Does Flow in Studies, Predisposed by Motivation, Improve Academic Performance?

Katarina Vatovec

S4750659

Department of Psychology, University of Groningen

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Supervisor: prof. dr. Miguel Garcia Pimenta

Second evaluator: Roxana Bucur, M.Sc.

In collaboration with:

Kajetan K. Goscianski, Veerle E. Kroon, Luca D. Reinwand, Tijs J. van Schaik.

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Abstract

Behavioral scientists throughout the decades have tried to answer how and why motivation influences students regarding their academic performance. Previous literature points to intrinsic motivation positively relating to academic success and experiences of flow. Moreover, extrinsic motivation was previously shown to hinder academic performance and has a less clear link to flow. In our current study, we investigate whether increased levels of flow, caused by higher intrinsic motivation, improve academic performance. We also examine whether extrinsic motivation lowers flow in studies, which consequently hampers academic performance. An online self-report was utilized, measuring motivation and flow in studies in 554 psychology students of the University of Groningen. A correlational design was used. We performed simple linear regressions and a mediation analysis. The results showed that intrinsically motivated students exhibited increased flow in studies and GPA, and flow was found to partially mediate between intrinsic motivation and GPA. However, the mediation model with extrinsic motivation was discarded because the path between extrinsic motivation and flow, as well as the path between extrinsic motivation and GPA, were non-significant. Our findings point to emphasizing intrinsic motivation in academic settings to foster flow and improve GPA in practice, and revisiting established notions about the effect of extrinsic motivation in theory.

Keywords: intrinsic motivation, extrinsic motivation, flow in studies, academic performance

Does Flow in Studies, Predisposed by Motivation, Improve Academic Performance?

We are all familiar with the paradox of a bright student who, despite intellectual dexterity, finds themselves struggling academically. Think of individuals like Henry Ford, Thomas Edison, and Winston Churchill, who are celebrated for their incredible achievements, yet were marked by underperformance in school. It is crucial to acknowledge the multifaceted nature of academic success, and research shows motivational factors play a substantial role in explaining variance in grades and could overshadow cognitive factors (Weber et al., 2013). Why do some gifted students struggle to meet academic demands? To what extent does motivation contribute to academic performance, and what mechanisms underlie this relationship? This study aims to unravel this dynamic, recognizing the potential impact of motivation and examining the possible mediating role of flow, to gain a comprehensive understanding of determinants of academic performance.

The relationship between academic performance and motivation is complex, yet evidenced in research (Broussard & Garrison, 2004). A layman's definition of motivation is that it involves a personal interest in a particular activity, and students who show interest, hence motivation, learn and achieve better because of it (Linnenbrink & Pintrich, 2002). Motivation is seen as an enabler of academic success, as it brings about deeper cognitive strategies, increased attention, and engagement (Linnenbrink & Pintrich, 2002). Thus, increased motivation improves academic performance and the relationship between being highly motivated and achieving higher strengthens with age (Broussard & Garrison, 2004). In extending this discussion, Weber et al. (2013) suggest that within the educational system, there exist two clearly defined forms of motivation: intrinsic and extrinsic motivation.

Intrinsic motivation (IM) is characterized by the motivation to partake in an activity for its own sake (Pintrich & Schunk, 2002), and it is oftentimes contrasted with extrinsic motivation (EM), which is described as motivation for an activity to attain some separable

outcome (Edmunds & Tancock, 2003). Therefore, IM energizes and sustains activities because of the satisfactions inherent in the action at hand (Deci et al., 1999), while EM arises from an external or social cause (Legault, 2016). In the context of education, IM can be seen when a student takes a genuine interest in what is being taught or finds enjoyment in the process of skill development. In contrast, EM can be seen when a student is driven by getting good grades, proving oneself to peers, obtaining rewards, or avoiding punishment from parents and teachers. All in all, one must acknowledge that IM and EM do not influence a student in the same way because they fundamentally differ in shaping the student's decision-making and behavior within an academic environment.

The relationship between IM and EM in traditional school settings is dynamic and complex. Conventionally, IM is considered to be more desirable and to bring about better learning outcomes than EM (Deci et al., 1999). Patall et al. (2008) found that if a person enjoys a task or finds it in line with their identity, the likelihood of fully endorsing it and participating increases. Based on this, Brossard and Garrison's (2004) finding that intrinsically motivated students tend to have higher grades in math and reading compared to extrinsically motivated students does not come as a surprise. Ginsburg and Bronstein (1993) demonstrate that familial factors, such as parental reaction to grades, increase extrinsic motivational orientation, which leads to hampered academic performance. Therefore, while IM is linked to better performance, EM is linked to worse.

