The Effect of Epistemic Curiosity, Stress Tolerance and Need for Cognition on Academic Engagement in Undergraduate University Students

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Abstract

This cross-sectional study is the first to have investigated the effects of the two sub-dimensions of epistemic curiosity - joyous exploration and deprivation sensitivity - stress tolerance and need for cognition on academic engagement. Building upon previous research which found positive relationships between these four cognitive motivational traits and academic engagement, this study investigated the effects of joyous exploration, deprivation sensitivity, stress tolerance and need for cognition on academic engagement within a unified model. Based on previous research, this study hypothesised that all four constructs demonstrate a unique positive effect on academic engagement. 507 first-year and 101 second- or third-year Dutch undergraduate psychology students filled in an online questionnaire, indicating their levels of curiosity, stress tolerance, need for cognition and academic engagement. The standard multiple regression analysis indicated the model explained a moderate amount of variance in academic engagement. It further indicated that joyous exploration, deprivation sensitivity and stress tolerance are significant positive predictors of academic engagement, while NFC is not. These results offer a more nuanced and complete perspective of the predictors of academic engagement and corrects inadequate assumptions inferred of previous studies. Future research might focus replicating the study within a different, more varied student population and investigate the effect of other cognitive motivational traits on academic engagement.

Keywords: academic engagement, epistemic curiosity, stress tolerance, need for cognition

The Effect of Epistemic Curiosity, Stress Tolerance and Need for Cognition on Academic Engagement in Undergraduate University Students

Academic performance, a topic of research for over a century, is broadly defined as a student's level of achievement in academic tasks and their ability to meet the demands of their educational program. Commonly assessed through grades, test scores, and grade point averages (GPA; Richardson, Abraham, & Bond, 2012), academic performance holds significance by facilitating benefits such as scholarships and job opportunities for students (Zou et al., 2022). As a result, extensive research in educational psychology has explored various cognitive motivational factors that influence university students' academic performance, including intelligence, personality and interest (Ackerman, 1996; Richardson, Abraham, & Bond, 2012). Additionally, research has established that academic engagement is linked to higher academic performance, rendering it a critical factor in comprehending and fostering student success (Casuso-Holgado et al., 2021; Ketonen et al., 2016). Given the significant role of academic engagement, understanding the cognitive motivational factors that influence it is of particular interest. This study investigates whether three such potential predictors—epistemic curiosity, stress tolerance, and need for cognition—predict academic engagement among university students.

Academic engagement refers to the degree to which students are actively involved in their academic work. Put simply, it describes how invested a student is in his/her studies in terms effort, time and attention. Furthermore, academic engagement comprises elements of vigor, dedication, and absorption (Ketonen et al., 2016; Robayo-Tamayo et al., 2020; Siu et al., 2014). More specifically, vigor entails high energy, mental resilience, and perseverance while studying; dedication involves a strong emotional connection to one's studies, including a sense of significance, personal meaning, enthusiasm, inspiration, and pride; and absorption

refers to complete concentration and immersion in studying, leading to a loss of time awareness and difficulty disengaging from academic activities (Schaufeli, 2017).

Epistemic Curiosity and Stress Tolerance on Academic Engagement

Curiosity is defined as the desire and pursuit to investigate novel, uncertain, complex, and ambiguous situations that exhibit potential for new information (Kashdan et al., 2018). Prior research has distinguished various subtypes of curiosity, such as perceptual, sensory, interpersonal, and epistemic curiosity. This paper will specifically examine epistemic curiosity as it embodies curiosity's intellectual nature (Litman, 2008), making it particularly relevant in understanding academic engagement.

Epistemic curiosity (EC) refers to an individual's innate drive to seek knowledge, inspiring them to explore new ideas, bridge information gaps, and tackle intellectual challenges. EC can be divided into two subcategories: interest-type (I-type) and deprivation-type (D-type). Interest-type (I-type) EC refers to the pleasure-driven aspect of EC, where individuals seek new knowledge for the sheer intrinsic enjoyment it provides. D-type EC, on the other hand, refers to the need-based pursuit of knowledge, where individuals seek out specific new information to reduce the discomfort of knowledge gaps (Litman, 2008). These two subtypes of EC correspond with the joyous exploration and deprivation sensitivity dimensions of the Five-Dimensional Curiosity Scale (5DC). Specifically, joyous exploration, characterised as the the pleasure of discovering derived from uncovering new information matches I-type EC. Conversely, deprivation sensitivity which refers to the desire to bridge knowledge gaps corresponds with D-type EC (Kashdan et al., 2018; Litman, 2008). For the remainder of this paper, the terms joyous exploration and I-type EC, and deprivation sensitivity and D-type EC will be used synonymously.

