

**To What Extent Do Need For Cognition and Curiosity Influence Academic Engagement
in University Students?**

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Group 11

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Abstract

In the typically demanding academic environment, it is important for students to be engaged in their studies. This thesis studies the influence of need for cognition and three curiosity modalities on academic engagement. Studying these concepts is important, because academic engagement has been proven to have numerous positive effects, such as more happiness and improved academic performance. However, as of now there are not a lot of studies on academic engagement regarding university students, and the separate curiosity modalities have not been taken into account previously. With the use of a self-report questionnaire, the need for cognition, curiosity, and academic engagement of a sample of 608 students from the University of Groningen were assessed. The sample mainly consisted out of females (74%) and most students were of Dutch nationality. After performing a multiple linear regression analysis, significant squared semi-partial correlations were found between the curiosity modalities, interest, deprivation, and stress tolerance, and academic engagement. However, for need for cognition and academic engagement, the squared semi-partial correlation was found to be nonsignificant. Additionally, the model as a whole was found to be significant. It was thus shown that the four variables together can predict academic engagement. Furthermore, it was shown that students who were high in interest, deprivation, and/or stress tolerance, were high in academic engagement. Even though there should be more research to create a more complete picture of the studied relationships, this study could already be an important step in knowing exactly what makes students academically engaged.

Keywords: academic engagement, need for cognition, interest, deprivation, stress tolerance, curiosity, university students

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To what extent do Need for Cognition and Curiosity influence Academic Engagement in University Students?

Not all students study in the supposed optimal way. While there are numerous ways of studying that can be beneficial, it might be the most helpful to focus on achieving a more general, long-lasting, and beneficial way of studying. This could be achieved by being engaged in the academic material. The concept of academic engagement has previously been proven to have positive effects on academic performance (Salanova et al., 2010) and subjective happiness (Tayama et al., 2018), which are two important factors for students' well-being. Additionally, Schaufeli et al. (2002) have found a negative association between engagement and burnout. This points to the possibility that academic engagement could serve as a buffer against burnout, which is very relevant to the stressful and competitive nature of studying in university. To help students be academically engaged and the positive consequences that arise from that, it is important to obtain better understanding of academic engagement. To create that more complete picture of the concept, there should also be identified how much certain traits influence academic engagement, so interventions for increasing engagement can be tailored to students' individual needs. Prior research has for instance focused on to what extent traits, such as emotional intelligence (McEown et al., 2023), or the Big Five personality traits (Qureshi et al., 2016), can predict academic engagement. However, in the current study we aim to see whether these studies potentially missed important variables that account for academic engagement. The first factor that is expected to influence the engagement of students is need for cognition, which is defined as is the desire to engage in and enjoy thinking (Coelho et al., 2020). The second factor that is expected to have that effect is curiosity, which can be defined as the desire to look for new things (Oudeyer et al., 2016), in which we will zoom in on the dimensions of interest, deprivation and stress tolerance.

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In this study we aim to gain insight into the way the following personality traits influence Academic Engagement: Need for Cognition, and Curiosity, split up into Interest, Deprivation and Stress Tolerance. Need for cognition and curiosity have both previously been linked to academic engagement (Cole & Korkmaz, 2013; Lavrijsen et al., 2021; Robayo-Tamayo et al., 2020; Vracheva et al., 2020), but this has mostly been done in samples of adults about work engagement or high school students about schoolwork engagement. However, in the current study the focus will be on university students and academic engagement. Furthermore, it will be interesting to address the three separate curiosity modalities in combination with need for cognition and their relationship with academic engagement, as this has not been done before. Thus, the aim of this study is to answer the following question: To what extent do need for cognition and curiosity influence academic engagement in university students?

Academic Engagement

Academic engagement has been derived from the concept of work engagement (Kahn, 1990). Work engagement entails a positive, fulfilling, work related state of mind (Schaufeli et al., 2002). When this concept is applied to the academic environment of students, the work they have to do refers to schoolwork, such as exams, papers and presentations. Academic engagement can further be characterized by three concepts. First of all, vigor. This concept refers to high levels of energy, mental resilience, persistence and high willingness to put effort into studying (Schaufeli et al., 2002). Besides vigor, there is the concept of dedication. Dedication mostly regards the involvement into studying, together with experiencing a sense of significance, enthusiasm, inspiration, pride, and challenge (Carmona-Halty et al., 2019). The last concept that is important for engagement is absorption, which is characterized by fully engaging with what is being done or used (Tellegen & Atkinson, 1974). During a state of absorption, individuals tend to be really concentrated and engaged in the material with pleasure.