However, IM and EM interact with each other and their effect on academic achievement sometimes yields opposing results. A meta-analysis from the late '90s concluded that rewards have a clear and consistent negative effect on IM (Deci et al., 1999), suggesting that minimizing EM in education would improve performance, as it would not diminish students' IM. However, many school tasks are not inherently interesting to students and therefore not intrinsically motivating (Bilbrey, 2017). Moreover, some believe that the

relationship between IM and EM is more situational, and EM can at times increase IM (Williams & Stockdale, 2004), for example in students who initially had the lowest motivation (Bilbrey, 2017). The differing views on IM and EM and their influence on academic outcomes underscore the need for further research for a more nuanced explanation.

In our current research, we aim to contribute to the ongoing debate and insights into how IM and EM influence students' academic performance. While the interaction between IM and EM is outside of the scope of this study, it will be interesting to see whether either IM or EM is linked to higher or lower grades, assuming that most students experience both types of motivation. Moreover, we aim to investigate whether the link between motivation and academic performance is direct or if there is an intervening factor influencing this relationship. Specifically, we are proposing flow as a possible mediator, as it could facilitate optimal learning conditions.

Despite the interest in how motivation influences academic performance, the underlying mechanism of this relationship remains unknown - but a possible explanation might lie in the concept flow. Mustafa et al. (2010) proposed that increased motivation predisposes you to experience more flow, which in turn would allow you to have better academic achievement. Pioneered by Csíkszentmihályi, flow was first defined as a holistic sensation when acting with total involvement in a task so enjoyable that participation alone is the goal (Csíkszentmihályi, 1975). He and Jackson have since outlined nine elements of flow, namely, action-awareness merging, challenge-skill balance, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, transformation of time, loss of self-consciousness, and an autotelic experience (Jackson & Csíkszentmihályi, 1999). The positive effects of flow are researched on diverse topics, like sports, work, well-being, as well as academic performance, which is the focal point of our study.

In the domain of education, flow is strongly linked to IM, and is seen as a driving force of learning (Mehta & Vyas, 2022). Keller et al. (2011) did an experiment, where they found that flow emerged when doing a knowledge task, which can be related to some tasks in academic settings. Moreover, they concluded that individuals demonstrating a heightened IM experience a flow state to participate in the activity at hand. It may be that this relationship does not come as a surprise as IM and flow share conceptual similarities. Both IM and flow in studies emphasize that satisfaction arrives from performing the task and because IM fosters better engagement and makes the task rewarding, this promotes the likelihood of flow in studies.

On top of that, flow in studies has been shown to have a positive effect on academic performance. Flow is closely connected to enhanced cognitive activation, which causes improved learning (Brom et al., 2017). Students in a flow state are immersed in the learning experience, feel in control, and maintain a high level of concentration, which aids in better academic performance (Chang et al., 2018). What is more, students experiencing flow in studies are excited when given challenging assignments (Shernoff et al., 2014), so flow has a significant role when faced with the frustration of challenging tasks. All things considered, researching the relationship between flow, IM, and academic performance shows promise.

The connection between EM and flow is less straightforward, as one harder finds common ground between the two. EM often directs attention outside of the activity and focuses on external rewards, like praise and good grades. Because of this focus, it can be speculated that the student is not engaged with the materials enough for flow in studies to occur. Students who believe their behavior is a result of forces outside of their control could stop taking part in academic activities (Deci & Ryan, 1985), and this could have a detrimental effect on the occurrence of flow (Mills & Fullagar, 2008).

Considering existing literature, there is an evident gap in research on how motivational factors, flow, and academic achievement are related. While there is research pointing out the connection between IM and flow, and flow and academic achievement, this, to our knowledge, was not incorporated in one model. Additionally, the connection between EM and flow in studies has not received much attention from researchers, so it is a relatively novel topic of exploration. This study aims to shed light on how these constructs are related, are therefore our research question is: What are the influences of IM and EM on the occurrence of flow states in studies, and how does flow in studies mediate the influence of IM and EM on academic performance?

Hypothesis 1. Increased IM improves GPA.

Hypothesis 2. Increased IM increases occurrences of flow in studies.

Hypothesis 3. Increased flow in studies increases GPA.

