Intrinsic and Extrinsic Motivation as Predictors of Academic Performance Among University Students with Flow as a Mediator

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Abstract

This study aimed to expand the current understanding of the interplay between intrinsic and extrinsic motivation, flow, and academic performance using linear regression and mediation analysis. We explored the direction of the associations between intrinsic and extrinsic motivation on academic performance and flow. Additionally, we explored a possible mediating role of flow between intrinsic and extrinsic motivation and academic performance. Our study looked at the results of 554 undergraduate psychology students who filled out a self-report questionnaire measuring academic motivation and flow experiences during their academic activities. To measure academic performance, we accessed their grades and calculated their GPA. We found significantly higher academic performance of intrinsically motivated students and students who experience more flow states. Students who were higher intrinsically motivated showed more flow experiences. Extrinsically motivated students did not show higher academic performance and flow experiences. We found that flow experiences partially explain the effect of intrinsic motivation on academic performance, but not for extrinsic motivation. Our results contribute to the literature by demonstrating flow experiences as a partial mediator and an important part of the predictiveness of the relationship between intrinsic motivation and academic performance. We cannot confirm extrinsic motivation as a significant predictor for both academic performance and flow states, which questions extrinsic motivation's relevancy in the context of academic performance and flow.

Keywords: motivation, flow, academic performance, mediation

Intrinsic and Extrinsic Motivation as Predictors of Academic Performance Among University Students with Flow as a Mediator

Motivation is an important factor in learning and academic achievement. Students who are motivated engage more with learning materials, persist longer in the face of challenges, and ultimately tend to perform better academically (Taylor et al., 2014). This makes understanding the underlying factors of motivation and how they exert their influence on academic performance an important endeavor and could promote increased academic performance for students. In this study, we are examining the relationship of motivational variables consisting of intrinsic motivation and extrinsic motivation and their association with flow and academic performance. The core of Motivation is well explained by Deci & Ryan, (2008):

> The topic of motivation concerns what moves people to act, think, and develop. (p. 14)

The distinction of motivation into intrinsic and extrinsic motivation was academically introduced with Self-determination Theory by Deci and Ryan (1985). Ryan and Deci (2000) described intrinsic motivation as follows:

> Intrinsic motivation is defined as the doing of an activity for its inherent satisfaction rather than for some separable consequence. When intrinsically motivated, a person is moved to act for the fun or challenge entailed rather than because of external products, pressures, or rewards. (p.56)

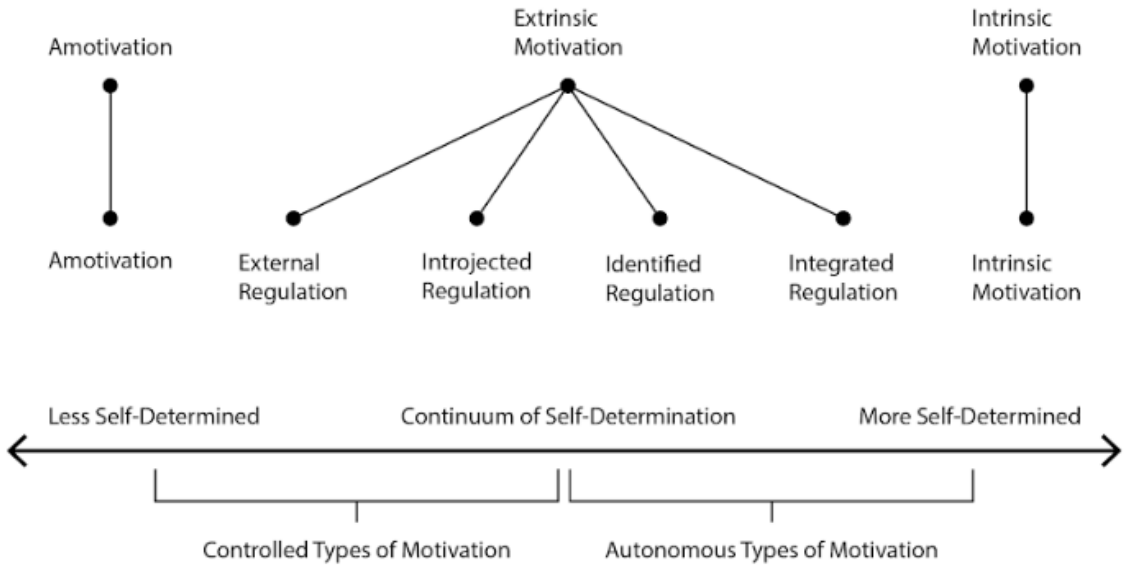
Contrary to intrinsic motivation, motivation towards a “separable outcome” can be defined as extrinsic motivation, as written by Ryan & Deci (2000):

> Extrinsic motivation is a construct that pertains whenever an activity is done to attain some separable outcome. Extrinsic motivation thus contrasts with intrinsic motivation, which refers to doing an activity simply for the enjoyment of the activity itself, rather than its instrumental value. (p.60)

Amotivation describes a lack of motivation and drive to engage in an activity and stands in contrast to motivation (Deci & Ryan, 2008). Deci and Ryan (2008) also mention the importance of intrinsic and extrinsic motivation being additive and not mutually exclusive. Several subtypes of intrinsic and extrinsic motivation which are ordered by autonomous or controlled motives were positioned by Deci and Ryan (1985). The spectrum is shown in an adapted figure originally published by Howard et al. (2021), visible in Figure 1 below.

