneficial for learning outcomes, but students' reluctance is oftentimes high. The purpose of our study is to investigate whether motivation to study and locus of control are linked to students' propensity to engage in academic risk-taking. We computed Pearson correlations, latent variable models, and multiple linear regressions to analyze a sample of $N = 245$ German university students. Our results indicate that intrinsic motivation to study and internal locus of control are moderately correlated with academic risk-taking at the group dimension, and in parts with academic risk-taking at the peer dimension. Extrinsic motivation and external locus of control do not show any clear associations with academic risk-taking. These findings indicate that internal locus of control and intrinsic motivation play an important role in the tertiary education classroom for supporting students to achieve their academic goals.

Keywords Motivation · Locus of control · Academic risk-taking · University students

Studying in higher education settings comes with much freedom that students need to navigate (e.g., Goppert et al., 2021): Universities set overall learning goals, but students are expected to identify and independently take appropriate measures to achieve these. In this context, *academic risk-taking* describes the extent to which students are ready to choose demanding rather than easy learning tasks in situations where they have to expect some sort of feedback on their performance (Abercrombie et al., 2022; Clifford, 1991). These kinds of decisions are risky because difficult tasks involve uncertainty about the correctness of the outcome, which makes it difficult for students to anticipate whether they will give the impression of being not as competent (Abercrombie et al., 2022; Beghetto, 2009).

Regarding the dimensionality of academic risk-taking, Hübner and Pfost (2023) proposed a two-dimensional structure differentiating the seminar group dimension, which

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refers to learning settings that include students and a teacher, and the peer dimension, where only students are present. This distinction is theoretically meaningful, as it accounts for the social context, i.e., who is present, to observe both the behavior and its outcome as a potential influence on students' propensity to take academic risks (Lund Dean & Jolly, 2012). For example, students may be willing to contribute tentative ideas or ask questions in peer-only settings, where others are perceived as similarly competent and evaluative consequences are limited. At the same time, they may refrain from doing so in whole-class or seminar-group contexts in which an instructor is present and may be perceived as a judging expert. Empirically, this factorial structure has been replicated across multiple samples (Hübner & Pfost, 2024a). Furthermore, prior research has demonstrated differential associations across these dimensions. For example, students' beliefs about errors have been shown to predict academic risk-taking for the seminar group dimension, but not for the peer dimension (Hübner & Pfost, 2022), suggesting that the two situations engage partially distinct motivational and control-related processes.

Building on Duell and Steinberg (2019), academic risk-taking can be considered a form of positive risk, in which the potential costs are typically low relative to the anticipated benefits. Positive risks are usually aligned with long-term developmental aims, such as deeper knowledge acquisition and personal growth (Fryt et al., 2022), or the pursuit of social recognition (Fryt & Szczygiel, 2021). In this sense, particularly in low- to moderate-stakes learning situations such as classroom discussions, taking the risk of failure tends to be regarded as socially acceptable and constructive (Beghetto, 2009). Importantly, academic risk-taking is qualitatively distinct from maladaptive academic behaviors that may also involve risk. For instance, negative risks related to academic dishonesty are more likely to arise from impulsivity (Bacon et al., 2020), are oriented toward short-term outcomes (Duell & Steinberg, 2019), and may therefore undermine learning and academic development.

Several reasons have been proposed as to why working on difficult tasks and possibly making errors enhances learning outcomes. For example, Abercrombie et al. (2022, p. 2) hypothesize that academic risk-taking is "a form of self-scaffolding by self-regulating toward optimally challenging tasks". They build on Vygotsky's (1978) idea of the zone of proximal development, which is characterized by activities that are sufficiently challenging to induce learning success while at the same time not overwhelming students. In a similar vein, academic risk-taking can be seen as a form of productive failure, as outlined by Kapur (2016). According to this concept, successful learning results from making an error while performing an optimally difficult task that requires prior knowledge and finding solutions in an exploratory manner. Students will learn from their errors when their preliminary answers are compared with the correct ones (Kapur, 2016). Thus, students need to challenge themselves to better understand a topic. Such demanding tasks come with "desirable difficulties", meaning that they "trigger encoding and retrieval processes that support learning, comprehension, and remembering" (Bjork & Bjork, 2020, p. 476).

Furthermore, it is widely acknowledged that making errors while learning is advantageous as it improves learning outcomes (e.g., Metcalfe, 2017; Zhang & Fiorella, 2023). To learn from errors, students first need to identify them and acknowledge that further elaboration is required (Tulis et al., 2016). Coming up with answers, even though they are potentially wrong, requires students to link the task and its topic to prior knowledge (Zhang & Fiorella, 2023), which is an effective foundation to build new knowledge on (Kornell et al., 2009). Indeed, empirical research on the pretesting effect suggests that people recall facts better after they gave incorrect responses to questions about the topic, compared to those in other learning conditions (e.g., Pan et al., 2020). Additionally, students' tendencies of

handling errors play an important role: Dresel et al. (2013) demonstrate that action adaptivity but not affective-motivational adaptivity predicts an increased study effort after a recently encountered error while learning. Thus, in the wake of detecting an error, students with a stronger action-based error-handling tendency are more inclined to intensify their study behavior, for example by working specifically on the deficits that have become apparent in the learning task. However, a higher level of affective-motivational error-handling tendency, characterized through regulatory measures to maintain motivation and positive affect when learning after an error occurred, was not related to future effort. Furthermore, Steuer and Dresel (2015) find that handling errors constructively in secondary school mathematics classrooms all in all is positively correlated with student achievement. Such constructive approaches for example include teachers helping students after they made an error but also students being willing to engage in class even though they are uncertain about their answer. The latter is a key element of academic risk-taking as defined above. These findings illustrate that academic risk-taking may be most conducive to learning when embedded in instructional contexts that respond to errors in a supportive and formative manner, suggesting that its positive effects are not only rooted in risk-taking per se but also depend on how errors are addressed in a learning environment (see Newman, 2017 for the construct of psychological safety).