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They often feel like time passes by quickly and find it difficult to detach themselves from the study material (Schaufeli et al., 2002).

Need for cognition

One of the concepts from which the relationship with academic engagement will be studied is need for cognition. Need for cognition is the extent to which an individual enjoys and engages in thinking (Cacioppo & Petty, 1982). Individuals with high need for cognition actively reflect on information to make sense of the world and are well equipped in situations in which reasoning and thinking is needed (Coelho et al., 2020). In contrast to individuals with low need for cognition, who rather use heuristics to make sense of this constantly changing world.

One of the bases for the concept of need for cognition can be found in Self-Determination Theory. Self-determination theory entails three basic psychological needs (Ryan & Deci, 2000). These are the need for autonomy, the need for competence, and the need for relatedness. Furthermore, self-determination theory focuses on sources of motivation. An individual high in need for cognition, will often have pleasure in thinking and making sense of the world. This relates closely to the concept of intrinsic motivation (Richardson et al., 2012), which involves doing something for its inherent satisfaction rather than for external benefits, which could for instance be thinking. When an individual is engaged in their task, they often have high intrinsic motivation, which creates the opportunity to fulfil the basic psychological needs, and helps facilitate optimal learning (Ryan & Deci, 2000).

In previous research about the relationship between need for cognition and academic engagement a positive correlation has repeatedly been found (Cole & Korkmaz, 2013; Lavrijsen et al., 2021). Cole and Korkmaz (2013) studied the relationship between need for cognition and academic engagement in a sample of American first-year college students. They found that need for cognition and well-being both have small positive correlations with

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academic engagement. In their study, need for cognition was assessed through the 18-item NFC scale (Cacioppo et al., 1984). In our current study, the abbreviated NFC-6 scale (Coelho et al., 2020) will be used. Further, to assess academic engagement, Cole and Korkmaz (2013) used nine items from the NSSE scale (*NSSE*, n.d.), while in the current study the Utrecht work engagement scale was used (Carmona-Halty et al., 2019).

Additionally, Lavrijsen et al. (2021) studied the association between need for cognition and engagement, and found a moderate positive correlation between the two concepts. Need for cognition was assessed through a Dutch translation of the German NFC-14 scale (Preckel & Strobel, 2011) and engagement was assessed through a selection of nine items of the Schoolwork Engagement Inventory (Salmela-Aro & Upadaya, 2012). In this former study, in which the positive correlation was found, a sample of Flemish 7th graders was used. In the current study it will be interesting to look at this relationship in a sample of university students. All in all, these studies both show positive relationships between need for cognition and academic engagement. Even though the studies used different measures for the two concepts and the samples are not the same, it can still be expected that the same relationship will be found in our current sample. This expectation holds, because although they are different, the measures show similarities and have both been designed to measure the same concept.

Curiosity

The second concept from which the relationship with academic engagement will be assessed is curiosity. Even though the concept of curiosity does not have one clear scientific definition, it can be defined best as an interest in stimuli that are surprising, new, and of intermediate complexity (Oudeyer et al., 2016). In the past, it even has been stated that learning only can be achieved when expectations are violated (Rescorla & Wagner, 1972), with violation of expectations being one of the defining components of curiosity. Nowadays, this way of looking at learning is not used commonly, but it is an interesting idea, nonetheless.

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A positive relationship between curiosity and academic engagement has been found on multiple occasions (Robayo-Tamayo et al., 2020; Vracheva et al., 2020). Robayo-Tamayo et al. (2020) performed a study based on the Job Demands-Resources model, which mainly concerns motivational processes. In a sample of 94 psychology students in Spain, they measured curiosity through the Curiosity and Exploration Inventory II (Kashdan et al., 2009). Academic engagement was measured through the Utrecht Work Engagement Scale (Carmona-Halty et al., 2019), which was also used in our current study. The results showed that curiosity early in the day predicts academic engagement later that day. In the current study we will address three separate curiosity modalities instead of the whole concept to see how they relate to academic engagement on their own.