Previous research collectively suggests that highly curious students exhibit greater academic engagement (Garrosa et al., 2017; Robayo-Tamayo et al., 2020; Vracheva et al., 2020). More specifically, curious high school students demonstrate higher perseverance in academic tasks and concentrate more fully, thereby contributing to vigor and absorption in academic engagement (Robayo-Tamayo et al., 2020; Kashdan & Yuen, 2007). Robayo-Tamayo and colleagues also found that higher curiosity levels demonstrated greater academic engagement in Spanish university students. However, the curiosity scale used in this study (Curiosity and Exploration Inventory II) measures curiosity along the dimensions of exploration and absorption, mainly referring to joyous exploration, not taking into account the effect of deprivation sensitivity. A similar gap is apparent in a preliminary study where EC significantly predicted academic engagement in US college students without differentiating the unique impacts of joyous exploration and deprivation sensitivity (Vracheva et al., 2020). This points to a gap in research as the effect of EC on academic engagement has not been fully explored across its two dimensions.

Theoretically, joyous exploration could stimulate academic engagement, as it is plausible that this inherently enjoyable form of novelty-seeking likely leads to active engagement. Through this lens, students high in joyous exploration might exhibit an increased willingness to invest their time, effort and attention in their academic material. It also plausible that deprivation sensitivity leads to academic engagement. Students might actively engage in their study material to eliminate the discomfort that originates from their knowledge gaps. This aligns with Gestalt theory and prior research, which indicate that the feeling of deprivation, stemming from a lack of knowledge, only dissipates when enough new knowledge is gathered (Beswick, 2017, pp. 9-27; Rotgans & Schmidt, 2014), suggesting that to eliminate uncomfort-

able states of knowledge deprivation the student has to engage in the academic material until the specific missing information has been obtained.

In light of this theoretical context and the identified gap in literature, the present study aims to investigate the individual effect of joyous exploration and deprivation sensitivity on academic engagement in university students. Based on the existing body of research, we hypothesise that both joyous exploration and deprivation sensitivity will predict higher levels of academic engagement.

Hypothesis 1. University students with higher level of joyous exploration will predict greater academic engagement.

Hypothesis 2. University students with higher deprivation sensitivity will predict greater academic engagement.

For our research purpose, it is also interesting to address an individual's capability to deal with stress and uncertainties when perusing knowledge, since these are reoccurring challenges for university students and could, therefore, play a crucial role in understanding academic engagement. We will, therefore, explicitly conceptualise the ability to tolerate stress and uncertainty when pursuing novel information in the learning process as a third construct, which we will refer to as *stress tolerance*.

While no specific study has yet examined the impact of stress tolerance on academic engagement, it has been found that high stress levels can negatively affect student engagement in Turkish high school students (Coşkun Şimşek & Günay, 2023). This may suggest that experiencing stress neutralises student's mental resilience and perseverance (vigor), enthusiasm (dedication), and their ability to fully concentrate and immerse themselves in their material when studying (absorption). Considering these findings, we hypothesise that stress tolerance positively predicts academic engagement.

Hypothesis 3. University students with higher levels of stress tolerance will predict greater academic engagement.

Need for Cognition on Academic Engagement

Need for cognition (NFC) has been characterised as an individual's tendency to seek out and derive satisfaction from complex cognitive tasks and challenging mental activities, such as problem-solving, critical thinking, and deep learning, even when there is no external motivation (Lavrijsen et al., 2021). In contrast to EC, NFC primarily focuses on the enjoyment of effortful mental activity that may not necessarily involve learning new information but are pursued for the sake of cognitive effort itself. This includes finding pleasure in complex tasks that are already familiar. NFC is considered a trait, suggesting that it is a relatively stable characteristic that influences an individual's thoughts, emotions, and actions across various situations and contexts (Cacioppo & Petty, 1982).

Although limited, the available studies investigating the effect of NFC on academic engagement have reported significant positive correlations across various student populations. For instance, Cole and Korkmaz (2013) found a positive effect of NFC on academic engagement among first-year university students from diverse programs at a US public university. Additionally, NFC has been show to predict school engagement in 7th graders (Lavrijsen et al., 2021). Theoretically, it seems reasonable that individuals who enjoy and seek effortful thinking are more likely to actively engage with academic material, particularly given that NFC is associated with higher perseverance, a component of vigor in academic engagement (Hill & Aita, 2018). However, there are certain limitations constraining the generalisability of these findings.

Prior studies have predominantly focused on high school and first-year university students, leaving a gap concerning second- and third-year university students (Lavrijsen et al.,

2021; Cole & Korkmaz, 2013). Extrapolating findings from high school students to university students is inadequate due to substantial differences between these groups, such as academic autonomy and the complexity of topics. Similarly, it is inappropriate to generalise findings from first-year university students to the entire undergraduate student population, given that students across different academic years may face unique experiences that impact the NFC-academic engagement relationship (Korhonen et al., 2017). For example, first-year students typically undergo a transition to university life and adjust to new academic expectations, which may pose challenges for academic engagement. These distinctions imply that the NFC-academic engagement relationship may vary between high school and university students and first-year and second- or third-year university students. As such, our study aims to investigate the relationship between NFC and academic engagement among first-, second-, and third-year university students, filling the gap in literature.