Despite the potential benefits, reluctance to engage in academic risk-taking is relatively high. Pan et al. (2020) point to an interesting discrepancy: Many undergraduate students acknowledge the advantages of errors and embrace them as learning opportunities, but only after they have happened. At the same time, they often avoid making errors in the first place, possibly because they perceive generating errors to be less conducive and evaluate errors as a sign of suboptimal performance (Pan et al., 2020).

Many factors determine whether students take academic risks, one of them being their initial level of competency. Proficient students are more likely to participate in voluntary quizzes, suggesting that they use them primarily to increase their confidence rather than competencies (Förster et al., 2018). Put differently, students whose risk of making errors is the lowest engage more in such optional learning opportunities (see Pfost et al., 2023, for similar findings using high school GPA as a predictor). Moreover, there is an affective component to academic risk-taking. In fact, Hübner and Pfost (2022) show that anticipating negative affect after an error occurs plays an important role in hindering academic risk-taking. Similarly, Üztemur (2020) finds that fear of negative evaluation significantly mediates the effect of perceived autonomy support in the classroom and academic risk-taking. Therefore, a higher degree of perceived autonomy leads to less fear of negative evaluation and ultimately to a greater willingness to take academic risks. Avoiding errors can also be seen as a rational strategy to maintain positive affect in a world that seems to strive for perfect results. Educators are quick to reward students even for trivia if they are deemed worth maintaining, but this does not necessarily induce a preference for more difficult tasks (Dweck, 1986). For example, praising students for merely doing the minimum of homework is not as beneficial as just rewarding those who completed a tricky bonus task. The first strategy makes additional effort and embracing challenges appear superfluous. Consequently, students could feel inhibited to opt for difficult tasks, especially if the majority avoids them. In addition, the instructional setting is a relevant factor. Some students might be unfamiliar with more flexible course formats that require active participation, which can result in disengagement from them (Shekhar et al., 2020). By contrast, greater instructional autonomy has been associated with increased academic risk-taking (Dachner et al., 2017), whereas an emphasis on rote learning and reproduction tends to reduce it (Hübner & Pfost, 2024a).

In sum, although taking academic risks has large potential for promoting learning success, students often seem to avoid such behavior. Therefore, it is important to identify variables that may have an impact on students' preferences for academic risk-taking. In this study, we examine motivation to study and locus of control, assuming that they are important for the emergence of academic risk-taking in higher education.

Motivation to study

At its core, motivation provides a reason for initiating, keeping up, and quitting particular behaviors (S. Graham & Weiner, 2012). Furthermore, motivation explains the link between a human's needs, e.g., for feeling competent or self-determined, and their behavior (Deci & Ryan, 1985). In the context of learning, motivation may explain why some students tend to favor taking academic risks whereas others do not. It is common to distinguish between intrinsic and extrinsic motivation. Students who are intrinsically motivated enjoy study activities per se, regardless of the potential results (Ryan & Deci, 2000). Self-determination theory posits that intrinsic motivation is based on an internal perceived locus of causality, i.e., being able to decide instead of being bound by coercion (Deci & Ryan, 1985, p. 38). Extrinsic motivation, however, is about "attain[ing] some separable outcome" (Ryan & Deci, 2000, p. 60). Consequently, actions are carried out based on their instrumental value. For instance, students with such an orientation are primarily motivated by obtaining a particular degree or finding a prestigious job in the future (Thomas et al., 2018).

Preferring tasks that are difficult relative to one's perceived skill level is a key component of intrinsic motivation, as it satisfies intrinsically motivated students' striving for continuous improvement and personal development (Deci & Ryan, 1985). Intrinsically motivated learners tend to choose difficult tasks because they perceive them to be interesting and not simply because they expect that they would perform well on them (Inoue, 2007). At the same time, enjoyment can increase with the level of difficulty, which is especially true for intrinsically motivated activities (Abuhamdeh & Csikszentmihalyi, 2012). Thus, individuals who constantly seek challenges also tend to have more fun engaging in them. Previous research supports the assumption that intrinsic motivation is linked to learning goal orientation (e.g., Simons et al., 2004; Cerasoli & Ford, 2014; see also Janke, 2022). Accordingly, students with a tendency to learn due to an inherent enjoyment of the activity per se also seek to increase their competence and learn something new, which includes that they embrace academic challenges and demonstrate endurance to achieve these (Dweck, 1986). In sum, intrinsically motivated students tend to be more academically successful (Howard et al., 2021), i.e., they achieve better grades (Richardson et al., 2012; Taylor et al., 2014) and drop out of classes less (Vallerand & Bissonnette, 1992). For example, based on a sample of undergraduate students from the United Kingdom, Dunn and Kennedy (2019) show that intrinsic motivation predicts students' engagement with optional, technology enhanced learning activities, which proved conducive to academic performance.

In a similar vein, a Dutch study involving medical students (Kusurkar et al., 2013) found that students with a high level of intrinsic and at the same time low controlled, i.e., extrinsic, motivation applied more deep learning and less surface strategies in comparison to students with higher levels of controlled motivation. Deep learning includes connecting concepts and transferring them to other contexts in order to gain a profound understanding of a matter (Kovač et al., 2023). Although not explicitly addressed within this study, we may consider academic risk-taking as one such deep learning strategy because it requires

students to engage in complex problem-solving activities. Thus, students with a deep learning orientation challenge themselves, and similarly to academic risk-taking (cf. Beghetto, 2009; Clifford, 1991) they are somewhat uncertain about whether their learning outcomes are correct. Deep learning has been found to correlate with the willingness to challenge oneself academically (Meyer et al., 1997). Consequently, we expect that intrinsically motivated students are more willing to accept challenges and therefore more likely to demonstrate academic risk-taking.