Hypothesis 4. Flow in studies mediates the relationship between IM and GPA.

Hypothesis 5. Increased EM decreases GPA.

Hypothesis 6. Increased EM decreases occurrences of flow in studies.

Hypothesis 7. Flow in studies mediates the relationship between EM and GPA.

Methods

Participants

The participants in this study initially included 742 Bachelor of Psychology students at the University of Groningen. First-year participants were recruited through the compulsory SONA program, earning points for course completion, while second and third-year students not participating via the same program were recruited through a paid SONA system, social networks of student researchers, and advertisements on campus and received a small monetary reward for their involvement.

We excluded participants based on the following predefined criteria: non-given consent, wrongly answered pseudo items that tested if the participants were paying attention, non-completion of all the scales we used, unavailability of data about their grade, age eligibility with the ASRS scale's requirement for adults and questions about honesty and language proficiency. After the first question regarding consent to participate, 32 participants were excluded, followed by an additional 34 after the second question concerning the consent for processing student numbers for grade access. Subsequent scale completions further narrowed the sample: 30 participants did not complete the AMS scale, 1 participant did not complete the DFS2 scale, and another 1 did not complete the ASRS scale. We decided to exclude any non-completed questionnaire data due to concerns about the general validity of that specific data set. Quality checks following scale completions resulted in 5 exclusions for participants who answered the pseudo item in the AMS scale incorrectly, while no exclusions were made for the pseudo item in the ASRS scale. Additional checks for honesty led to the exclusion of 2 participants. The check for perceived English proficiency resulted in no further exclusions. Exclusion based on age eligibility, aligning with the ASRS scale's requirement for adults, led to the elimination of 13 participants. An additional 39 participants were excluded due to the unavailability of data about their grades. After these steps, 585 participants remained, each with complete data across all scales, including information about academic performance.

Demographically, the final sample was diverse. Among them, 430 indicated their biological sex assigned at birth as female, 153 as male, and 2 participants preferred not to disclose their biological sex assigned at birth. Nationalities varied, with 311 participants being Dutch, 125 German, and 149 representing other nationalities. The age range was 18 to 35, with a mean age of 20.2479 (SD = 2.1641). Occupationally, 417 participants were full-time students, while 168 were working students. The distribution across academic years

included 469 participants in their 1st year, 40 in their 2nd year, and 76 in their 3rd year of studies. Educational backgrounds ranged from upper secondary education to Master's or equivalent degrees. Among the participants, 508 finished upper secondary education - high school, six finished post-secondary vocational education preparing for labor market entry, 10 finished short-cycle higher education, 29 participants had already obtained a Bachelor's degree or equivalent, and two had obtained a Master's degree or equivalent. None of the participants had obtained a Doctoral or a higher degree, and 30 were unsure about their highest completed level of formal education.

Materials/ Measures

An online self-report was used with Qualtrics, containing seven scales, namely, Hyperfocus in School Scale of the AHQ, Short-Dispositional Flow Scale, Need for Cognition, The Utrecht work engagement scale for students, Academic Motivation Scale, Adult ADHD Self-Report Scale, and Five Dimensional Curiosity Scale. The self-report was formulated in English. To address the primary research question, two of these questionnaires were utilized, the Short Dispositional Flow Scale and the Academic Motivation Scale.

The Academic Motivation Scale (AMS) included 28 items measuring motivation toward education on a Likert scale (Vallerand et al., 1992). AMS is a translation of the 1989 French Echelle de Motivation en Education (EME) by Vallerand et al. (1992). Within AMS, there are seven subscales, assessing three types of intrinsic motivation, three types of extrinsic motivation, and amotivation. More specifically, it measures intrinsic motivation to know (e.g. a student that goes to school for the pleasure of learning something new), intrinsic motivation toward accomplishment (e.g. the motivation of a student to surpass themselves and the enjoyment associated with it), intrinsic motivation to experience stimulation (e.g. students who go to class to experience the excitement of stimulating class discussions), extrinsic motivation-identified (e.g. “I’ve chosen to study tonight because it is something

important for me"), extrinsic motivation-introjected (e.g. "I study the night before the exams because that is what good students are supposed to do"), extrinsic motivation-external regulation (e.g. "I study the night before the exams because my parents force me to"), and amotivation, with four items in each subscale. We combined the scores of the subtypes of IM and separately of those measuring EM to transform them into a mean score of extrinsic and intrinsic motivation per student. We calculated the internal reliability for both our subscales, intrinsic motivation, and extrinsic motivation. The internal reliability of IM yielded a Cronbach's Alpha of .89 while the Cronbach's Alpha of EM was .85 in our sample. Internal reliability for the seven subscales has been shown by previous studies and typically ranged from .83 to .86, apart from the Identification subscale, which yielded a lower internal reliability score from .62 to .78 (Vallerand et al., 1992). Additionally, investigating the AMS subscales yielded fairly strong discriminant and convergent reliability, providing evidence of the distinctiveness of the seven subscales (Fairchild et al., 2005).