Figure 1

Motivation in self-determination theory by Howard et al. (2021).



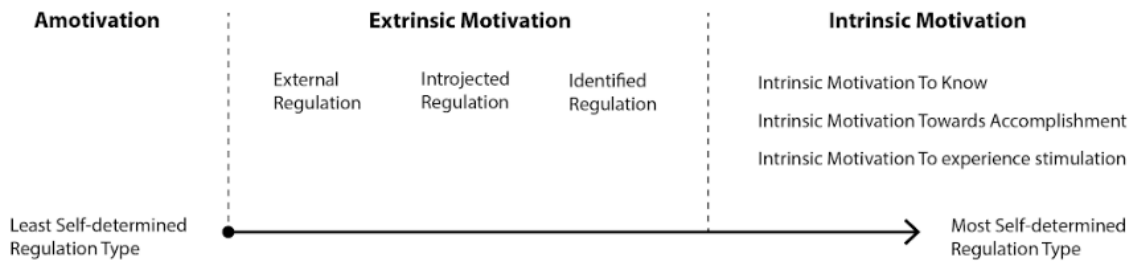
Note. We adapted this figure ourselves based on Howard et al. (2021)

A short description of the subtypes is as follows: In amotivation, we find no motivation and intention to engage in an activity. With external regulation, the motivational source comes from external rewards and punishments, in introjected regulation we find significant ego involvement and approval from others as motivational drivers, for identified regulation the person engages in an activity because absolving the activity is important to their identity, in integrated regulation a person absolves an activity because the person believes the outcomes of engaging align with their needs and values. At last, Intrinsic

motivation stands for the inherent enjoyment of an activity as the main motivational driver, as already explained above. Vallerand et al. (1992) proposed several motivational subtypes built on the Self-Determination Theory, specifically operationalized and validated for the educational domain. The differences to the subtypes in self-determination theory are visible in Figure 2 and appear in intrinsic motivation, where we find three new subtypes. These new subtypes provide a more precise perspective for the educational context:

Figure 2

Motivational subtypes for academic motivation by Vallerand et al. (1992)



Note. We created this figure ourselves based on Vallerand et al. (1992)

In Figure 2, Intrinsic motivation to know stands for engaging in an activity for the pleasure of learning or exploring. Intrinsic motivation towards accomplishment stands for the satisfaction of accomplishing or creating something and intrinsic motivation to experience stimulation stands for engaging in an activity for the pleasant sensations that are associated with that activity.

Previous research by Richardson et al. (2012) looked at predictors of academic performance via a large meta-analysis and showed that demographic and psychosocial factors are at best weakly correlated with grade point average (GPA). They found medium-sized correlations with academic performance for high school GPA, SAT Test Results, ACT Test Results and A-Level Scores, academic self-efficacy, grade goals, and effort regulation. The

researchers identified performance self-efficacy as the largest correlate with academic performance.

Howard et al. (2021) conducted another meta-analysis, inspecting different types of motivation as they apply to performance, well-being, goal orientation, and persistence-related student outcomes. Findings highlighted intrinsic motivation being particularly related to student success and well-being, while identified regulation was highly related to perseverance. Other different subscales of extrinsic motivation, like introjected regulation, showed a relation to perseverance and performance goals but came with decreased well-being. External regulation did not show a correlation with performance or perseverance and also came with decreased well-being. At last, amotivation was an indicator of poor performance outcomes. They concluded that identified regulation and intrinsic motivation are probable key factors in student outcomes. The findings underscore that not all forms of motivation are equally beneficial for students. Intrinsic motivation emerged as a particularly important predictor of both student success and well-being while external regulation, being motivated by external rewards or punishments, was not associated with improved performance. Identified regulation did show itself as a positive predictor for student outcomes and shows, that some forms of extrinsic motivation can have a beneficial effect on academic performance. However, since identified regulation is only one part of the spectrum of extrinsic motivation, one cannot completely apply it to our used variable in this study, extrinsic motivation, which consists of the combined 4 subtypes of extrinsic motivation in academic performance and one has to be careful with generalizing these findings to our results.