Extrinsically motivated students, on the other hand, are typically assumed to be more performance-oriented and therefore prioritize praise over competence development, are prone to give up more easily, and opt for less demanding tasks (Deci & Ryan, 1985; Dweck, 1986). If extrinsically motivated students are concerned with being correct, they likely prefer easy over challenging tasks and should thus be less inclined to demonstrate academic risk-taking. At the same time, Dunn and Kennedy, 2019) demonstrates that not only intrinsic drive but also striving for good grades motivates students to participate in voluntary e-learning activities. Hence, it is unclear whether extrinsic motivation hampers or fosters academic risk-taking, making it difficult to formulate a hypothesis on the relationship between both variables.

Locus of control

Students may have different explanations for the causes of their academic performance, i.e., different loci of control. If they believe that results such as grades are based on their own merit, this testifies to an internal locus of control; if they are convinced that their actions have no impact in this regard, this is called external locus of control (Rotter, 1966). Locus of control is not a dichotomous concept but is represented by a continuum with the ends being internality and externality (Findley & Cooper, 1983).

Indeed, previous research suggests that internal locus of control is beneficial for academic success. For example, Micomonaco and Espinoza (2022) observed that internal locus of control is highly prevalent in a sample of overachieving university students. Furthermore, meta-analytic findings by Findley and Cooper (1983), Richardson et al. (2012), and Fong et al. (2017) show a positive association between university students' internal locus of control and different academic outcomes such as grades or study persistence. However, the observed correlations between internality and grades often are small (e.g., Drago et al., 2018; Gifford et al., 2006; Hrbáčková et al., 2012).

An internal locus of control is closely linked to seeking challenges and risks. For instance, people with an internal, rather than an external locus of control, tend to demonstrate a higher willingness to take positive risks (e.g., financial risks; Rabbani et al., 2021). Furthermore, people with an internal locus of control not only perceive their jobs as more challenging, but also report greater job satisfaction, attach more meaning to their work and feel more psychologically empowered in the workplace (Ng et al., 2006). This indicates that people with an internal locus of control tend to thrive in complex work environments that require them to take initiative to solve problems. In an academic setting, we can thus expect that students with an internal locus of control, who enjoy optimally difficult tasks and do not shy away from taking risks, are more likely to engage in academic risk-taking than those with an external locus of control. Furthermore, people with an internal locus of control prefer to choose a task themselves rather than being assigned one, suggesting that they value being in charge of their work's outcomes (Harrison et al., 1984; see also

Caliendo et al., 2024). In an academic setting, this could translate into a preference for self-regulation instead of directed learning arrangements. Both anticipated and actual outcomes of students with an internal locus of control are better than for those with an external locus of control, and they demonstrate various behaviors and emotions that are helpful in this regard (Perry et al., 2001). Because the self-concepts of students with an internal locus of control tend to be more positive than of those with an external locus of control (Sagone & Caroli, 2014), they can also be expected to have more confidence in their abilities and to try more challenging tasks. Students with an external locus of control on the other hand often are less confident. They have been shown to be more likely to exhibit self-handicapping, that is, actively impairing their study process in order to not have to attribute failure to themselves (Akça, 2012).

Akbay and Delibalta (2020) provide initial evidence regarding the relationship between academic locus of control and academic risk-taking. Based on a sample of $N = 507$ Turkish university students, they find a small correlation between academic internal locus of control and academic risk-taking ($r = .18$, $p < .001$), with internality increasing academic risk-taking scores. One caveat with this study is, however, that the academic risk-taking scale used mainly looks at reactions to errors that have already occurred (see Clifford, 1991), whereas recent conceptualizations of academic risk-taking just consider errors as a possible outcome of learning actions and capture the general willingness to demonstrate engagement with challenging and uncertain learning tasks (see Hübner & Pfost, 2023). In our study, we follow the latter approach.

Research questions and hypotheses

Academic risk-taking refers to a behavior where students deliberately prefer challenging over simple tasks, even though the former includes a risk of making an error and thereby appearing less competent (Abercrombie et al., 2022; Beghetto, 2009; Clifford, 1991). Theoretical considerations and empirical findings suggest that academic risk-taking is beneficial for learning outcomes and academic success (e.g., Hübner & Pfost, 2023, 2024b). Moreover, intrinsic motivation and internal locus of control have been shown to be conducive to various learning outcomes (e.g., Richardson et al., 2012). Thus far, there is mostly indirect evidence suggesting that either motivation or locus of control is linked to academic risk-taking. Many studies include goal orientations instead of motivation (e.g., Abercrombie et al., 2022; Hübner & Pfost, 2022) or a domain-specific (i.e., academic) rather than a more general conceptualization of locus of control (e.g., Akbay & Delibalta, 2020). In addition, we are not aware of any studies analyzing academic risk-taking propensity in higher education with both variables in a joint model. The purpose of our study thus can be broken down into two research questions:

- RQ1**:** *Are motivation to study and locus of control each associated with academic risk-taking?*
- RQ2: *To what extent can academic risk-taking be predicted by motivation to study and locus of control when these two variables are considered simultaneously, and when relevant covariates are taken into account?*

We answer these research questions in line with our preregistration (Fischer et al., 2024)[1] by testing the following hypotheses:

- H1: *The higher students' level of intrinsic motivation, the more they tend to display academic risk-taking.*
- H2: *The higher students' level of internal locus of control, the more they tend to display academic risk-taking.*

We do not have specific hypotheses concerning the associations between extrinsic motivation and academic risk-taking or external locus of control and academic risk-taking. In these cases, theoretical underpinnings are less clear and prior empirical findings often tend not to differentiate between components of motivation and locus of control in a clear-cut manner. In consequence, these relations are analyzed exploratively. In addition to zero-order correlations, the hypotheses outlined above are tested while taking into account covariates (gender, number of semesters, age, current grade point average, grade point average at high school graduation, family education background). These covariates have often been shown to be important for students' motivation, locus of control, and academic outcomes.