Based on existing literature, we hypothesise that university students with greater NFC will display higher levels of academic engagement. By examining this relationship, our study seeks to provide a more in-depth understanding of the impact of NFC on academic engagement among university students. Moreover, this investigation is the first to explore the combined effect of NFC, EC and stress tolerance on academic engagement. By analysing the individual effects of these factors on academic engagement within a unified model, we hope to contribute to the comprehension of the key cognitive motivational traits that foster academic engagement in university students.

Hypothesis 4: Higher levels of NFC in university students will predict greater academic engagement.

Methods

Participants

Using a convenience sample, a group of five bachelor students recruited participants via social media, faculty notice boards, and the SONA system for their bachelor's thesis research project. The participants were first-, second-, and third-year students taking either the English or Dutch track of the Psychology program at the University of Groningen. The age range of the participants was 17 to 35 (M = 20.18, SD = 2.25). Twenty-six percent of the sample consisted of males, 74% consisted of females, and < 1% of participants chose the option "other". The demographic distribution of the participants included three categories: Dutch (n = 313), German (n = 133), and other (n = 162). The exclusion criteria included checks for language proficiency and answer sincerity. The participants' language proficiency was tested via the question "Do you think your level of English was good enough to answer the questions in the survey reliably?", with answer options "Yes" or "No". The participants' answer sincerity was checked via the question "Did you try to answer all questions in this survey seriously and honestly so that we can use your data in our research?", with answer options "Yes" or "No". A "No" answer to either the language proficiency or answer sincerity questions, resulted in exclusion. Additionally, attentive responding was verified by an instructed response item, namely, a question that asked a participant to choose a specific number on a Likert scale; only participants who answered as instructed were included in the data. The final number of excluded participants was 104. The sample consisted of 507 first-year students and 101 second- and third-year students, which resulted in a total sample of 608 students. Consent of the Ethics Committee of psychology of the University of Groningen was granted before initiation of the sampling procedure.

Materials

Curiosity was measured using the Five-Dimensional Curiosity Scale (Kashdan et al., 2018). This scale consists of 25 items measuring five curiosity modalities, five questions for each. Three curiosity modalities were used in our study, namely joyous exploration, deprivation sensitivity and stress tolerance. For joyous exploration an example of a corresponding item is "I view challenging situations as an opportunity to grow and learn". For Deprivation Sensitivity an example item is "I can spend hours on a single problem because I just can't rest without knowing the answer". Finally, for stress tolerance an example item is "I cannot handle the stress that comes from entering uncertain situations". Participants were asked to indicate the degree to which each statement accurately describes them on a seven-point Likert scale where 1 = does not describe me at all, and 7 = completely describes me. To compute a participant's overall score in each modality, we calculated the average scores across the items of the corresponding subdomains. The sample provided sufficient reliability for all curiosity subdomains, namely joyous exploration (Cronbach's $\alpha = 0.78$), deprivation sensitivity (Cronbach's $\alpha = 0.82$) and stress tolerance (Cronbach's $\alpha = 0.82$). Previous studies have demonstrated that the curiosity scale has sufficient construct validity, which confirms that we can trust the test accurately measures the concept it was designed to evaluate (e.g., Kashdan et al., 2018).

The second scale used was the Need for Cognition Scale-6 (NCS-6; Coelho et al., 2020) which is an abbreviated version of a larger scale called The Efficient Assessment of Need for Cognition (NCS-18; Cacioppo et al., 1984). In the shortened six-item scale, participants had to indicate whether the statements are characteristic of themselves. This indication was made on a five-point Likert scale with 1 = extremely uncharacteristic of me and 5 = extremely characteristic of me. Examples of items from the NCS-6 include statements such as "I would prefer complex to simple problems" or "I really enjoy a task that involves coming up

with new solutions to problems". To compute the scores for the variable need for cognition, we calculated the average of each participant's scores on the six questions. This measure offers good psychometric properties (Cronbach's $\alpha = 0.75$). Finally, construct validity has previously been found to be sufficient (Coelho et al., 2020). The last scale participants had to fill out with relevance to our study was the Utrecht Work Engagement for Students (UWES-9S; Carmona-Halty et al., 2019) which was an abbreviated version of the 17-item Utrecht Work Engagement Scale (UWES; Schaufeli et al., 2006). This questionnaire consisted of nine statements regarding one's feelings about studying at university. The UWES–9S assesses students' engagement towards their studies across three modalities, namely vigor, dedication, and absorption. For vigor an example of a corresponding item is "When I'm doing my work as a student, I feel bursting with energy". For dedication an example item is "I am enthusiastic about my studies". Finally, for absorption an example item is "I am immersed in my studies". This seven-point Likert scale starts at 0 = never, and goes up to 6 = always / every day. This measure offers an excellent reliability of $\alpha = 0.91$, and good construct validity (Seppälä et al., 2009).