Flow was measured through the Short Dispositional Flow scale (DSF-2) (Jackson et al., 2008). It is a modified version of the DSF-2 scale, which is shortened from 36 to nine items, representing each of the nine flow dimensions conceptualized by Csikszentmihalyi (1990). The nine dimensions are the following: (1) challenge-skills balance, (2) merging of action and awareness, (3) clear goals, (4) unambiguous feedback, (5) concentration on the task at hand, (6) sense of control, (7) loss of self-consciousness, (8) transformation of time, and (9) autotelic experience. The short DSF-2 scale measures one item per flow dimension on a five-point Likert scale. The students were asked to imagine themselves in a studying situation by the following sentence: "When I'm studying…" followed by a description of one of the nine dimensions of flow. The students had to respond on a five-point Likert scale about how much they experienced that dimension. The introductory sentence is our modification from the original DSF-2 scale and operationalized for our academic setting. Previous research

showed a reliability score for this scale of around .80 after cross-validation, and a high internal consistency score from .78 to .90. The shortened dispositional scale is reliable, and more effective than the long DSF-2 for multimethod studies due to its shortened length (Jackson & Eklund, 2002) which made it a better choice considering the students needed to fill in other scales as well. The internal reliability of the DSF-2 scale yielded a Cronbach's Alpha of .73 in our sample. To measure academic success, the grades of the students were collected from the student office. We calculated the grade point average by calculating the mean of the grades achieved by the students. In the questionnaire, we included four attention-check questions to confirm if the participant paid attention to the questions and did not answer randomly.

Procedure

After the approval by the Ethics Committee of the Psychology Faculty of the University of Groningen, the data collection started. The participants were asked to fill in an online questionnaire of around 20–25 minutes. The participants were informed of the goals of the study and no deception was involved. Participation for the students was voluntary, and they could quit at any time. Students then had to fill in the consent form to take part in the study after which they received several questions about their personal data and demographic characteristics (age, sex). Then, the scales we used were introduced as questions about "hunger for knowledge" and included all the items of the AMS scale and the DSF-2 scale. Students were told that no negative consequences of participation were expected and that the data is pseudonymous. Finally, an honesty question was included to ask participants if they filled in the questionnaire truthfully, a question confirmed English capabilities and asked participants if they think their English is good enough to answer the questionnaire reliably.

Design

Our research design is correlational. We are planning to use two mediation models as there is multicollinearity between our predictors and using two separated models enables us to differentiate easily between the unique explained variance of both predictors. We measured the variables through the different scales and assessed the grades of the participants. The measured variables are the following. There are two predictors, namely extrinsic and intrinsic motivation, one mediating variable, flow, and a dependent variable, academic success.

Results

Assumptions Checks

Initially, we performed an assumptions check, to ensure we can proceed with data analysis. Regression analysis assumes normality, homoscedasticity, linearity, and independence of observations, while mediation analysis assumes no interaction effect for reliable results. The assumption of normality was assessed with a Q-Q plot, and the distribution of data was deemed normal. Additionally, we can assume that the data distribution will approximate normality, given our large sample size ensures the central limit theorem. Assumptions of homoscedasticity and linearity were tested with a scatterplot of standardized residuals and showed equal spread with no pattern. Moreover, when checking for outliers using Cook's distance 4/n=0.007, 31 participants with a higher score were excluded. Lastly, we checked the predictor and mediator do not exhibit an interaction effect, to make certain we can perform a mediation analysis. Overall, all examined assumptions were met.