Methods

Participants

Participation was voluntary, and all participants provided informed consent before beginning the questionnaire. We collected data between April and June 2024. Our recruitment strategy was two-pronged (see ESM 2 for further details). First, we invited students from universities and universities of applied sciences across Germany via seminars, mailing lists, and SurveyCircle (2024). Second, students were recruited via the access panel provider Bilendi. Initially, there were 305 cases in which participants had completely filled out our online survey. After a first data screening, 60 cases had to be removed because of implausible response times (less than 180 s in total) or incorrect answers to an attention check item (in the access panel only; see ESM 2).

Consequently, the analyzed sample consists of $N = 245$ students ($Mdn_{age} = 24.0$ years), 68.6% of which were female or non-binary. At the time of participation, 51.8% of the participants were enrolled in a Bachelor's program. Many different subjects were represented in the sample, with the largest proportion of participants studying psychology and education science (32.7%), followed by economics (12.7%), teaching (9.0%), sociology, political and communication science (7.3%) as well as natural sciences (6.9%). The median number of semesters the students have already spent in higher education is six. Slightly more than half of the students (54.1%) reported that none of their parents has obtained an academic degree.

[1] We included age as an additional covariate. Moreover, we initially measured academic locus of control using a translated and shortened version of the scale proposed by Morelli et al. (2023). For the sake of conciseness and due to unclear psychometric properties of the applied scale, we decided to not report the respective findings in our main article. For reasons of completeness, however, we report correlations in ESM 1.

Measures

Academic risk-taking

To measure academic risk-taking, we used the German-language scale developed by Hübner and Pfost (2023). Each item describes a type of classroom behavior characterized by a learning task that can be particularly challenging for a person and is associated with the risk of making a visible error. Participants had to indicate the probability of engaging in these on a five-point scale ranging from very unlikely (1) to very likely (5). The scale includes two dimensions of academic risk-taking. At the seminar group dimension, there are six items capturing academic risk-taking in settings that include both students and instructors (e.g., "To participate in seminar discussions even on difficult topics"). Internal consistency was good (McDonald's Omega ω=.85). In addition, four items measured the peer dimension, in which only fellow students are present (e.g., "To participate in a study group even though I feel like I know less than the others"). Internal consistency was satisfactory (ω=.76).

Motivation to study

We used the German-language scale for the measurement of motivational regulation for learning in university students (Skalen zur motivationalen Regulation beim Lernen im Studium; SMR-LS) as developed by Thomas et al. (2018). For our purposes, we only considered the subscales for intrinsic and extrinsic motivation regulation that each include three items and score high on reliability (ω=.87 and ω=.74, respectively). Response options ranged from strongly disagree (1) to strongly agree (7). Intrinsic motivation was measured with items such as "I really enjoy my studies", whereas extrinsic motivation was measured with items like "I primarily study to have a prestigious job afterward".

Locus of control

We used the German-language short scale by Jakoby and Jacob (1999) to capture students' locus of control. There were three items each to measure the internal (ω=.68) and external (ω=.59) locus of control that had to be rated on a scale ranging from strongly disagree (1) to strongly agree (5). Examples include "I like to take responsibility" (internal locus of control) and "I often feel like I have little influence on what happens to me" (external locus of control).

Covariates

To control for third variables that potentially influence the association between motivation, locus of control, and academic risk-taking, we collected data on a set of covariates. These include variables that have been shown to impact academic risk-taking in earlier studies (see Hübner & Pfost, 2022, 2024b). One of them was gender. As only one person indicated to be non-binary, for statistical purposes we decided to combine this category with the female reference category (coded as 0). The category male was coded as 1. We also captured socio-economic status by asking students whether their parents have obtained an academic degree, distinguishing between "no" (0) and "yes, at least one of them" (1). Age was

collected categorically, ranging from "18 years or younger" (1) to "27 years or older" (10). To facilitate the interpretation of our results, we converted the categories to years by adding 17 and treating the variable as metric. Furthermore, we included additional covariates in order to control for individual performance differences. Academic success was approximated with the students' current grade point average (GPA). Furthermore, we asked for students' GPA obtained at high school graduation to account for potential performance differences in the past. In the German education system, lower grades indicate higher achievement and grades below 4.0 are usually required to pass. High school GPA was categorized in six intervals: "1.0 to 1.5" (1), "1.6 to 2.0" (2), "2.1 to 2.5" (3), …, "3.6 to 4.0" (6). For the current GPA we additionally included the category "4.1 or worse" (7). We decided to ask students to select GPA categories rather than raw GPA because this allowed for immediate anonymization of the data. Since raw GPA values are quite fine-grained, some values potentially would have been selected by one person only. Finally, we asked study participants to indicate the number of semesters they have been going to university so far, ranging from "1" to "more than 12". This variable serves as a proxy for familiarity with academia. Specifically, it is plausible to assume that students are increasingly willing to take academic risks as they become more acquainted with the social environment in their university (see e.g., Cooper & Brownell, 2020).