In another study, the focus has been on the relationship between engagement, curiosity, and student development (Vracheva et al., 2020). They distinguished between two types of curiosity: epistemic curiosity (focus on obtaining new knowledge) and perceptual curiosity (focus on sensory stimulation). Epistemic curiosity was measured through a 10-item Epistemic Curiosity Scale (Litman & Spielberger, 2003) and perceptual curiosity was measured through a 12-item Perceptual Curiosity Scale (Collins et al., 2004). In order to measure academic engagement, a modified student version of the 17-item Engagement Scale (Schaufeli et al., 2002) was used. In their sample of American college students, indirect evidence was found that epistemic curiosity and perceptual curiosity both had small positive correlations with academic engagement, of which epistemic curiosity was the highest (Vracheva et al., 2020).

Interest, deprivation, and stress tolerance

According to Kashdan et al. (2018), it is important to look at the different dimensions that can be used to study curiosity. These dimensions are Joyous Exploration, Deprivation Sensitivity, Stress Tolerance, Social Curiosity, and Thrill Seeking (Kashdan et al., 2018). In the current study the focus will be on three of the concepts of curiosity mentioned above. These

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are interest (Joyous Exploration), deprivation (Deprivation Sensitivity), and stress tolerance. These three factors are expected to be important for engagement, because the definitions of interest and deprivation seem to be the most closely related to the general definition of curiosity, and the concept of curiosity has previously been proven to relate to academic engagement (Robayo-Tamayo et al., 2020; Vracheva et al., 2020). Further, we expect that students need to be stress tolerant in order to be engaged in their studies. This is in contrast to Social Curiosity and Thrill Seeking, which seem to be less relevant to engagement, because they mostly concern social situations and risk taking.

One of the concepts that will be studied is interest. Interest focuses on the pleasure that is experienced when performing certain activities and the enjoyment of encountering new stimuli (Kashdan et al., 2018). Interest was found to relate strongly to the motivation to seek novel experiences and knowledge, which is very similar to the used definition of curiosity, namely an interest in new and surprising stimuli (Oudeyer et al., 2016). Because the concept of curiosity has been proven to positively relate to engagement on many occasions (i.e., Robayo-Tamayo et al., 2020), the similar definitions lead us to believe that interest will also positively predict academic engagement in university students.

The second curiosity-related concept that is expected to be relevant for engagement is deprivation. For deprivation, feelings of tension are central (Kashdan et al., 2018). An example of this tension is feeling uncomfortable when not knowing the answer to a problem, and obsessing over this till the answer is known. This definition seems to fit in the academic engagement component 'absorption' (Schaufeli et al., 2002), which is a state in which students are concentrated and absorbed in the material. Even though the relationships between the separate curiosity modalities and academic engagement have not been studied previously, based on the definitions, we expect deprivation to predict academic engagement positively.

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Finally, stress tolerance is expected to be interesting for academic engagement. Stress tolerance mainly regards coping with new stimuli and uncertainty (Kashdan et al., 2018). It has been shown to have the greatest negative associations with several negative outcomes, including experiential avoidance and psychological inflexibility (Kashdan et al., 2018), which points to the possibility that stress tolerance might be able to serve as a buffer against several negative traits. We also expect stress tolerance to serve as a buffer in the academic environment. Because the academic environment is a rapidly changing world where expectations are high, students often need to cope with new situations. Therefore, it is expected that students who are high in stress tolerance, and thus able to cope with those new situations, will be able to be more academically engaged.

Curiosity and need for cognition

When looking at the relationship between curiosity and need for cognition with regards to academic engagement, it is also relevant to look at the relationship between the first two concepts. Curiosity and need for cognition both relate to intrinsic motivation (Kashdan et al., 2018; Coelho et al., 2020). For curiosity this shows itself as the intrinsic motivation to look for and do new things. For need for cognition, a similar relationship with intrinsic motivation can be found, but instead of the motivation to do new things, the motivation to learn new material is central. Importantly, for both of these concepts it is central that these desires are not there due to external benefits, such as payments or grades, but because of an inherent interest in what is focused on.

When studying curiosity, Kashdan et al. (2018) additionally looked at the relationship between need for cognition and the separate dimensions of the Five-Dimensional Curiosity Scale. They found a positive correlation between need for cognition and all of the five different dimensions of the concept of curiosity. The strongest correlation (.76) was found between need for cognition and Joyous Exploration, which can be described as interest. The

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high correlation can be explained by the similarities in the definitions of the two concepts.