Procedures

To participate in the study, participants filled out a questionnaire via the online portal Qualtrics. First-year students were recruited through the SONA platform. For second- and third-year students, the questionnaire links were distributed via online messengers such as WhatsApp, alongside flyers on bulletin boards around the building of the Faculty of Behavioral and Social Sciences of the University of Groningen. The first-year students received SONA credits after completing the questionnaire. Second- and third-year students were presented with an incentive of €1.50 upon completing the questionnaire. As the questionnaire

was filled out online in each participant's environment of choice, the researchers were not involved in the data collection, except for the recruitment of the sample.

Participants were encouraged to fill out the entire questionnaire in one go. At the start of the questionnaire, participants were asked to indicate which year and study program they were currently in. Only participants who indicated they were first-, second- or third-year psychology students were authorized to proceed with the questionnaire - other participants were asked to leave the study. Students who were selected to proceed were then given information about the study, their data, and the consequences of participating. The information included an explanation that the study has to do with “hunger for knowledge” and “experiences of concentration in everyday life”. Additionally, the participants were informed that participation is voluntary. After reading this information they were asked to give their informed consent, acknowledging that their personal data will be erased after a given date. Finally, the participants were given the choice of granting the researchers access to their grades, which may be used in other studies. Once the participant decided whether to consent, they were able to begin the survey.

The survey starts by asking the participants to fill out questions about their demographic information, including information about their biological sex, age, nationality, professional status, and education level. After they filled out their information, participants were presented with the scales in a randomized order. In addition to the scales used in our study, the questionnaire included four scales and measures of medical history that the participants were requested to fill out. This information was not relevant for our current study. After answering all the questions, participants were presented with checks for language proficiency and answer sincerity. Additionally, they were free to leave any comments they had concerning the study. Upon completion of the survey, they were then asked to fill out a follow-up survey to

claim their monetary reward if they were a second- or third-year student, or to enter their SONA number to receive SONA credits if they were a first-year student.

Data Preparation and Statistical Analysis

After the exclusion criteria were applied, the data was checked for statistical outliers. Using the Cook's distance, a univariate outlier measure, no influential outlier was found. Based on the Mahalanobis distance, a measure to detect multivariate outliers, no influential outliers were found. Thus, using univariate and multivariate outlier detection, no data was removed from our sample. A standard multiple linear regression analysis using the enter method was applied using the following five variables: independent variables (IV) need for cognition, joyous exploration, deprivation sensitivity, stress tolerance, and the dependent variable (DV) academic engagement. Additionally, zero-order Pearson correlations were computed to investigate the relationships between the variables. Finally, semi-partial correlations of the IV's were explored to differentiate between their independent contributions to the DV. All values and calculations were computed using SPSS 27 software.

Results

In our total sample, students demonstrated a mean score of 5.11 (*SD* = 0.92) in joyous exploration, 4.36 (*SD* = 1.21) in deprivation sensitivity, 3.62 (*SD* = 1.27) in stress tolerance, 3.6 (*SD* = 0.64) in NFC and 4.67 (*SD* = 0.94) in academic engagement (Table 1). Our academic engagement mean is consistent with the mean of 4.21 (*SD* = 1.04) from a previous study which also utilised the UWES-9S (Robayo-Tamayo et al., 2020).

Table 1

Descriptive Statistics for Entire Sample, First-year Students, and Second- or Third-year Students

Variable	Entire Sample		First-year Students		Second- and Third-year Students	
	M	*SD*	*M*	*SD*	*M*	*SD*
Joyous Exploration	5.11	0.92	5.10	0.91	5.11	0.93
Deprivation Sensitivity	4.36	1.21	4.36	1.23	4.35	1.14
Stress Tolerance	3.62	1.27	3.64	1.26	3.51	1.32
NFC	3.60	0.64	3.58	0.64	3.70	0.65
Academic Engagement	4.67	0.94	4.70	0.95	4.56	0.89

Note. *M* = mean; *SD* = standard deviation; NFC = need for cognition.

Assumptions of multiple regression were assessed, and the data met the requirements of normality, linearity, homoscedasticity, and independence. Univariate normality of each variable was checked through visual inspection of Q-Q plots, P-P plots, and histograms. Furthermore, univariate normality was checked through Shapiro-Wilk tests, skewness, and kurtosis statistics. Although the Shapiro-Wilk test was significant for academic engagement ($W(608) = 0.989$, $df = 608$, $p < .001$), skewness (3.72) and kurtosis (0.196) values indicated only a slight deviation from normality. Scatterplots of the independent variables and academic engagement indicated a linear relationship, while plots of residuals versus predicted values displayed homoscedasticity. Lastly, multicollinearity was not a concern, as all VIF values remained below the threshold of 10, and tolerance values exceeded 0.1. The correlation matrix is provided in Table 2.

Table 2

Zero-order Correlation Matrix

	1	2	3	4	5
1. JE	-	-	-	-	-

2. DS	.377**	-	-	-	-
3. ST	.321**	-.111*	-	-	-
4. NFC	.636**	.409**	.306**	-	-
5. AE	.396**	.289**	.242**	.350**	-

Note. * $p < .01$. ** $p < .001$. JE = joyous exploration; DE = deprivation sensitivity; ST = stress tolerance; AE = academic engagement.