Taylor et al. (2014) conducted a meta-analysis of the results of studies that used the Academic Motivation Scale (Vallerand et al. 1992) and investigated each motivational subtype in its relationship to academic achievement. They found intrinsic motivation showing significant positive effect sizes and identified regulation with significant positive effect sizes.

Significant negative associations were found for introjected regulation and external regulation. The largest significant negative association was for amotivation. This further confirms the positive role of intrinsic motivation in academic performance and the negative role of the less self-determined forms of extrinsic motivation. We were specifically interested in providing evidence of the overall general effects of intrinsic and extrinsic motivation in this study and decided to use and focus on the combined scores of the several subtypes of both intrinsic and extrinsic motivation.

Looking at academic performance and motivation, Liu et al. (2019) found extrinsic motivation was very harmful for students with high intrinsic motivation but not for students with low intrinsic motivation, where extrinsic motivation significantly helped improve academic performance. This shows that the relationship between motivation and academic performance may not only depend on high intrinsic motivation but extrinsic motives playing an important role for some students as well. The effect sizes for intrinsic motivation alone were very significant across the different academic performance measures. For extrinsic motivation, they found no significant influence on academic performance alone and also negative effect sizes.

To summarize, in general, more self-determined motivational forces seem to be a positive predictor for academic performance while the less self-determined motivational forces point towards negative associations with academic performance. However, the literature does show some ambiguousness of the effects of extrinsic motivation, with some studies suggesting possible facilitation of academic performance by extrinsic motivation.

Flow experiences

Another important aspect of performance is the mental state “flow”, originally termed by the psychologist Csikszentmihalyi in the late 20th century. The name “flow” originates from descriptions of a mental state that were given by people in Interviews Csikszentmihalyi

initiated during his research where he investigated artists and athletes and how they describe their mental state under high performance. They described a “flow” experience and the feeling of being carried by water when they were in high-performance situations (Csikszentmihalyi, 2000). He has described flow with nine dimensions that are associated with flow experiences (Csikszentmihalyi, 1990). These consist of a (1) challenge-skill balance, (2) merging of action and awareness, (3) clear goals, (4) unambiguous feedback, (5) concentration on the immediate task, (6) sense of control, (7) loss of self-consciousness, (8) transformation of time and (9) autotelic experience (intrinsically rewarding activity). A good definition of flow is given in the Oxford Handbook of Human Motivation:

> Flow is an optimal psychological state characterized by the enjoyment of deep absorption in what one is doing. (Ryan, 2012, p.169)

Later, Nakamura & Csikszentmihalyi (2009) placed the nine dimensions as either structural task characteristics or conditions of the flow experience, where “challenge-skills balance”, “clear goals” and “unambiguous feedback” were classified as conditions for flow and the other six as part of the flow experience itself.

Norsworthy et al. (2021) conducted a large scoping review, mapping flow-related research with 236 sources across different scientific disciplines, and identified optimal challenge and high motivation as common flow antecedents. Characteristics of the flow experience itself were absorption, effortless control, and intrinsic reward. They concluded that flow was predominantly linked to positive development (meaning well-being and health), high functioning, and further engagement, although they also point out that previous research across disciplines is inconsistent in their methods and mostly consists of correlational studies. What stands out is that reviewed research showed not only intrinsic motivation as an antecedent for flow but extrinsic motivation as well. Based on this ambiguousness of results

Norsworthy et al. (2021) placed additional emphasis on the necessity for further research to understand the interplay of intrinsic versus extrinsic motives on the occurrence of flow states.

Academic performance, motivation, and flow

The literature on motivation, flow, and academic performance is scarce. Flow had statistically significant direct impacts on university achievement in a study done by Joo et al. (2015) and also acted as a mediator between self-efficacy and students' academic performance. This shows that flow states also could act as a mediator for other previously found predictive variables for academic performance.

Looking at all forms of motivation, levels of intrinsic, extrinsic, and also amotivation, Mills and Fullagar (2008) found significant relations between flow experiences during academic activities and the self-determined forms of intrinsic motivation and also with extrinsic motivation subtypes. Intrinsic motivation subtypes had significantly higher correlations with flow experiences than extrinsic motivation. After controlling for the effects of the intrinsic motivation subtypes, extrinsic motivation subtypes did not explain any additional effect in flow, showing the importance of intrinsic motivation for flow alone.

Kowal and Fortier (1999) investigated motivational antecedents of flow experiences in a sample of professional swimmers and found that participants who reported a high occurrence of flow had significantly higher levels of intrinsic motivation and scored higher on the more self-determined extrinsic motivation forms, than swimmers who reported a low occurrence of flow states.