For both concepts the focus lies on the pleasure of activities. With need for cognition this refers to cognitive activity, like studying, and with Joyous Exploration this refers to an overall pleasure in activities, which could very well be learning new information by studying. For the other two independent variables, deprivation and stress tolerance, smaller correlations of respectively .41 and .43 were found. In our current study we will also look at the correlations between the three different curiosity modalities and need for cognition to see whether and to which extent the different concepts overlap.

Current study

In the current study we aim to see to what extent need for cognition and the three curiosity modalities influence academic engagement. Until now, engagement has not been studied often in university students. Also, interest, deprivation, and stress tolerance have not been separately studied, together with need for cognition and academic engagement, yet. In the current study this will be done, with the use of a self-report questionnaire. We hope this study will add information to the current, relatively small, body of research on this topic, so in the end more students could be able to be academically engaged and experience the positive consequences that arise from that. Based on the previous research, the following hypotheses have been formed: First of all, students high in need for cognition will have higher academic engagement. Second of all, students high in interest (curiosity) will have higher academic engagement. Third of all, students high in deprivation (curiosity) will have higher academic engagement. And finally, students high in stress tolerance (curiosity) will have higher academic engagement.

Methods

Participants

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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,

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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

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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

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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

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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

To study the relationships between need for cognition, interest, deprivation, and stress tolerance, and academic engagement, a Multiple Linear Regression analysis has been conducted. It was hypothesized that these four separate variables would all positively predict academic engagement.

Assumptions

Before conducting the analysis, we have checked whether the assumptions for Multiple Linear Regression have been met in this study. These assumptions include normality, multicollinearity, linearity, and homoscedasticity. For the assumption of normality, the QQ-plots and histograms have been checked for the independent and dependent variables. The distributions appeared normal, which has been supported by the values of kurtosis and skewness, which all laid within the normal range (between -1 and 1). Additionally, the assumption of multicollinearity has been checked through the Pearson correlation table (See Table 1). The highest correlation between independent variables that can be found was 0.64, between interest and need for cognition. However, all values fell below 0.70, which indicates there is no question of severe multicollinearity. Thus, the assumption of multicollinearity does not seem to be violated. The third assumption that has been checked is linearity. When looking at the residual plots, the relationships between the independent variables and the dependent

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variable appear to be linear, which indicates there are no large deviations from linearity. Finally, for the assumption of homoscedasticity, the residuals were plotted against the dependent variables. The scatterplot indicated no violations, the error appeared to be constant, which means the assumption of homoscedasticity does not seem to be violated. Based on these assumption checks there are no problems with proceeding the use of Multiple Linear Regression.

Table 1*Correlation Table*

		Engagement	NFC	Interest	Deprivation	Stress Tolerance
Pearson Correlation	Engagement	1.000				
	NFC	.350	1.000			
	Interest	.396	.636	1.000		
	Deprivation	.289	.409	3.77	1.000	
	Stress Tolerance	.242	.306	.321	-.111	1.000

Note.

Main analysis

The overall mean score of academic engagement in this sample of 608 university students was 4.67 (out of 7; $SD = .941$). For the independent variables, the mean score of need for cognition was 3.60 (out of 5; $SD = .644$), the mean score of interest was 5.11 (out of 7; $SD = .917$), the mean score of deprivation was 4.36 (out of 7; $SD = 1.212$), and finally, the mean score of stress tolerance was 4.38 (out of 7; $SD = 1.274$).

Furthermore, the zero-order correlations between the independent variables and the dependent variable were assessed (See Table 1). The zero-order correlation between need for cognition and academic engagement was .350, the zero-order correlation between interest and

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academic engagement was .396, the zero-order correlation between deprivation and academic engagement was .289, and the zero-order correlation between stress tolerance and academic engagement was .242.

After conducting a standard multiple linear regression analysis, an adjusted R square of 20,6% was found. This entails that 20,6% of the variance in academic engagement can be explained by a combination of need for cognition, interest, deprivation and stress tolerance. The regression model was found to be significant, $F(4, 603) = 40.428, p < .001$.