Procedure

First, we take a descriptive look at our data and identify Pearson correlations between academic risk-taking, motivation to study and locus of control. Next, we estimate correlations between latent variables by applying a tau-congeneric measurement model (J. M. Graham, 2006; Steyer & Eid, 2001). In addition to zero-order correlations, we estimated correlations of latent variables while controlling for all covariates described above (gender, socio-economic status, age, GPA, high school GPA, number of semesters). All latent variable models were computed using Mplus (Muthén & Muthén, 1998–2017) and by applying an MLR-estimator.[2] Model fit was evaluated in line with criteria provided by Schermelleh-Engel et al. (2003). We follow Cohen's (1992) way of interpreting correlation coefficients: Values around .3 are considered to represent a medium effect size, values substantially lower (around .1) or higher (around .5) than that value are called small or large effects, respectively. Figures that display the results were created using Microsoft PowerPoint. Finally, we computed a structural equation model (SEM) with linear regressions that simultaneously considers motivation to study, locus of control and relevant covariates for predicting academic risk-taking. Motivation to study, locus of control, and academic risk-taking were again modeled as latent variables using Mplus and by applying an MLR-estimator. Due to the large number of estimated parameters in this model and for checking robustness of the findings, further two multiple linear regression models with manifest variables were estimated using R version 4.4.2 (R Core Team, 2022). The results of these analyses are presented in the Appendix.

[2] see https://doi.org/10.23668/psycharchives.21671 for Mplus output as well as https://doi.org/10.23668/psycharchives.21670 for Mplus input and R files. Due to parameter estimation difficulties in the covariate age, the variance of the covariate age was fixed to a prior derived model-based estimate in all latent variable models that include this covariate.

Results

Descriptive statistics

Table 1 provides descriptive statistics and bivariate Pearson correlations. Results show that intrinsic motivation is positively and significantly associated with academic risk-taking at the group and peer dimension. Correlations had a medium effect size. Concerning the relation between internal locus of control and academic risk-taking, we also observed positive significant correlations that are small (academic risk-taking peer dimension) or medium in size (academic risk-taking group dimension). Extrinsic motivation and external locus of control were both not significantly correlated with either dimension of academic risk-taking.

Correlational analysis: latent variable modeling

In order to evaluate relations between motivation to study, locus of control and academic risk-taking, net of measurement error, we estimated two latent variable models. The first model (Fig. 1) analyzes relations between the latent variables intrinsic and extrinsic motivation as well as academic risk-taking. Model fit was satisfactory ($\chi^2 = 160.32$, $df = 98$, $p < .01$; RMSEA = .051; CFI = .950; SRMR = .054). Results show substantial medium-sized relations between intrinsic motivation to study and both academic risk-taking dimensions. Extrinsic motivation was not related to academic risk-taking.

When considering the covariates, modeled as predictor variables of motivation to study and academic risk-taking, model fit remains satisfactory ($\chi^2 = 287.80$, $df = 171$, $p < .01$; RMSEA = .053; CFI = .916; SRMR = .051). Relations between intrinsic motivation to study and academic risk-taking remained largely constant (group dimension: $r = .43$, $p < .01$; peer dimension: $r = .34$, $p < .01$). Still, relations between extrinsic motivation and academic risk-taking were not significant (group dimension: $r = .06$, $p = .45$; peer dimension: $r = -.01$, $p = .91$).

The second model (Fig. 2) analyzes relations between the latent variables internal and external locus of control as well as academic risk-taking. Fit indices, with the exception of CFI, indicate acceptable fit ($\chi^2 = 191.77$, $df = 98$, $p < .01$; RMSEA = .062; CFI = .904; SRMR = .066). Internal locus of control shows medium-sized positive relations to both academic risk-taking dimensions. Concerning external locus of control, a negative relation to the peer dimension of academic risk-taking was observed. We did not observe a significant relation to the group dimension of academic risk-taking.

Again, a model that additionally considers the covariates, modeled as predictor variables of locus of control and academic risk-taking, was estimated ($\chi^2 = 317.41$, $df = 171$, $p < .01$; RMSEA = .059; CFI = .866; SRMR = .058). Internal locus of control remains associated with academic risk-taking at the group dimension ($r = .46$, $p < .01$) as well as at the peer dimension ($r = .25$, $p < .05$). However, no significant relations for external locus of control and both academic risk-taking dimensions were found (group dimension: $r = -.11$, $p = .19$; peer dimension: $r = -.14$, $p = .13$). Therefore, when separating true-score and error variance in the latent variable model, a significant association was observed between external locus of control and academic risk-taking at the peer dimension, which was not evident in the manifest variable model. After controlling for confounding variables, no significant correlation was found in the latent variable model either, suggesting that external locus of control shares common variance with some covariates.

Table 1 Overview of descriptive statistics: Variables and their mean values, standard deviations, and bivariate correlations with each other

Variable	*N*	*M (SD)*	1	2	3	4	5	6	7	8	9	10	11
1. Intrinsic motivation	245	4.32 (1.36)											
2. Extrinsic motivation	245	4.83 (1.33)	.05										
3. Internal locus of control	245	3.64 (0.70)	.30**	.19**									
4. External locus of control	245	2.76 (0.66)	−.12	.15*	−.26**								
5. Gender (dichotomized)	245	0.31 (0.47)	−.01	−.02	−.01	.05							
6. Age	245	23.93(2.80)	.04	.03	.15*	.02	.26**						
7. Current GPA	219[a]	2.34 (1.21)	−.29**	.00	−.15*	.11	.21**	−.07					
8. High School GPA	244	2.68 (1.23)	−.17**	−.13*	−.05	.07	.09	.11	.44**				
9. Family education (dich.)	244	0.46 (0.50)	.05	.02	−.05	.01	.00	−.07	−.06	−.20**			
10. Current semester	245	6.31 (3.74)	−.01	.04	.02	−.04	.07	.53**	−.15**	−.06	.05		
11. ART (group dimension)	245	2.77 (0.83)	.36**	.07	.38**	−.12	.21**	.18**	−.04	−.04	.02	.01	
12. ART (peer dimension)	245	3.54 (0.84)	.28**	−.01	.16*	−.06	−.05	−.10	−.22**	−.08	.00	−.02	.26**