Descriptive Statistics

Descriptive statistics for each variable of interest, namely, intrinsic motivation, extrinsic motivation, flow, and GPA, along with correlations between them, can be found in Table 1. When examining the means, it is evident that the mean score for IM is more than one

standard deviation above the 3.50 average of the seven-point Likert scale. This suggests that the majority of respondents' IM is on the higher end of the scale. Likewise, participants scored more than a standard deviation above the mean point of a five-point Likert scale for flow in studies. In EM, respondents on average scored the highest. The standard deviation of EM entails that the vast majority of participants scored above the mean point of the scale, with almost two standard deviations above average. Lastly, the GPA average score of roughly 7. With the passing grade in most psychology courses being 5.5, the standard deviation tells us that 92 % of students from our sample have a passing GPA.

Table 1

Mean, Standard Deviation, and Zero-order Correlations for Four Variables of Interest.

	M (SD)	2	3	4
1. Intrinsic motivation	4.78(0.91)	.31**	.41**	.18**
2. Extrinsic motivation	5.20 (0.88)		.05	-.01
3. Flow	3.42 (0.51)			.20**
4. GPA	6.91 (1)			

Note. ** p<.01, GPA= grade point average.

As we consider the significance of these findings, we utilize the revised effect size guidelines for individual differences researchers, which propose 0.10, 0.20, and 0.30 to represent relatively small, medium, and relatively large correlations (Gignac & Szodorai, 2016). Accordingly, IM was positively correlated to EM, flow, and GPA, with all the associations being significant. The correlation between IM and EM, as well as IM and flow, was relatively large, and the correlation between IM and GPA was relatively small. EM had a non-significant slightly positive link to flow and a non-significant slightly negative link to

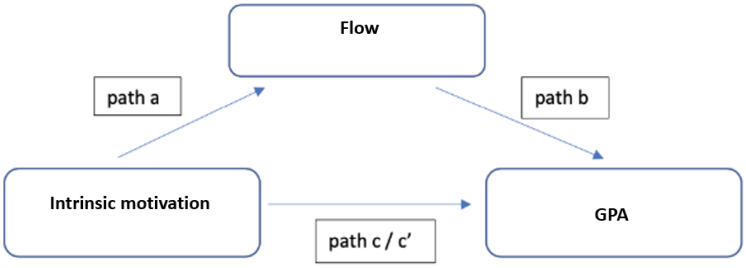
GPA. Lastly, a relatively small to medium, significant, positive correlation is seen between flow and GPA.

Examining the Proposed Hypotheses with IM

Because of significant zero-order correlations, we performed a mediation analysis, taking IM as the predictor, flow in studies as the mediator, and GPA as our response variable. Here is Figure 1, is the mediation analysis model for the visual representation of the relationships among the variables.

Figure 1

The Mediation Analysis Model



The results revealed that there was a significant total effect between IM and GPA (β=.19, p<.001), shown in the figure with path c. This leads us to conclude that our hypothesis 1 is supported, as IM is shown to improve GPA. Path a, indicating IM's effect on flow (β=.41, p<.001) was significant, with 95 % bootstrap CI [0.03, 0.22]. This gives support to our hypothesis 2, as IM increases occurrences of flow in studies. Next, path b, indicating flow's effect on GPA, was again significant (β=.15, p=.001), with 95 % bootstrap CI [0.12, 0.47]. Accordingly, our hypothesis 3 is supported, as flow in studies improves GPA. Finally, taking flow into account of the relationship between IM and GPA, the direct effect, signaled by path c', was significant (β=0.13, p=.01). The bootstrap confidence interval for the direct effect was 95 % CI [0.03, 0.22]. The indirect effect of IM on GPA was significant (β=.07), with the bootstrap confidence interval 95 % CI [0.03, 0.11]. The significant indirect effect

gives support to our hypothesis 4, as flow shows to mediate the relationship between IM and GPA.

Examining the Proposed Hypotheses with EM

Performing simple linear regression to examine relationships between EM, flow in studies, and GPA yielded insignificant results. EM explained 0 % of the variance in GPA (R^2_{adj}=-.00, F(1,554)=0.01, p=.90). EM was not a significant predictor of GPA (β=- .01, p=.90), leading to the rejection of hypothesis 5. Moreover, EM explained 0 % of the variance in flow (R^2_{adj}=.00, F(1,554)=1.24, p=.27), and was not a significant predictor (β=.05, p=.27). As a result, our hypothesis 6 was rejected. Since EM turned out to be an insignificant predictor of both flow and GPA, the mediational effect was not feasible, and thus, the mediation analysis was not performed. With that, our hypothesis 7, indicating that flow mediates the relationship between EM and GPA, was not supported.