Given the differences in age, study experience and depth of knowledge across different academic years in our sample, we assessed whether significant differences existed between first-year and second- or third-year university students in the independent variables (joyous exploration, deprivation sensitivity, stress tolerance, and NFC). Welch's t-tests demonstrated no significant differences between the two groups for joyous exploration ($t(1, 140.95) = 0.82$, $p = .366$), deprivation sensitivity ($t(1, 149.87) = 0.01$, $p = .912$), stress tolerance ($t(1, 138.25) = 0.82$, $p = .367$), and NFC ($t(1, 142) = 2.64$, $p = .106$). These results suggest that differences in first-year and second- or third-year of study do not significantly influence the independent variables in our sample. As such, we can proceed with subsequent analyses without controlling for the two academic year groups.

To test whether joyous exploration, deprivation sensitivity, stress tolerance and NFC positively predict academic engagement, a standard multiple linear regression analysis (MLR) was performed with academic engagement as our dependent variable and joyous exploration, deprivation sensitivity, stress tolerance, and NFC as our independent variables. The overall model proved to be significant, $F(4, 603) = 40.30$, $p < .001$, explaining 20.6% of the variance in academic engagement ($R^2 = 0.211$, $R^2_{\text{Adjusted}} = 0.206$). Consistent with hypotheses 1, 2 and 3, joyous exploration ($\beta = 0.218$, $t = 4.47$, $p < .001$, $sr^2 = 0.026$), deprivation sensitivity ($\beta = 0.193$, $t = 4.58$, $p < .001$, $sr^2 = 0.027$), and stress tolerance ($\beta = 0.170$, $t = 4.18$, $p < .001$, $sr^2 =$

0.023) emerged as significant positive predictors of academic engagement. In contrast to hypothesis 4, NFC ($\beta = 0.080$, $t = 1.61$, $p = 0.108$, $sr^2 = 0.003$) did not significantly predict academic engagement. Notably, NFC demonstrated moderate to strong correlations with joyous exploration ($r = 0.636$), deprivation sensitivity ($r = 0.409$), and stress tolerance ($r = 0.306$; Table 2).

Discussion

The purpose of the present study was to investigate the effects of the two sub-dimensions of epistemic curiosity (EC), —joyous exploration and deprivation sensitivity— stress tolerance and NFC on academic engagement in a unified model among first-, second-, and third-year university students. Our results revealed that these four factors combined significantly predict academic engagement. More specifically, joyous exploration, deprivation sensitivity, and stress tolerance emerged as significant predictors of academic engagement, supporting Hypotheses 1, 2, and 3, respectively. However, in contrast to Hypothesis 4, NFC was not found to be a significant predictor of academic engagement. Furthermore, our results suggested that joyous exploration, deprivation sensitivity, and stress tolerance each provided a similar unique contribution to explaining academic engagement, whereas NFC had almost zero unique contribution.. Reflecting upon our research question, this study conclusively established that joyous exploration, deprivation sensitivity, and stress tolerance are critical predictors of academic engagement among university students, with the effect of NFC being insignificant, when considered with the other prevailing factors.

In total, our model revealed to be significant, explaining a moderate amount of the variance in academic engagement through joyous exploration, deprivation sensitivity and stress tolerance. Nonetheless, the total variance explained by our model indicates that further

factors need to be considered to predict academic engagement, since a substantial amount of variance remained unexplained.

Our results regarding Hypotheses 1 and 2 align with prior research demonstrating that curiosity and particularly, EC play a significant role in fostering academic engagement in university students (Robayo-Tamayo et al., 2020; Vracheva et al., 2020). Building upon previous findings, which mainly focused on the effect of joyous exploration, not differentiating between the effect of the two EC dimensions, this study is the first to specifically investigate the individual effects of both joyous explorations and deprivation sensitivity on academic engagement.

Our results revealed significant positive correlations for both EC sub-dimensions with academic engagement; with joyous exploration demonstrating a substantially higher correlation with academic engagement than deprivation sensitivity. In our model, both joyous exploration and deprivation sensitivity emerged as significant unique predictors of academic engagement. Interestingly, while joyous exploration demonstrated a higher correlation with academic engagement than deprivation sensitivity, the unique contribution in explaining academic engagement were found to be almost similar for the two EC dimensions. This indicates that, in the presence of stress tolerance and NFC in one unified model, both joyous exploration and deprivation sensitivity accounted for a comparable amount of unique variance in academic engagement.

It remains to be explored in what way joyous exploration and deprivation sensitivity influence academic engagement. Our previous theoretical explanations suggest that joyous exploration might inherently stimulate academic engagement due to its novelty-seeking nature that incites students to invest their time, effort, and attention into their academic material. In contrast, deprivation sensitivity could equally motivate academic engagement, as students

may be propelled to actively engage with their studies to alleviate the discomfort originating from knowledge gaps, in line with the Gestalt theory and prior research. Therefore, these theories serve as an initial foundation for investigating their respective relationships with academic engagement.