Lee (2005) found similar results within a sample of Korean undergraduate students where the relationship of motivation and flow experience to procrastination in university was measured. High procrastination was associated with missing self-determined forms of motivation and here as well with a low occurrence of flow state. Amotivation and intrinsic motivation showed unique effects on procrastination, but when considering the effects of flow

experiences, no additional variance was explained by either. This suggests that flow experiences could be a significant key variable for academic performance and a potential mediator between different forms of motivation and academic performance.

A hypothesized model by Mustafa et al. (2010) proposed flow as the mediator and link between motivational influences and academic achievement, which we see too, in light of the literature, as a potential gap in the understanding of motivational forces on academic performance.

Taking previous research into account, the relationships between intrinsic and extrinsic motivation, flow, and academic performance are not clear and together have little research available, thus the present study aims to further explore the underlying nature of these predictors. We propose the following hypotheses for this study:

Hypothesis 1: Intrinsic motivation is a positive predictor of academic performance

Hypothesis 2: Intrinsic motivation is a positive predictor for the occurrence of flow states

Hypothesis 3: Flow is a positive predictor of academic performance

Hypothesis 4: Flow is a mediator between intrinsic motivation and academic performance

Hypothesis 5: Extrinsic motivation is a negative predictor of academic performance

Hypothesis 6: Extrinsic motivation is a negative predictor for the occurrence of flow states

Hypothesis 7: Flow is a mediator between extrinsic motivation and academic performance

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 had 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

Linear regression and mediation analysis were used to analyze the data. Before conducting our data analysis, we checked for the necessary assumptions to make sure the results were valid. Controlling for outliers with Cooks Distance $4/n = 0.00683760683$, 31 participants were removed from our total data set due to having a too-high Cooks Distance, resulting in a sample size of $N=554$.

Homoscedasticity was met for all tested variables. The normality assumptions were also met for all variables and all P-P plots show their points near the diagonal line. Looking at scatter plots of the tested variables, linear relationships are not visible for all variables. The necessary graphs, tables, and plots are included in the appendix. In accordance with the assumptions of mediation analysis, we tested the absence of an interaction between the

predictor (independent variable, Intrinsic Motivation) and the mediator (flow) for our mediation hypothesis. The results indicated that the interaction was not statistically significant, F (1, 550) = .0534, p =.8173.

Descriptive Statistics:

Descriptive statistics of the used variables are found in Table 1 below. We provided the means and standard deviations for the variables used in all of our hypotheses. The students in our sample had an average GPA of 6.91, which lies between satisfactory (grade of 6) and more than satisfactory (grade of 7), in the Dutch grading system. The average scores on the flow scale and our intrinsic and extrinsic motivation scale were all above the midpoint of possible scores and moderately high.

Table 1

Descriptive statistics, means, and std deviations

	Mean	Std. Deviation
GPA	6.910	.996
FLOW	3.417	.505
IM	4.778	.914
EM	5.195	.882

Note. N =554, IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA = grade point average

The correlations of our used variables are found in Table 2 below. We provided the Pearson correlations and the significance levels between the different variables. We find the highest significant correlations between intrinsic motivation and flow, followed by the significant correlation between intrinsic and extrinsic motivation. There is a medium-sized

significant correlation between flow and GPA. The correlation between extrinsic motivation and flow as well as with GPA is not significant and very small. Intrinsic motivation and GPA have a small to medium-sized significant correlation.

Table 2

Correlations between tested variables

Variable		IM	EM	FLOW	GPA
IM	Pearson's r	—			
	p-value	—			
EM	Pearson's r	.312***	—		
	p-value	< .001	—		
FLOW	Pearson's r	.412***	.047	—	
	p-value	< .001	.266	—	
GPA	Pearson's r	.176***	-.005	.196***	—
	p-value	< .001	.903	< .001	—

* p < .05, ** p < .01, *** p < .001

Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Hypothesis 1: Intrinsic Motivation and Academic Performance

Our first hypothesis suggested intrinsic motivation being a positive predictor for academic performance. A simple linear regression was conducted to determine the relationship between Intrinsic Motivation and GPA. The regression equation was found to be significant, F (1, 552) = 17.747, p < .001. The variance explained was .031. The unstandardized regression coefficient for IM was .192, with a standard error of .046, and a 95% confidence interval ranging from .103 to .282. Our first hypothesis, which assumed a positive association, was confirmed.

Hypothesis 2: Intrinsic Motivation and occurrence of flow states

Our second hypothesis suggested intrinsic motivation being a positive predictor for the occurrence of flow states. A simple linear regression was conducted to examine the relationship between intrinsic motivation (IM) and the experience of flow. The regression model was significant, F (1, 552) = 113.067, $p < .001$. The variance explained was .170. The unstandardized regression coefficient for intrinsic motivation was .228, with a standard error of .021, and a 95% confidence interval ranging from .186 to .270. Our second hypothesis, which assumed a positive association, was confirmed.