Values for the variable gender are female/non-binary = 0, male = 1. Values for the variable family education are none of the parents obtained an academic degree = 0 and at least one parent has an academic degree = 1

ART academic risk-taking

*$p < .05$; **$p < .01$

[a]In total, 245 valid responses were given to this question. However, 26 of these indicated that the respondent could not provide a current GPA. In our analyses, we treated these responses as missing values

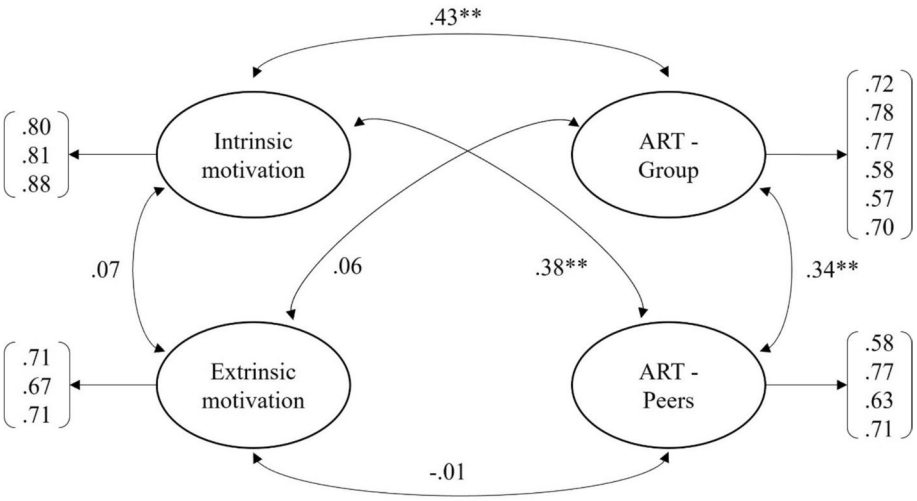

Fig. 1 Latent variable model on motivation to study and academic risk-taking (ART). The figure shows standardized parameter estimates (factor loadings, correlations). The standardized factor loadings are significant; $^{**}p < .01$

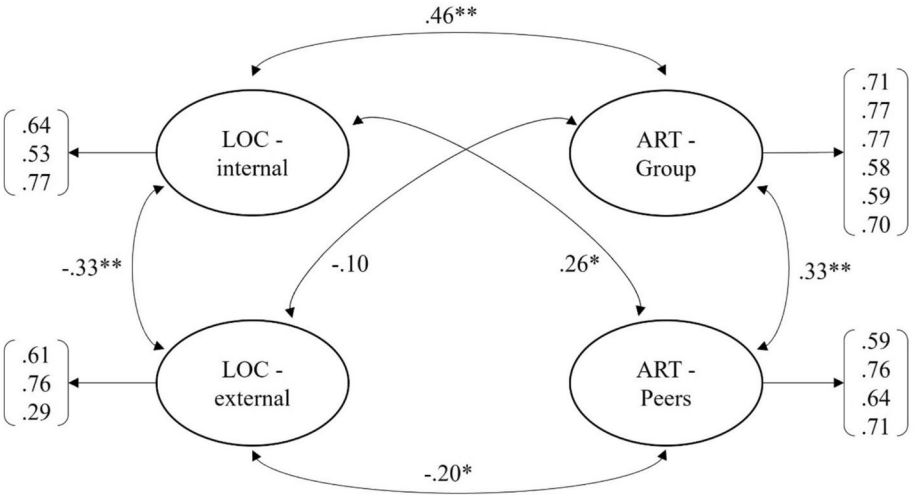

Fig. 2 Latent variable model on locus of control (LOC) and academic risk-taking (ART). The figure shows standardized parameter estimates (factor loadings, correlations). The standardized factor loadings are significant; $^{*}p < .05$; $^{**}p < .01$

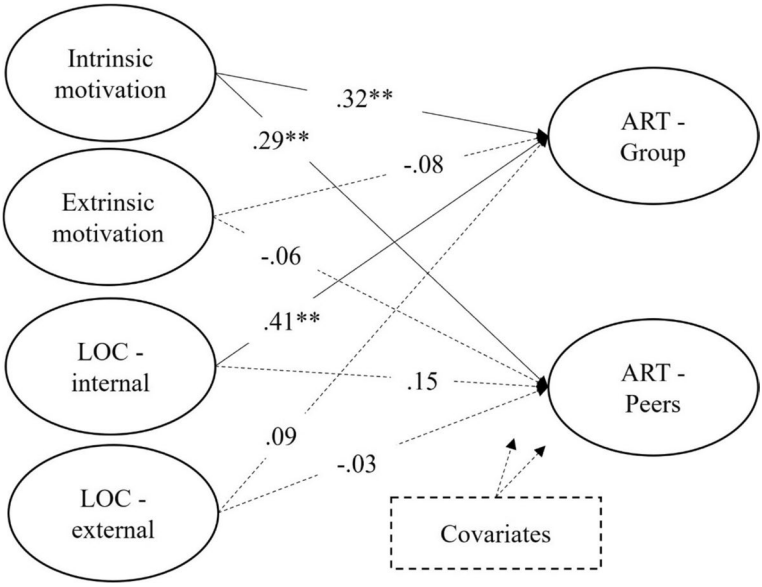

Fig. 3 SEM with linear regressions of locus of control (LOC), study motivation, and control variables on academic risk-taking (ART). The figure shows standardized parameter estimates of regression coefficients between latent variables. Covariances and regression estimates of covariates on academic risk-taking are not depicted; $^{**}p < .01$

Regression model

Finally, we predicted each dimension of academic risk-taking using a SEM with multiple linear regressions (Fig. 3). Fit indices indicate acceptable model fit ($\chi^2 = 490.11$, $df = 291$, $p < .01$; RMSEA = .053; CFI = .883; SRMR = .056). At the group dimension, both intrinsic motivation and internal locus of control are statistically significant predictors of academic risk-taking when controlling for the covariates, with the effect size being in the medium to medium-large range.