Our study notably discovered that stress tolerance is a significant predictor of academic engagement among university students. This finding is consistent with existing evidence on the relationship of stress and academic engagement in high school students (Coşkun Şimşek & Günay, 2023), suggesting that heightened stress could hinder students' mental resilience, enthusiasm, and their ability to fully concentrate on their academic tasks. Furthermore, this finding adds to the gap in literature by being the first to demonstrate that students with higher levels of stress tolerance are more likely to actively engage in academic activities.

In our model, stress tolerance provided a similar unique contribution in explaining academic engagement, as derivation sensitivity and joyous exploration. Despite these discoveries, the intricate dynamics of how stress tolerance actually influences academic engagement still remains an open question, highlighting a promising direction for future research.

In stark contrast to our expectations and previous findings (Cole & Korkmaz, 2013; Lavrijsen et al., 2021), NFC did not significantly predict academic engagement. This is particularly interesting, given that previous research has found significant positive effects between NFC and academic engagement among 7th-grade high school students and first-year university students (Cole & Korkmaz, 2013; Lavrijsen et al., 2021). While we did observe a significant positive correlation between NFC and academic engagement—a stronger correlation than those of deprivation sensitivity and stress tolerance with academic engagement—NFC did not emerge as a meaningful predictor of academic engagement in our model, as it

contributed almost nothing unique in the explanation of academic engagement when considered alongside the three other factors.

A possible reason for this deviation from earlier studies could be an overlap between the effects of NFC and the other three predictors, as each factor showed a significant moderate correlation with NFC. In other words, when joyous exploration, deprivation sensitivity, and stress tolerance are accounted for, a person's inclination toward effortful cognitive activity appears to provide no incremental validity in explaining academic engagement. In short, joyous exploration, and to a lesser degree, deprivation sensitivity and stress tolerance, are suggested to be stronger determinants of academic engagement within our model, thereby overshadowing the effect of NFC. This explanation of present findings is supported by previous research that found a lack of discriminant validity between EC and NFC, suggesting that these constructs might not be entirely distinct and could have overlapping effects on certain outcome variables such as academic engagement (Mussel, 2010).

Strengths & Limitations

A key strength of our study lies in its ability to predict academic engagement by incorporating multiple cognitive motivational factors such as EC, stress tolerance and NFC within a unified model. This stands in contrast to previous studies that have primarily focused on predicting academic engagement considering NFC and EC individually. Moreover, this study is the first to examine the effects of EC's two sub-dimensions—joyous exploration and deprivation sensitivity—on academic engagement, rather than viewing EC as a singular, broad curiosity trait. Finally, this study also pioneers in exploring the impact of stress tolerance on academic engagement. By addressing these aspects, our study marks significant progress in understanding the research questions, exploring the predictors of academic engagement, compared to previous studies. It offers a more nuanced and complete perspective

of the predictors of academic engagement. It also corrects possible inadequate assumptions one might have inferred of previous studies, as in the case for NFC, which didn't hold to be significant predictors of academic engagement when considered with these other factors.

Despite the contributions of this study, we must also acknowledge its limitations. The overrepresentation of female participants, a common occurrence in psychology student samples, presents a potential bias that limits the generalisability of our findings to undergraduate psychology students. Furthermore, due to the use of a convenience sample, these findings can only be confidently generalised to psychology students of explicitly the University of Groningen. We cannot infer that other universities provide similar learning environments for students to attain comparable experiences in EC, stress tolerance, NFC and academic engagement, since no random sampling could be utilised. Moreover, the way our study was framed to potential second- or third-year participants, focusing on the "hunger for knowledge and academic achievement", might have disproportionately attracted more academically engaged and intellectually curious students, potentially biasing our measurements and results. Therefore, the possibility of a selection bias in our sample is a concern that needs to be acknowledged.

Furthermore, our study relied on self-report questionnaires, which may present possible social desirability bias and limitations in individuals' self-insight, especially considering that all three scales focused on attitudes and emotional responses rather than quantifiable behaviours. Relating to this, it is also worth mentioning the absence of behavioural measures in our academic engagement scale, which does not provide a holistic approach that encompasses both attitudinal and behavioural aspects of academic engagement. Without incorporating behavioural measures, it is more difficult to discern whether cognitive motivational traits indeed translate into real-world academic engagement behaviours.

Future Research

There are a multitude of possibilities for future research that the findings of this study may serve to inspire. Future research might focus to replicate the study within a different, more varied student population while investigating moderating effects between EC, particularly joyous exploration, and NFC within our model. Other potential directions include exploring the relationships between EC, stress tolerance and other cognitive motivational traits such as intrinsic motivation and psychological capital (PsyCap), since these factors have been found have significant predictive effects on academic engagement when investigated individually. Exploring these factors may help to further unveil the unexplained variance of academic engagement and test whether these cognitive motivational traits hold to be significant predictors of academic engagement when considered with other factors within an unified model (e.g. NFC in our study). The objective of this would be to ultimately contribute to more effective strategies for fostering student engagement and subsequently, academic performance and student well-being. Lastly, future studies should delve into understanding the specific ways in which stress tolerance influences academic engagement.