Hypothesis 3: Flow and academic performance

Our third hypothesis suggested flow as a positive predictor of academic performance. A simple linear regression was conducted to examine the relationship between flow and academic performance. The regression model was significant, F (1, 552) = 22.105, $p < .001$. The variance explained was .039. The unstandardized regression coefficient for flow was .386, with a standard error of .082, and a 95% confidence interval ranging from .225 to .548. Our third hypothesis, which assumed a positive association, was confirmed.

Hypothesis 4: Flow as a mediator between intrinsic motivation and academic performance

Our fourth hypothesis suggested flow as a mediator between intrinsic motivation (IM; X) and academic performance (GPA; Y). We tested a simple mediation model (Model 4) using the Process macro for SPSS (Hayes, 2013) with 5000 bootstrap samples for bias-corrected confidence intervals. The indirect effect of intrinsic motivation on GPA through flow was significant, with a point estimate of .0669 and a 95% bootstrap confidence interval that did not include zero [.0290, .1075], showing a significant mediation effect. The direct effect, controlling for the indirect effect, was significant, $\beta = .1255$, $SE = .0497$, $t = 2.526$, $p = .012$. These results suggest that flow partially mediates the relationship between intrinsic

motivation and GPA, with both direct and indirect paths being significant. The proportion of the total effect that was mediated by flow was approximately 34.8%. The percentage of mediation tells how much of the total effect of intrinsic motivation on academic performance (GPA) is explained by the indirect path through the mediator flow.

Hypothesis 5: Extrinsic Motivation and Academic Performance

Our fifth hypothesis suggested extrinsic motivation being a negative predictor of academic performance. A simple linear regression was conducted to determine the relationship between Extrinsic Motivation and GPA. The regression equation was not found to be significant, F (1, 552) = .015, p = .903. The variance explained was less than .001, indicating that a negligible proportion of the variance in GPA was explained by the model. The unstandardized regression coefficient for EM was -.006, with a standard error of .048, and a 95% confidence interval ranging from -.100 to .089. Our fifth hypothesis, which assumed a negative association, was not confirmed.

Hypothesis 6: Extrinsic Motivation and occurrence of flow states

Our sixth hypothesis suggested extrinsic motivation being a negative predictor for the occurrence of flow states. A simple linear regression was conducted to examine the relationship between extrinsic motivation and the occurrence of flow states. The regression model was not significant, F (1, 552) = 1.241, p = .266. The variance explained was .002. The unstandardized regression coefficient for extrinsic motivation was .027, with a standard error of .024, and a 95% confidence interval ranging from -.021 to .075. Our sixth hypothesis, which assumed a negative association, was not confirmed.

Hypothesis 7: Flow as a mediator between extrinsic motivation and academic performance

The simple linear regression between extrinsic motivation and academic performance was negative, very small, and not significant, F (1, 552) = .015, p = .903, with an

unstandardized regression coefficient of -.006. The simple linear regression between extrinsic motivation and flow too was very small and not significant, F (1, 552) = 1.241, p = .266, unstandardized regression coefficient of .027. We decided not to do a mediation analysis for flow between the two variables based on these results.

Discussion

This study aimed to understand the relationships between intrinsic/extrinsic motivation and flow on academic performance. We assumed a positive association between intrinsic motivation on academic performance and the occurrence of flow states and a negative association between extrinsic motivation and academic performance and flow states. We also assumed flow states to be positively associated with academic performance. Additionally, we hypothesized a positive mediating relationship by flow between intrinsic motivation and academic performance and a negative mediating relationship by flow between extrinsic motivation and academic performance. Our results are partly expected but contain also unexpected outcomes. Intrinsic motivation showed itself as a significant positive predictor for academic performance and the occurrence of flow states. Flow was also a significant partial mediator between intrinsic motivation and academic performance, showing itself as a relevant aspect of the predictiveness of intrinsic motivation on academic performance. Extrinsic motivation was not a significant positive or negative predictor of academic performance and occurrence of flow states. Because of the missing correlation between extrinsic motivation, flow, and GPA, we decided not to perform a mediation analysis between extrinsic motivation and academic performance by flow, rendering our mediation hypotheses of flow between extrinsic motivation and academic performance moot.

Intrinsic motivation showed itself to be a significant positive predictor for academic performance with a small effect. Since our questionnaire was also based on self-reports, we found a lower effect compared to the self-report results by Howard et al. (2021). Nonetheless,

the effect was positive and significant and shows further that students with higher levels of intrinsic motivation show better academic performance.

Taylor et al. (2014) and Liu et al. (2019) also found significant effect sizes for intrinsic motivation and school achievement in their meta-analysis and we can confirm these findings further. However, their findings did show bigger effects of intrinsic motivation compared to our findings.