This model explains $R^2 = 36.8\%$ of the variance in academic risk-taking at the group dimension. Moreover, we find that extrinsic motivation and external locus of control only have negligibly small effects that do not contribute to our prediction in a statistically significant way. Concerning the peer dimension, we still observe a noticeable, statistically significant effect of intrinsic motivation on academic risk-taking. The effect of internal locus of control, however, is not statistically significant. Furthermore, neither extrinsic motivation nor external locus of control proved to be significant predictors. This model explains $R^2 = 22.3\%$ of the variance in academic risk-taking at the peer dimension.

Discussion

The purpose of our study was to investigate how intrinsic motivation to study as well as internal locus of control are related to university students' preferences to demonstrate academic risk-taking. In our first hypothesis, we assumed that intrinsic motivation to study

positively relates to students' propensity to engage in academic risk-taking. Supporting this assumption, we found positive medium-sized bivariate Pearson correlations between intrinsic motivation to study and academic risk-taking at both the group and peer dimensions. The latent model affirms this finding. After controlling for measurement error, the correlations remain medium-sized and statistically significant. The association even remains stable including a broad set of covariates, specifically students' current GPA, students' final school exam grades, gender, age, number of semesters, and family education background. Moreover, even within a joint predictor model, which considers students' locus of control, intrinsic motivation remains a statistically significant predictor of both academic risk-taking dimensions. In sum, intrinsic motivation to study is an important predictor of student academic risk-taking. Those who study for the sake of learning and tend to enjoy this activity do mind less risking negative feedback for making errors on a difficult task. This finding is in line with prior research that has shown intrinsic motivation to study to be beneficial for a broad range of study behaviors including effort, engagement, and mastery orientation (Howard et al., 2021), the use of deep learning strategies (Kusurkar et al., 2013), or persistence (Vallerand & Bissonnette, 1992) – in short, variables that ultimately contribute to students' academic success (Richardson et al., 2012). On the other hand, extrinsic motivation has not shown to be correlated with academic risk-taking. Therefore, students whose motivation to study is strongly tied to a specific instrumental value such as obtaining a good academic degree or a well-paid job afterward demonstrate neither more nor less academic risk-taking. This finding is consistent with a view that does not necessarily see extrinsic motivation as detrimental to adaptive learning behavior and academic success, but rather as unrelated to it (Howard et al., 2021; Richardson et al., 2012). Nevertheless, we should bear in mind that the scale used to assess extrinsic motivation emphasizes long-term external goals. Immediate incentive structures that affect students' learning behavior, such as grades or avoiding disappointing others, are neglected even though they could be equally important with regard to the propensity to take academic risks.

In our second hypothesis, we assumed that internal locus of control is linked to a higher propensity to demonstrate academic risk-taking. Correlation analyses revealed a positive relationship, but also heterogeneous effect sizes: The correlation between internal locus of control and academic risk-taking is small at the peer and medium-sized at the group dimension. Latent variable models with and without the consideration of further covariates confirm the observed positive relationship between internal locus of control and academic risk-taking. These models allow for estimating relationships of true score variables net of measurement error. In consequence, the observed relations between internal locus of control and academic risk-taking increased and even reached medium to large effect sizes for the group dimension of academic risk-taking. Therefore, internal locus of control needs to be considered a profound predictor for students' academic risk-taking in higher education. Our results are clearly in line with findings presented by Akbay and Delibalta (2020), who observed a positive relationship between internal academic locus of control and academic risk-taking. However, while there is a general trend linking internal locus of control to a higher propensity to demonstrate academic risk-taking, the strength of this relationship may vary across individuals or contexts. Regression analyses, which further consider motivation to study as a concurrent predictor variable, did not show a significant relationship between internal locus of control and academic risk-taking at the peer dimension, whereas such a relationship was still found for the group dimension of academic risk-taking. As suggested by Hübner and Pfost (2022), students might evaluate the negative affective consequences of a learning error differently depending on the persons present in the situation. In situations where only peers are present, students may feel less exposed to the risk of being shamed

or embarrassed than they would if both peers and instructors were simultaneously present. Consequently, all students might demonstrate higher levels of academic risk-taking in peer situations and predictor variables on the individual level tend to become less important, leaving the locus of control with no relevant influence in this regard.

Concerning external locus of control, correlations of manifest variables and regression analysis did not reveal significant associations to academic risk-taking. When taking measurement error into account, latent variable models showed a negative relationship between external locus of control and academic risk-taking at the peer dimension, supporting prior findings on this relationship by Akbay and Delibalta (2020). In other words, the perception that outcomes and rewards are not contingent upon individual behavior is associated with seeking less challenging learning tasks and avoiding risks of learning errors to occur in the presence of peers. Although avoiding potential errors to occur and become visible seems highly plausible and rational when the individual is convinced that fate or powerful others are responsible for the outcomes of actions, a convincing explanation of differences between the two academic risk-taking dimensions on this relationship besides chance variation is lacking. Based on theoretical considerations and empirical data (Hübner & Pfost, 2023, 2024a), the treatment of academic risk-taking as a two-dimensional construct depending on the presence of different persons (peers or peers and teachers) is a more advanced development of classical approaches to the assessment of academic risk-taking (e.g., Clifford, 1988), which certainly requires further research to specify its implications. Nevertheless, we should bear in mind that, since this association was no longer observable once the covariates had been taken into account, we should be cautious in our content-related interpretation.