When looking at the unique variance explained by each of the four variables, it became clear that only three out of four variables significantly contribute to academic engagement. Interest ($\beta = .218, t = 4.469, p < .001$), deprivation ($\beta = .193, t = 4.577, p < .001$), and stress tolerance ($\beta = .170, t = 4.184, p < .001$) were all significantly shown to positively predict academic engagement, as was predicted in the hypotheses (see Table 2). For need for cognition, the results turned out to be different from the hypotheses. In contrast, the results revealed need for cognition to be nonsignificant ($\beta = .080, t = 1.611, p = .108$).

After performing the analysis, the squared semi-partial correlations were calculated for the four independent variables with academic engagement. First of all, interest. The squared semi-partial correlation between interest and academic engagement was .026. For deprivation, the squared semi-partial correlation was .027. For stress tolerance, the squared semi-partial correlation was .023. Finally, the squared semi-partial correlation for need for cognition was .003. Thus, the unique explained variance of academic engagement by interest ($sr^2 = .026$) is much greater than the unique explained variance by need for cognition ($sr^2 = .003$). This is notable, because even though the squared semi-partial correlations of the two variables were so far apart, the zero-order correlation between interest and academic engagement ($r = .396$) and the zero-order correlation between need for cognition and academic engagement ($r = .350$) were around the same value. This could in part be due to high correlations between need for

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cognition and the other independent variables that are included in the model, which could have led to overlap between the explained variance of academic engagement by need for cognition and by the other variables. Based on the correlation table (See Table 1), it becomes apparent that a moderate-to-high positive correlation can be found between need for cognition and interest ($r = .636$). For deprivation ($r = .409$) and stress tolerance ($r = .306$), the correlations with need for cognition were smaller, but positive, nonetheless.

Extra analysis

Additionally, a preliminary check was performed to see whether there were differences between the first-year students who received SONA credits and are just starting with their studies, and the second- and third-year students who received monetary rewards and are further along in their studies. To check whether study year has any effect, a Welch independent samples t-test has been conducted. When comparing the two groups, we found there were no significant differences between the first-year students and the second- and third-year students for academic engagement ($t(606) = 1.339, p = .181$; See Table 2), need for cognition ($t(606) = -1.634, p = .103$), interest ($t(606) = -.919, p = .358$), deprivation ($t(606) = .106, p = .916$), and stress tolerance ($t(606) = -.938, p = .349$). Because there were no significant differences found between the students in the two groups, there were no problems with interpreting the results for the students as a whole.

Table 2*Group Statistics*

	Group	N	M	SD
Academic Engagement	1st year students	507	4.70	.950
	2nd/3rd year students	101	4.56	.888
Need For Cognition	1st year students	507	3.58	.643

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	Group	N	M	SD
	2nd/3rd year students	101	3.70	.648
Interest	1st year students	507	5.10	.914
	2nd/3rd year students	101	5.19	.932
Deprivation	1st year students	507	4.36	1.227
	2nd/3rd year students	101	4.35	1.140
Stress Tolerance	1st year students	507	4.36	1.262
	2nd/3rd year students	101	4.49	1.330

Note.

Discussion

In this study the influence of need for cognition and the three curiosity modalities, interest, deprivation and stress tolerance, on academic engagement have been studied. The aim of the study was to gain more information on the personality traits that predict engagement, so possible interventions for increasing the academic engagement of students can be tailored to students' needs, which could lead to benefits, such as improved academic performance (Salanova et al., 2010) and subjective happiness (Tayama et al., 2018). It was hypothesized that need for cognition and the three curiosity modalities would all positively predict academic engagement in our sample of university students. To summarize, these four traits together can predict academic engagement. However, when looking at the separate relationships, it was found that only interest, deprivation, and stress tolerance positively predict academic engagement. As opposed to need for cognition, which was not found to be a significant predictor.

Theoretical implications

With accordance to our hypotheses, deprivation was found to be a significant positive predictor of academic engagement. It has previously been proven that curiosity positively

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predicts academic engagement (Robayo-Tamayo et al., 2020). However, the separate relationships between the curiosity modalities and academic engagement had not been studied before. We hypothesized that deprivation would positively predict academic engagement. Accordingly, in our sample of university students, deprivation was found to be able to predict academic engagement the best out of the four variables, which is interesting to note when assessing the important personality traits for academic engagement. This could mean that students with a high amount of tension until they accomplish their tasks, which means they are high in deprivation, have a higher predisposition for academic engagement. Highlighting this tension for these students in their study programs, could possibly lead to more academic engagement, which would then have beneficial effects on their performance (Salanova et al., 2010) and happiness (Tayama et al., 2018).