Conclusion

In conclusion, this study broadens our understanding of the influence of epistemic curiosity, stress tolerance, and NFC on academic engagement among undergraduate psychology students across their first, second, and third years. Our findings suggest that epistemic curiosity and stress tolerance are crucial contributors to academic engagement while NFC is not when considered alongside them. Furthermore, we found that both dimensions of epistemic curiosity and stress tolerance had a similar unique influence on academic engagement, while NFC had almost no unique effect. However, further research is necessary to validate and expand these findings beyond the psychology student population at the University of Groningen. Nevertheless, these insights hold theoretical importance and provide initial thoughts for the

development of effective educational strategies that nurture epistemic curiosity and stress tolerance to foster academic engagement and, ultimately, academic performance. Our findings also pave the way for future studies aiming to identify further cognitive motivation traits that influence university students' academic engagement.

References

Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interests, and knowledge. *Intelligence, 22*(2), 227–257. https://doi.org/10.1016/s0160-2896(96)90016-1

Beswick, D. (2017). Towards a General Theory of Cognitive Motivation. *Cognitive Motivation* (pp. 9–27). Cambridge University Press.

Boulton, C. A., Hughes, E., Kent, C., Smith, J. R., & Williams, H. T. P. (2019). Student engagement and wellbeing over time at a higher education institution. *PloS One, 14*(11), e0225770. https://doi.org/10.1371/journal.pone.0225770

Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology, 42*(1), 116–131. https://doi.org/10.1037/00223514.42.1.116

Carmona-Halty, M. A., Schaufeli, W. B., & Salanova, M. (2019). The Utrecht work engagement scale for students (UWES-9S): Factorial validity, reliability, and measurement invariance in a Chilean sample of undergraduate university students. *Frontiers in Psychology, 10,* 1017. https://doi.org/10.3389/fpsyg.2019.01017

Casuso-Holgado, M. J., Cuesta-Vargas, A. I., Moreno-Morales, N., Labajos-Manzanares, M. T., Barón-López, F. J., & Vega-Cuesta, M. (2013). The association between academic engagement and achievement in health sciences students. *BMC Medical Education, 13*(1), 33. https://doi.org/10.1186/1472-6920-13-33

Cohen, A. R., Stotland, E., & Wolfe, D. M. (1955). An experimental investigation of need for cognition. *Journal of Abnormal Psychology, 51*(2), 291–294. https://doi.org/10.1037/h0042761

Cole, J. S., & Korkmaz, A. (2013). First-year students' psychological well-being and need for cognition: Are they important predictors of academic engagement? *Journal of College Student Development, 54*(6), 557–569. https://doi.org/10.1353/csd.2013.0082

Coşkun Şimşek, D., & Günay, U. (2023). The effects of stress on adolescents' school engagement. *Journal of Child and Adolescent Psychiatric Nursing: Official Publication of the Association of Child and Adolescent Psychiatric Nurses, Inc, 36*(1), 35–43. https://doi.org/10.1111/jcap.12397

Datu, J. A. D., & King, R. B. (2018). Subjective well-being is reciprocally associated with academic engagement: A two-wave longitudinal study. *Journal of School Psychology, 69*, 100–110. https://doi.org/10.1016/j.jsp.2018.05.007

Garrosa, E., Blanco-Donoso, L. M., Carmona-Cobo, I., & Moreno-Jiménez, B. (2017). How do curiosity, meaning in life, and search for meaning predict college students' daily emotional exhaustion and engagement? *Journal of Happiness Studies, 18*(1), 17–40. https://doi.org/10.1007/s10902-016-9715-3

Grass, J., Strobel, A., & Strobel, A. (2017). Cognitive Investments in Academic Success: The Role of Need for Cognition at University. *Frontiers in psychology*, *8*, 790. https://doi.org/10.3389/fpsyg.2017.00790

Hill, B. D., & Aita, S. L. (2018). The positive side of effort: A review of the impact of motivation and engagement on neuropsychological performance. *Applied Neuropsychology. Adult, 25*(4), 312–317. https://doi.org/10.1080/23279095.2018.1458502

Kashdan, T. B., Stiksma, M. C., Disabato, D. D., McKnight, P. E., Bekier, J., Kaji, J., & Lazarus, R. (2018). The five-dimensional curiosity scale: Capturing the bandwidth of curiosity and identifying four unique subgroups of curious people. J*ournal of Research in Personality, 73*, 130-149. https://doi.org/10.1016/j.jrp.2017.11.011

Kashdan, T. B., & Yuen, M. (2007). Whether highly curious students thrive academically depends on perceptions about the school learning environment: A study of Hong Kong adolescents. *Motivation and Emotion, 31*(4), 260–270. https://doi.org/10.1007/s11031007-9074-9

Ketonen, E. E., Haarala-Muhonen, A., Hirsto, L., Hänninen, J. J., Wähälä, K., & Lonka, K. (2016). Am I in the right place? Academic engagement and study success during the first years at university. *Learning and Individual Differences, 51*, 141–148. https://doi.org/10.1016/j.lindif.2016.08.017

Korhonen, V., Inkinen, M., Mattsson, M., & Toom, A. (2017). Student engagement and the transition from the first to second year in higher education. *In Higher education transitions* (pp. 113–134). Routledge.