Intrinsic motivation significantly predicted the occurrence of flow states with 17% of variance accounted for, revealing that students with higher intrinsic motivation showed higher levels of flow states. This shows a significant practical relevance of intrinsic motivation as a precursor for the occurrence of flow states which has been thoroughly discussed in the metanalysis by Norsworthy et al. (2021), in which intrinsic motivation showed itself as a significant predictor of flow in a multitude of studies. We did not find positive evidence for extrinsic motivation as a predictor of flow states, which Norsworthy et al. (2021) pointed out.

Joo et al. (2015) found students with higher levels of flow states showed increased academic performance and we can confirm the results with similar effect sizes. Further, we can confirm intrinsic motivation as a significant predictor of flow states, also found by Mills and Fullagar (2008). Extrinsic motivation did have significant correlations with flow states in their results which we cannot confirm based on our results.

At last, the associations found by Kowal and Fortier (1999) in a self-report done after practice with high-level swimmers, where intrinsic motivation was significantly related to flow occurrence, are also confirmed by our results. Kowal and Fortier (1999) also found no significant results for non-self-determined forms of extrinsic motivation and flow, similar to our results.

Our mediation hypothesis for intrinsic motivation was confirmed with a significant partial mediation by flow between intrinsic motivation and academic performance. The

hypothesized mediation of flow between motivation and academic performance by Mustafa et al. (2010) did materialize and was also sizeable, with 34% of the effect of intrinsic motivation on academic performance being mediated by flow. A part of the impact of intrinsically motivated students achieving higher academic performance comes directly from their flow experiences. It was hypothesized that the effect of extrinsic motivational forces on academic performance is mediated by flow states, which we cannot confirm.

Extrinsically motivated students did not perform better academically in our sample and extrinsic motivation did not explain any additional variability of academic performance results. On top, the relationship and regression were statistically not significant. In our sample, it seems to be an almost completely unrelated variable to academic performance, which is surprising. Taylor et al. (2014) and Liu et al. (2019) both reported negative effects for the extrinsic forms of motivation which we also cannot confirm. This throws up questions about the role of extrinsic motivation within the context of academic performance and university students and needs further exploration.

Extrinsic motivation and flow also had no significant relationship and behaved unrelated. We expected a negative predictive power by extrinsic motivation on flow, which did not materialize within our sample of students. Norsworthy et al. (2021) reviewed sources that also point towards extrinsic motivation playing a role in the occurrence of flow states which we cannot confirm in our results.

Flow was a significant predictor for academic performance and accounted for 3.9% of the variance explained in GPA (academic performance) which shows small but significant effects. Compared to Joo et al. (2015), which found effect sizes for flow as a predictor for academic performance of $\beta = .165$, $p < .05$, and intrinsic value (related to intrinsic motivation) as a predictor of academic performance of $\beta = .134$ $p < .05$, our effect sizes are similar and also significant.

Our results highlight the complicated nature of intrinsic and extrinsic motivation, flow, and academic performance but partially confirm previous work for positive associations regarding intrinsic motivation and academic performance, intrinsic motivation, and flow and flow as a mediator between intrinsic motivation and academic performance. On the other hand, extrinsic motivation turned out to be no positive or negative predictor for both academic performance and flow and our results point towards insignificance of this variable in the academic performance context and for flow experiences.

Limitations and Future Research

Regarding methodological issues, we have to point out several possible problems with our sampling methods, measurement methods, and data methods. Since our study only included participants who are students in the bachelor program of psychology, our findings may not be generalizable to all other academic disciplines. The majority of recruited participants joined via a university course where students had to take part in research to get credits for their degrees. Students were able to choose between studies they wanted to take part in, which opened up room for a self-selection bias since participation was voluntary, and motivated students might be more likely to participate. This could have confounded the predictors and distorted results. Our research is cross-sectional, so we were only able to capture a specific moment in time of students' estimates about their motivation and flow experiences. Students' self-reported motivation levels may not stay the same over time and we suggest longitudinal and different study designs like experimental settings where we have increased ecological validity. Additionally, we cannot establish causality with our results due to the nature of linear regression. Also, students might have response biases and provide more socially desirable answers that do not reflect their true motivation levels, even though the questionnaire was anonymous.

Problems with our data methods could be other confounding variables we did not consider, that could affect the relationship of our predictors and the dependent variable. Examples would be age, gender, and socioeconomic status-related variables but also other important academic-related variables like the teaching style of the university, classroom climate, and course structure that could influence student's motivations and engagement. Controlling for prior academic ability/achievement from the family of origin, specific personality traits, and mental health elements could provide further information regarding the nature of our variables. Future research should re-validate our hypotheses within a broader academic context to increase the external validity of our findings within the academic context. We suggest the continuation of testing intrinsic and extrinsic motivation as a predictor of academic performance with flow as a partial mediator to re-validate our confirmed and unconfirmed hypotheses with a different sample and preferably in a non-self-report context to increase ecological validity.