Limitations and outlook

Our study is not without limitations. At first glance, the internal consistency of the locus of control scales—with values being $\omega = .68$ for the internal and $\omega = .59$ for the external locus of control scale—seems not very satisfactory. However, the scale aims to measure locus of control in a broad way, which leads to a heterogeneous item set and constrains scale reliability. The observed values of internal consistency in this study correspond well with the reported values of internal consistency by the scale developers (see Jakoby & Jacob, 1999). In addition, our analyses follow a latent modeling approach, which allows for the differentiation between the variable's true score and error variance. We kept these measures of locus of control in our analyses to comply with our preregistration and because the instrument is widely used in German-speaking countries.

On the whole, we encountered no problems estimating our models. However, the sample of 245 observations can be considered somewhat small, given that four to six latent factors are estimated each. Only regarding the covariate of age, identification problems were observed; hence, its variance was not estimated freely but was fixed at a value observed empirically in advance. Nevertheless, comparing the results obtained from the manifest and latent models yields similar conclusions and thereby testifies to the trustworthiness of our results. When including covariates in the models containing locus of control as a predictor, CFI dropped below the customary threshold of.90, whereas RMSEA remained at an acceptable level. Since the interpretation of such a pattern is controversial, we are cautious with reading too much into this finding (see Lai & Green, 2016).

Furthermore, all results are based on correlational and cross-sectional data, making it impossible to draw causal conclusions. Although analyses are carried out under

consideration of potential sources of measurement error and systematic bias due to important covariates such as students' GPA or family education background, longitudinal analyses studying lagged effects of motivation to study and locus of control on students' academic risk-taking would be desirable in the future. Subsequent studies could also investigate the link between academic risk-taking and actual learning behavior and if such an effect is moderated by a student's current performance. Moreover, it would be interesting to address affective-social factors and their relationship with academic risk-taking in future studies.

Despite these limitations, our study fills a critical research gap. Building on a substantial body of indirect evidence based on different ways of operationalizing and measuring relevant variables, we present evidence that both motivation to study and general locus of control are substantially associated with academic risk-taking. Even though our findings are correlational rather than causal, we are the first to show that intrinsic motivation and internal locus of control have a simultaneous effect on academic risk-taking. These results are an important step toward understanding academic risk-taking and thereby helping students to achieve their academic goals in the long term.

Appendix

Table 2

Table 2 Regression models with manifest variables to predict academic risk-taking at the group and peer dimensions

	Dependent variable	
	ART Group dimension *B* (*β*)	ART Peer dimension *B* (*β*)
Intercept	−0.193 (.000)	4.029** (.000)
Intrinsic motivation	0.182 (.293)**	0.135 (.221)**
Extrinsic motivation	−0.001 (−.002)	−0.008 (−.012)
Internal locus of control	0.398 (.318)**	0.107 (.087)
External locus of control	−0.060 (−.046)	0.048 (.037)
Covariates		
Gender	0.357 (.196)**	0.046 (.026)
Age	0.035 (.113)	−0.059 (−.190)*
High school GPA	−0.030 (−0.043)	0.012 (.018)
Current GPA	0.054 (.077)	−0.110 (−.159)*
Family education	0.003 (.002)	−0.128 (−.076)
Current semester	−0.018 (−.079)	0.018 (.078)
N	218	218
R^2	.309	.124
Adjusted R^2	.276	.082

Values for the variable gender are female/non-binary = 0, male = 1. Values for the variable family education are none of the parents obtained an academic degree = 0 and at least one parent has an academic degree = 1

ART academic risk-taking, *B* unstandardized regression coefficients, *β* standardized regression coefficients

*$p < .05$; **$p < .01$

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Author contribution Conceptualization: Luis Fischer, Vanessa Hübner, and Maximilian Pfost; investigation and data curation: Luis Fischer and Maximilian Pfost; methodology: Luis Fischer and Maximilian Pfost; formal analysis: Luis Fischer and Maximilian Pfost; writing—original draft: Luis Fischer; writing—review and editing: Luis Fischer, Vanessa Hübner, and Maximilian Pfost.

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Data availability The minimal dataset generated during the current study will be available on https://doi.org/10.23668/psycharchives.21669

Declarations

Ethics approval For the purpose of this study, survey data was collected. Prior to participating, all potential respondents were thoroughly informed about their rights and privacy regulations. Participation was completely voluntary, and respondents could quit at any time.

Informed consent Before presenting the questionnaire, respondents were given some contextual information about the purpose of the study and contact details in case they had any questions or concerns. Reading and accepting this information was required to start the survey.

Conflict of interest The authors declare no competing interests.

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Current themes of research

Motivational interventions. Academic risk-taking. Rapid guessing in large-scale assessments

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Current themes of research

Academic risk-taking. Learning from errors in higher education

Most relevant publications in the field of Psychology of Education

Hübner, V. & Pfost, M. (2024). Leap, learn, earn: Exploring academic risk taking and learning success across gender and socioeconomic groups. Higher education. 90(1), 49–67. https://doi.org/10.1007/s10734-024-01307-w
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Current themes of research

Self-regulated learning in higher education. The development of reading comprehension and reading behavior

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