For interest, it was previously found that this concept correlates with positive outcomes, such as happiness and finding meaning, the most out of all curiosity modalities (Kashdan et al., 2018). The results were inline with our hypothesis, interest was found to positively predict academic engagement. This relationship was just a little weaker than the relationship between deprivation and academic engagement. Hence, this suggests that students high in interest are predisposed to being academically engaged. As well as with deprivation, the relationship between the curiosity modality interest and academic engagement was not studied before, either. Thus, these results could possibly function as an important first step to find which traits are important and how interventions could be tailored to students' needs. Accordingly, it might be beneficial for universities to focus on the students having pleasure in the tasks they have to do by displaying the study material in a way that sparks students' interest, which could lead to more academic engagement and the positive consequences that arise from that.

As we hypothesized, stress tolerance also turned out to positively predict academic engagement. Even though this variable had the smallest positive association, it was significant,

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nonetheless. The relationship between stress tolerance and academic engagement together with the other curiosity modalities and need for cognition was not studied before, either. In conclusion, it was found that students high in stress tolerance, have a high predisposition to being academically engaged. This finding could have implications for the way in which students' engagement could be enhanced. It could for instance be that academic programs that offer support in order to improve students' stress tolerance, leads to them experiencing the positive consequences that can be derived from being academically engaged. All in all, when looking at the three studied curiosity modalities, it can be concluded that it was found that students with high interest, deprivation, and/or stress tolerance have higher academic engagement.

In contrast, need for cognition was not found to be a significant predictor of academic engagement. This could mean that need for cognition might not be a necessary addition to the model when trying to find the traits that account for academic engagement. This result could be explained by the moderate-to-high correlation between interest and need for cognition in this study. Previously, Kashdan et al. (2018) also found a strong correlation of .76 between interest and need for cognition. Besides that, need for cognition was also positively associated with deprivation and stress tolerance, just like what was found in prior research (Kashdan et al., 2018). It could be that, when considering the other variables, the overlap with the other curiosity modalities leaves little room for need for cognition's unique explained variance of academic engagement. Accordingly, when looking at the relationship between need for cognition and academic engagement on its own, a small positive correlation can be found. In previous research which assessed the relationship between need for cognition and academic engagement in a sample of Flemish 7th graders, a moderate-to-high positive correlation was found (Lavrijsen et al., 2021). So, when looking at the zero-order correlations, the results somewhat agree with prior research, as they were all found to be positive. However, when

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removing the other variables to assess the unique explained variance of academic engagement by need for cognition, this relationship becomes much less strong, and is even nonsignificant, which is different from what was found in previous research. Thus, when taking into account interest, deprivation, and stress tolerance, our study does not show support for the idea that students high in need for cognition are predisposed to being academically engaged. This might mean that it is not needed to assess students' need for cognition to predict academic engagement, when students' interest, deprivation, and stress tolerance are also assessed.

All in all, the variables together can predict academic engagement fairly well in this sample of university students. This suggests that the extent to which students have need for cognition, interest, deprivation, and stress tolerance altogether, can predict the extent to which they are academically engaged. It was found that need for cognition and the three curiosity modalities together can account for about 20% of academic engagement. This is not a large percentage; however personality research has an inherent high percentage of unexplained variance, because of the many factors that can influence a person's traits. The model was thus found to be significant, even though the unique explained variance of academic engagement by need for cognition was not significant. These results fit the previous finding that curiosity is a predictor of academic engagement (Robayo-Tamayo et al., 2020). However, this might suggest that need for cognition is not necessary for predicting academic engagement, which is contrary to our predictions and what was found in prior research. Further research in this area should be conducted to be able to create a more complete image of these relationships.

Limitations

A possible limitation could be that a convenience sample has been used in this study. With a convenience sample, the individuals who are the easiest to reach out of the sample are included, which was the case for us since the questionnaire was distributed via WhatsApp and the SONA participant system. This might mean that the sample we used is not representative

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of the desired population. It could for instance be that the students who have chosen to participate in the study, are on average more academically engaged or have a higher need for cognition, than the students who did not choose to participate. However, we cannot be sure whether this is the case as of now. This thus limits the interpretation of the findings because it is not known whether the found results hold true for the entire population of students. Also, the sample exclusively consisted out of students of the University of Groningen. We cannot be sure that the students of the University of Groningen will be representative of students of The Netherlands as a whole, or of students in other countries. Therefore, it is important to take this into account when interpreting the results.