Testing other important predictors and including covariates, of which we mentioned several, that might influence our motivational predictors, could provide additional confirmation and answers about the relationship between motivational forces, flow, and academic performance. The partial mediation by flow between intrinsic motivation and academic performance could point towards other important mediators that may play an effect and our mediation analysis could be repeated with additional mediators to increase the understanding of the relationship between intrinsic motivation and academic performance. Possible further mediators between intrinsic motivation and academic performance could be perseverance, self-efficacy, or a sense of belonging, to name a few, which all would provide interesting avenues for further exploration.

Conclusion

In conclusion, our results show that intrinsic motivation is an important predictor of student's academic performance and of flow states that students experience during their studies. Flow states showed itself as an important aspect of students' academic performance. Extrinsic motivation did not play a role as a predictor of student's academic performance and did not play a predictive role in their experience of flow. We found a partially mediating relationship of flow between intrinsic motivation and academic performance, showing that flow states are an important aspect of the effect of intrinsic motivation on academic performance. Extrinsic motivation showed itself as an unrelated variable to flow and academic performance which poses questions about its importance as a predictor for flow and extrinsic motivation.

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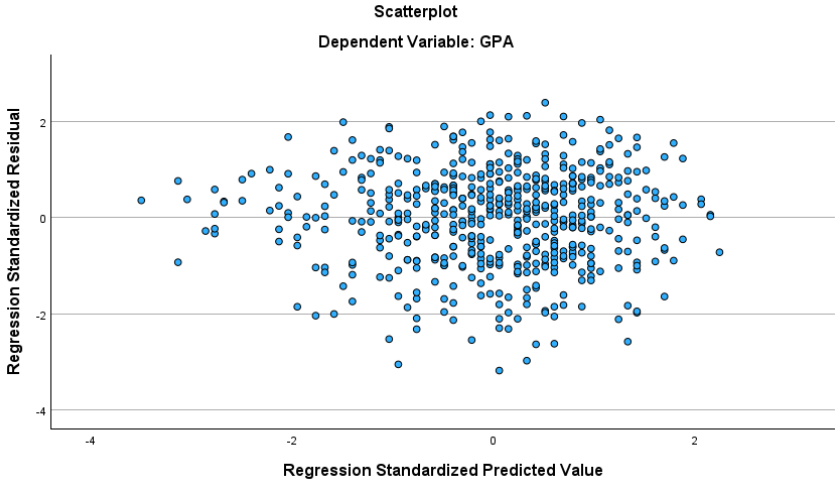
Appendix A

Figure A1

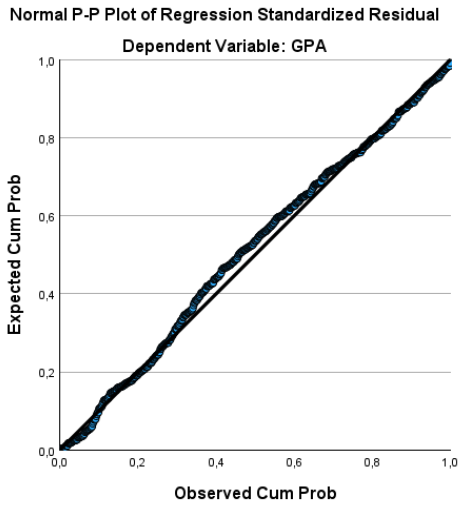
Scatterplot of standardized predicted values vs standardized residuals for IM and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A2

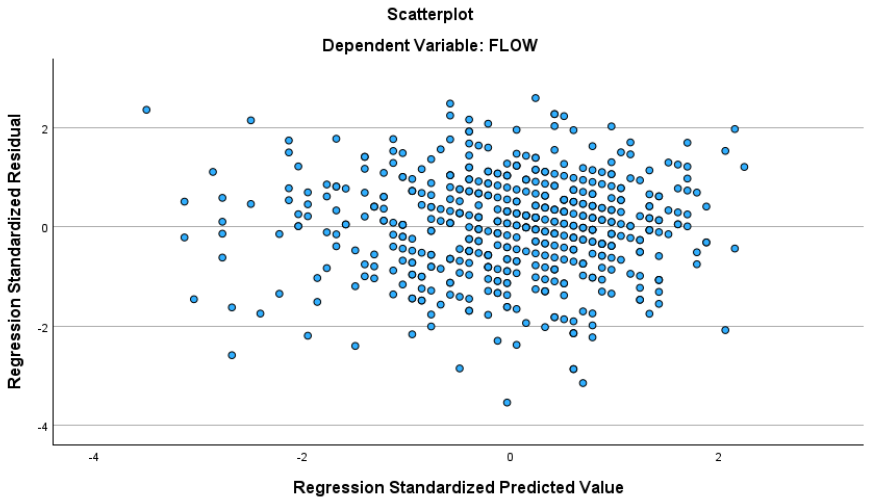
Normal P-P Plot of Regression Standardized Residuals for IM and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A3