Discussion

The purpose of the present study was to gain a better understanding of the interplay between motivation, flow, and GPA, and more specifically, whether flow in studies mediates the relationship between motivational factors and GPA. We aimed to investigate whether increased IM improves GPA, with the hypothesis that this relationship is mediated by flow in studies. We also sought to examine whether increased EM decreases GPA, where flow in studies was again assumed to mediate this association. Our findings support our hypotheses regarding IM, as it was shown to increase GPA and flow in studies. Moreover, flow in studies turned out to positively impact GPA, and increased IM led to increased flow in studies, which in turn increased GPA, so flow in studies was identified as a mediator between IM and GPA. However, our hypotheses regarding EM were not supported, as EM did not decrease either flow or GPA. Consequently, as high scores on EM did not predispose students to fewer

occurrences of flow in studies, the mediating role of flow between EM and GPA was not supported.

Evaluating the Proposed Connections Between IM, Flow in Studies, and GPA

To start, more intrinsically motivated students showed higher academic performance, so our hypothesis 1 was supported. In my view, the most compelling explanation of this is in line with Vansteenkiste et al.'s (2006) finding that intrinsically motivated students are more likely to persist longer on tasks and overcome challenges, which brings about better academic achievement, although they proposed a different intermediate variable, persistence. It is possible both higher flow in studies and persistence, resulting from higher IM, improve academic performance. Joo et al.'s (2011) study investigating cyber-university students' experiences found that experiences of flow while studying significantly affect persistence. This indicates that flow in studies and persistence are closely related, and they could share influences on GPA. Multifaceted nature of academic performance determinants aside, IM is seen to improve GPA, so our hypothesis is supported.

More intrinsically motivated students also reported more frequent occurrences of flow while studying, so our hypothesis 2 was supported as well. These results are consistent with previous studies, giving support to Keller et al. (2011) finding that increased IM and increased flow are related. A possible explanation for this link could be that IM gives a student the required drive and enthusiasm needed for sustained attention and engagement, which is needed to achieve a flow state. Another possibility is that because IM occurs in activities the student finds enjoyable, this could lead to more immersive studying, ultimately resulting in the student experiencing flow. On top of that, a study observing and interviewing skateboarders found that IM correlates to flow, and they both share some key qualities (Seifert & Hedderson, 2009). Despite the notable differences in the populations of the

aforementioned study and ours, the consistency of the observed effect indicates robust applicability to various situations.

Next, our mediation analysis gave support to hypothesis 3, as increased flow in studies was shown to increase GPA. Students who reported more flow while studying tended to have higher grades. One interpretation of this finding is that students in the flow state, which is characterized by better focus and immersion, exhibit better learning, and that has a positive impact on academic performance (Zhang & Qi, 2023). Perhaps this does not come as a surprise. Flow entails an optimal experience; students experiencing flow in studies are not distracted or feeling overwhelmed or disconnected from the materials, all of which could assumingly hinder learning. Because flow in studies warrants efficient learning, it consequently translates into better performance.

Finally, our hypothesis 4, flow in studies is a mediator between IM and GPA, was partly supported. Our results showed that students with higher levels of IM tended to achieve greater grades, and flow played a significant role in influencing this positive relationship. This pattern of results is consistent with the previous work of Keller et al. (2011). Shernoff et al. (2014) found that IM, amongst other things like esteem and mood, are crucial parts of obtaining optimal engagement in classrooms - flow, and this brings about better academic performance. However, precaution must be taken, as flow in studies only partly mediates the effect of IM on GPA, meaning there are other possible mechanisms for explaining how IM leads to better academic performance.

Evaluating the Proposed Connections Between EM, Flow in Studies, and GPA

When considering EM, our hypothesis 5, suggesting increased EM decreases GPA, was not supported. EM seemed to have virtually no effect on GPA. Therefore, our insignificant results go against the line of reason that EM makes individuals feel controlled, and thus harms academic outcomes, as demonstrated in Ryan & Deci's (2000) research, and

as we expected to be replicated in our study. However, there seems to be a lack of consensus on the topic, and there is speculation that the effect of EM is mediated by culture (Liu et al., 2019). For example, Chinese students obtained better academic results when extrinsically motivated, maybe because they are more accustomed to outside values from families and schools, and will not feel being controlled by extrinsic incentives the way students in the West might feel (Liu et al., 2019). A possible reason why we got insignificant results might come from the ethnically diverse sample we used. While the majority of participants were either Dutch or German, representing Western culture, there was a category “other”, representing roughly 25 % of our participants, where the participants could be from Eastern culture. Since our research did not include specific nationality identification to protect students’ identities, it is impossible to recognize individual nationalities. Consequently, analyzing this with our data set was not appropriate but we hope it will stimulate further research. It is feasible that the effects of EM on GPA manifested differently across diverse cultural groups, leading to non-significant findings.