Another possible limitation could be related to the social desirability bias. Because the questionnaire asked about personality traits that can be perceived as either beneficial or negative traits, people could be motivated to give socially desirable answers to the questions asked. This could be harmful to the research, because the study aims to learn more about actual personalities, instead of their socially desirable versions. Social desirability bias is especially common in personality research with self-report questionnaires (Nikolopoulou, 2023), which makes our research prone to this risk. However, the fact that our questionnaire was anonymous and that there are usually no other persons or researchers present when conducting an online survey such as was used in the current study, can reduce the risk of socially desirable answers being given. Even though this lowers the risk, it is still important to note while interpreting the results.

Finally, more than half of the sample consisted of Dutch students. Further, about 20% of the sample consisted of German students and 27% of the sample consisted of ‘other’ students, which meant they were from countries other than The Netherlands or Germany. For this last group of students, we cannot be sure what their nationality is. Because the majority of the sample is from two countries, there can be cultural biases in the study. This entails that

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people interpret the questions in terms of their own cultural background. It might be that the results will look different when the study would be performed in other, non-Western cultures.

Suggestions for future research

All in all, our result helped fill some gaps in knowledge about the studied personality traits together with academic engagement. However, a lot is still unknown about these concepts and the relationships between them. Because we found a result for the relationship between need for cognition and academic engagement that was different from what was found in previous research, it would be interesting to see why this happened. While we expected the overlap between interest and need for cognition to be a possible explanation, further research into the relationship between these variables would be helpful to see whether these concepts overlap too much to be included in the same model.

When assessing to what extent need for cognition, interest, deprivation, and stress tolerance can account for academic engagement together, it was found to explain about 20% of the variance in academic engagement. Even though it is not unusual for research concerning personality traits to have an inherent relatively large amount of unexplained variance, it would be interesting to see how much of academic engagement can be explained by personality traits when studying different or additional traits. It would for instance be interesting to see what the relationships will look like when all of the five curiosity modalities would be included in the model. Adding Social Curiosity and Thrill Seeking could be interesting, because even though the definitions of these variables seem less compatible with the concept of academic engagement, these are still factors that contribute to curiosity, which has been proven to positively predict engagement (Robayo-Tamayo et al., 2020; Vracheva et al., 2020). Thus, it would be interesting to see whether the academic engagement of students could be better predicted when including all of the curiosity facets.

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Additionally, one of the limitations that were mentioned, was that a convenience sample was used in the study, which could have limited the generalizability. In future research, it would be interesting to see whether the results would be different when this research would be conducted through a simple random sample, which provides any individual of the desired population an equal chance of participation. Besides that, it could be interesting to perform the study in different samples. While our sample exclusively consisted out of psychology students of the University of Groningen, we cannot be sure whether the results hold when looking at different universities, study majors, cities, or countries.

Finally, it could be interesting to see whether culture plays a role in assessing the personality traits and academic engagement of university students. Because various important concepts for this study, such as intrinsic motivation (Mugabe et al., 2016) and need for cognition (Zhang et al., 2021), have been previously proven to look different across cultures, it would be interesting to see what the relationships between academic engagement, need for cognition, interest, deprivation, and stress tolerance will look like in cross-cultural research.

Conclusion

In this study we aimed to find to what extent and in what direction need for cognition, interest, deprivation and stress tolerance influence academic engagement in university students. It was found that the four traits together can predict the amount of academic engagement students have. When looking at the unique explained variance of each trait, it was found that students who had more interest, deprivation, and/or stress tolerance were found to be more academically engaged, while students who had more need for cognition were not found to be more academically engaged. In conclusion, this research brought about more knowledge about the influence of the specific curiosity modalities together with need for cognition on the concept of academic engagement, as this was not studied before in this combination and context. However, it also raises questions about the results that were found for need for

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cognition. Because of the stressed nature of studying in university, we argue it is important to make more students able to study while being academically engaged, so they can achieve optimal results (Salanova et al., 2010) and happiness (Tayama et al., 2018). We think this can at least in part be achieved by gaining more knowledge about the personality traits that affect academic engagement, so interventions can subsequently be tailored to students' needs. Even if it was for this reason alone, it is important that the concept of academic engagement, and everything involved, will be studied more in the future.

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