Lavrijsen, J., Preckel, F., Verachtert, P., Vansteenkiste, M., & Verschueren, K. (2021a). Are motivational benefits of adequately challenging schoolwork related to students' need for cognition, cognitive ability, or both? *Personality and Individual Differences, 171*. https://doi.org/10.1016/j.paid.2020.110558

Lins de Holanda Coelho, G., H P Hanel, P., & J Wolf, L. (2020). The very efficient assessment of need for cognition: Developing a six-item version. *Assessment, 27*(8), 1870–1885. https://doi.org/10.1177/1073191118793208

Litman, J. A. (2008). Interest and deprivation factors of epistemic curiosity. *Personality and Individual Differences, 44*(7), 1585–1595. https://doi.org/10.1016/j.paid.2008.01.014

Mussel, P. (2010). Epistemic curiosity and related constructs: Lacking evidence of discriminant validity. *Personality and Individual Differences, 49*(5), 506–510. https:// doi.org/10.1016/j.paid.2010.05.014

Oudeyer, P. Y., Gottlieb, J., & Lopes, M. (2016). Intrinsic motivation, curiosity, and learning: Theory and applications in educational technologies. *Progress in Brain Research* (Vol. 229, pp. 257–284). Elsevier B.V. https://doi.org/10.1016/bs.pbr.2016.05.005

Paladino, D. A., Gonzalez, L. M., & Watson, J. C. (2020). Stress and anxiety. *College counseling and student development: Theory, practice, and campus collaboration.* (pp. 331-351). American Counseling Association.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin, 138*(2), 353–387. https://doi.org/10.1037/a0026838

Robayo-Tamayo, M., Blanco-Donoso, L. M., Román, F. J., Carmona-Cobo, I., Moreno-Jiménez, B., & Garrosa, E. (2020). Academic engagement: A diary study on the mediating role of academic support. *Learning and Individual Differences, 80*. https://doi.org/10.1016/j.lindif.2020.101887

Rotgans, J. I., & Schmidt, H. G. (2014). Situational interest and learning: Thirst for knowledge. *Learning and Instruction, 32*, 37–50. https://doi.org/10.1016/j.learninstruc.2014.01.002

Russo, D., Masegosa, A. R., & Stol, K.-J. (2022). From anecdote to evidence: the relationship between personality and need for cognition of developers. *Empirical Software Engineer, 27*(3), 71. https://doi.org/10.1007/s10664-021-10106-1

Studer, B., & Knecht, S. (2016a). A benefit-cost framework of motivation for a specific activity. *Progress in Brain Research*, *229*, 25–47. https://doi.org/10.1016/bs.pbr.2016.06.014

Sadowski, C. J., & Cogburn, H. E. (1997). Need for cognition in the big-five factor structure. *The Journal of Psychology, 131*(3), 307–312. https://doi.org/10.1080/00223989709603517

Schaufeli, W. B. (2017). General engagement: Conceptualization and measurement with the Utrecht general engagement scale (UGES). *Journal of Well-Being Assessment*, *1*(1–3), 9–24. https://doi.org/10.1007/s41543-017-0001-x

Shin, D.-J. D., Lee, H. J., Lee, G., & Kim, S.-I. (2019). The role of curiosity and interest in learning and motivation. *In The Cambridge Handbook of Motivation and Learning* (S. 443–464). Cambridge University Press.

Silvia, P. J., & Christensen, A. P. (2020). Looking up at the curious personality: individual differences in curiosity and openness to experience. *Current Opinion in Behavioral Sciences, 35*, 1–6. https://doi.org/10.1016/j.cobeha.2020.05.013

Siu, O. L., Bakker, A. B., & Jiang, X. (2014). Psychological Capital Among University Students: Relationships with Study Engagement and Intrinsic Motivation. *Journal of Happiness Studies, 15*(4), 979–994. https://doi.org/10.1007/s10902-013-9459-2

Suldo, S. M., Riley, K. N., & Shaffer, E. J. (2006). Academic correlates of children and adolescents' life satisfaction. *School Psychology International*, *27*(5), 567-582. http://dx.doi.org.proxy-ub.rug.nl/10.1177/0143034306073411

Vracheva, V. P., Moussetis, R., & Abu-Rahma, A. (2020). The mediational role of engagement in the relationship between curiosity and student development: A preliminary study. *Journal of Happiness Studies, 21*(4), 1529–1547. https://doi.org/10.1007/s10902-019-00140-8

Widiger, T. A. (Ed.). (2017). The oxford handbook of the five factor model. *Oxford University Press.*

Zou, T., Zhang, Y., & Zhou, B. (2022). Does GPA matter for university graduates' wages? New evidence revisited. *PloS One, 17*(4), https://doi.org/10.1371/journal.pone.0266981