Our hypothesis 6, EM decreases the occurrence of flow in studies, was again not supported. Extrinsically motivated students did not experience less nor more flow while studying. This pattern of results is consistent with Mills and Fullagar's (2008) work, where they found no relationship between EM and flow in studies in architecture students. This goes against some of the past research that has found that some forms of EM can positively affect the occurrence of flow; Kowal and Fortier (1999) showed that self-determined EM, such as identified regulation, increases flow in swimmers. The differences between results might stem from different samples used, as our and Mills and Fullagar's (2008) study focused on university students and the other on athletes. Alternatively, the difference in results may be because we aggregated subscales measuring different types of EM into one predictor, meaning an effect of a specific subscale could get lost. Interestingly, Mills and Fullagar

(2008) found significant correlations between self-determined EM and flow as well, but after controlling for IM, all the relationships became nonsignificant. Our results give further proof that there is likely no relationship between EM and flow in studies.

Moreover, we did not find support for our hypothesis 7 flow in studies is a mediator between extrinsic motivation and GPA. Because there was no relationship between EM and GPA, as well as EM and flow, we did not conduct a mediator analysis. This invites exploration into alternative mediators that could explain the relationship between EM and GPA. Other psychological, cognitive, or contextual variables might play a role, and identifying them could reveal that the relationship between EM and GPA can be significant under the right circumstances.

Limitations and Future Directions

Recognizing the potential limitations of this study is essential for a comprehensive understanding of the link between motivation, flow, and academic performance. Firstly, the study was cross-sectional, meaning that we do not know the direction between variables, and therefore we cannot establish causality. It may be that flow in studies leads to IM and not the other way around or their relationship is bidirectional. The same applies to the relationship between IM and GPA, and flow and GPA. For example, obtaining good grades could boost a student's confidence, leading the student to study deeper and take on challenging material to improve or maintain their performance. The student's deeper engagement with the materials could evoke flow in studies. Another possibility is that because experiencing flow is very enjoyable, it could create positive associations with studying. As a result, a student who experienced flow in studies at one point might be more intrinsically motivated to study because they anticipate those positive emotions. On that account, this study is limited by potential reciprocal relationships between the studied constructs.

Secondly, there is uncertainty about whether or not the participants' responses to the questionnaire reflect their true experiences. The investigated constructs were abstract and intangible, so it may be challenging to accurately report them. Both motivation and flow are subjective and personal in nature. For example, to assess IM, we used questions such as: "Because I experience pleasure and satisfaction while learning new things," and "For the intense feelings I experience when I am communicating my own ideas to others." The criteria for what constitutes pleasure, satisfaction, or intense feelings might vary from student to student. This means two participants could experience the exact same thing while studying but one would score much higher on IM than the other because of a different interpretation of their experience. In the case of assessing flow in studies, we asked participants to rate statements, such as: "When I am studying, I am not worried about what others may be thinking of me," and "When I am studying, I have a feeling of total control over what I am doing." The student's concerns about external judgments and a sense of autonomy while studying depend on a plethora of things. For example, the level of concern about other people's opinions might depend on the student's level of confidence, social anxiety, where he studies, and with whom. A confident student with low levels of social anxiety might not be worried about other people's perception, not because they would be so immersed in the material but because they simply are not preoccupied about with possible external judgment. Since participants' ability to reflect and report their motivation might vary, caution in interpreting results should be applied.

Lastly, the partly homogeneous nature of the sample constrains generalizations. All participants were psychology students, predominantly assigned female at birth in their first year of study and all from the same university, thus, generalizing to other populations might be misleading. It would be interesting to know how our results relate to students from different fields, for example. It could be that levels of IM, and thus flow in studies differ in

different disciplines. Fields with significant financial reward and emphasis on status, like finance or law, could attract individuals with higher EM and lower IM. There is also some evidence that law students experience a shift towards more extrinsic values and a decrease in intrinsic values during the course of their studies (Sheldon & Krieger, 2004). Therefore, studying students from diverse fields with the understanding there are variations in levels of IM could show different influences on academic performance. To conclude, possible limitations are the research design's incapacity to establish causality, uncertainty about how the students' perception translates in practice, and issues with generalizability.

Despite the limitations of the present research, it contributed to a currently sparse body of knowledge on this topic, and it raises a variety of interesting questions for future research. Firstly, there is a need for research that explores how motivation, flow, and academic outcomes interact in different educational levels and settings. Bouffard et al. (2003) found that IM within the school setting is unstable, and students' IM often declines following early school experiences. IM seems to be on the decline up until age 16, and after that, it starts increasing (Spinath & Steinmayr, 2012). Therefore, exploring the relationship at different ages could result in interesting differences. Additionally, it would be interesting to see how these findings translate into more clinical samples. For example, students with ADHD were found to report less or a similar number of flow experiences in comparison to students without ADHD (Grotewiel et al., 2022). Despite this, adults with ADHD frequently report enduring, highly focused attention, termed hyperfocus (Hupfelt et al., 2018). Investigating the possible connection between hyperfocus, flow, motivation, and academic achievement for a sample with ADHD, could expand this knowledge to a more diverse group of learners. By investigating targeted contexts like this, we could uncover specific factors that affect how IM influences GPA, which would refine and deepen our knowledge about the relationship between motivation, flow, and GPA.

Despite our results being statistically significant, it is important to consider their practical relevance. While we found that IM and flow in studies have a significant relationship with GPA, both in considering them individually, and as a mediation model, obtaining partial mediation highlights the likelihood of further mechanisms influencing the relationship between IM and GPA. Further investigation to identify factors playing a role in explaining variance in GPA in practical contexts is warranted. For example, Dumfart and Neubauer (2016) concluded that conscientiousness and intelligence are the most powerful predictors of academic performance. Conscientiousness is said to be the crucial predictor for academic performance, and can even compensate for low fluid intelligence (Dumfart & Neubauer, 2016). Interestingly, conscientiousness is significantly correlated with IM (Tomšik, 2018). Exploring factors that would impact GPA more could be valuable for future research, and we could enhance our knowledge and build more effective educational interventions connecting these influential factors with IM and flow.

Theoretical and Practical Implications

Our research sheds light on some important possible implications, both theoretical and practical. For theoretical implications, our results partly support Mustafa et al. (2010) proposal that the motivational path model incorporating flow helps us understand what makes a student perform better academically. This implies that integrating the flow theory allows for a more comprehensive understanding of motivation's influence on academic performance. On top of that, our insignificant result of EM on both flow and GPA warrants some reevaluations. Existing motivational models predominantly emphasize the direct impact of extrinsic motivation on academic outcomes, either positive or negative. They could be expanded and adjusted - finding potential moderator or suppressor variables may lead to a more significant contribution of EM to GPA. For example, considering individual differences, like peer support or social dynamics, we could uncover possible effects of EM on

unique characteristics of a student. Peer support is a social reinforcer and is shown to improve students' academic motivation (Wentzel et al., 2010). It may interact with EM to enhance GPA. To sum up, theoretical implications suggest integrating flow in explaining how IM predicts academic performance and revisiting frameworks concerning EM and academic performance.

In practice, our newly found knowledge could inform educational interventions. There should be less emphasis on EM, as it has been shown to not affect flow in studies or GPA. Instead, interventions should aim at fostering higher IM and flow in studies in order to help students improve their academic performance. This same idea should be implemented in teacher training programs and the making of the curriculum. Flow in studies, for example, can be increased by the vividness and interactivity of the instructor's presentation in the classroom (Chan & Ahern, 1999). By employing strategies, such as the aforementioned one, pedagogical practices would be improved, and ultimately, it would lead to an improvement in GPA.

Conclusions

Taken together, our research enhanced our knowledge of the relationship between motivation, flow, and academic performance. The goals of our study were to see whether EM decreases the number of occurrences of flow in studies, which leads to a lower GPA, as well as to see whether IM increases flow in studies, which in turn improves GPA. While the influence of IM and the mediating role of flow on academic success were supported, extrinsic motivation led to insignificant results. Future research on the topic could improve generalizability, and possibly do an experimental design to overcome our limitations in regard to causality and whether questionnaires reflect participants' true experiences. Our findings suggest a practical shift towards fostering IM and flow to improve academic

performance while placing less emphasis on extrinsically motivating students. We hope that this study will stimulate further exploration in this direction.

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