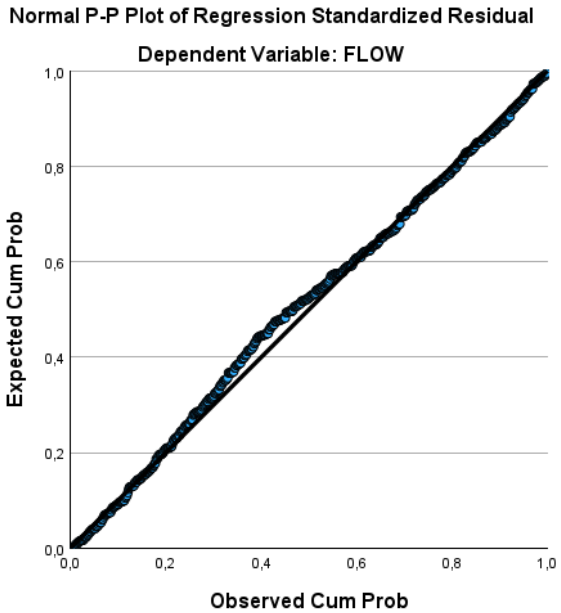
Scatterplot of standardized predicted values vs standardized residuals for IM and FLOW



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A4

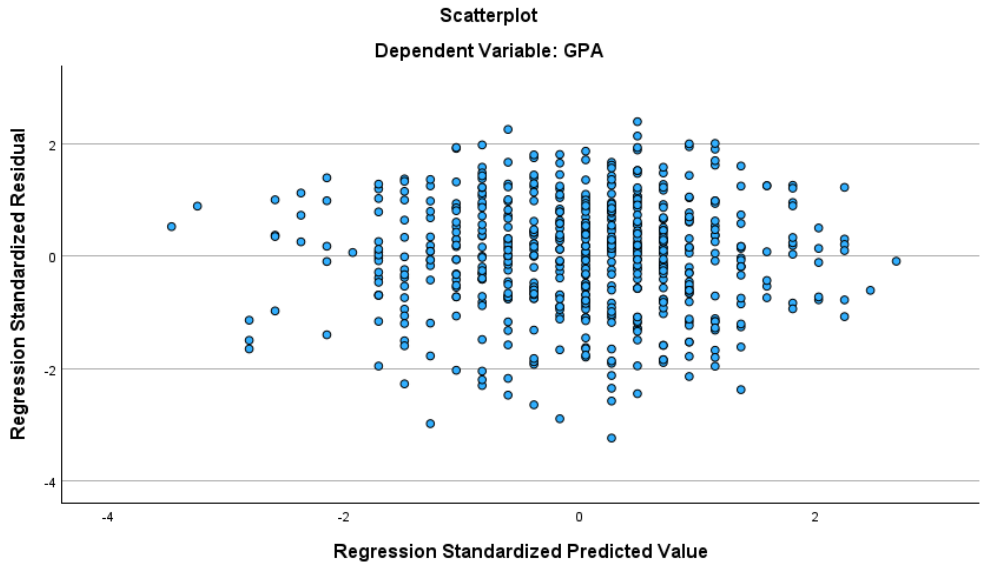
Normal P-P Plot of Regression Standardized Residuals for IM and FLOW



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A5

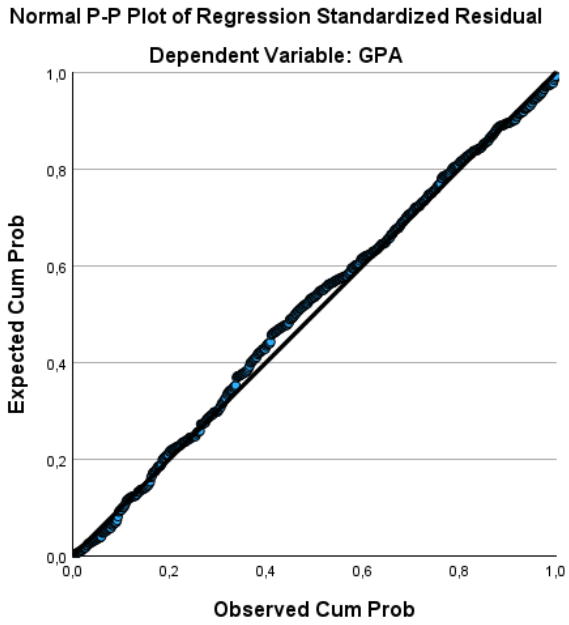
Scatterplot of standardized predicted values vs standardized residuals for FLOW and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A6

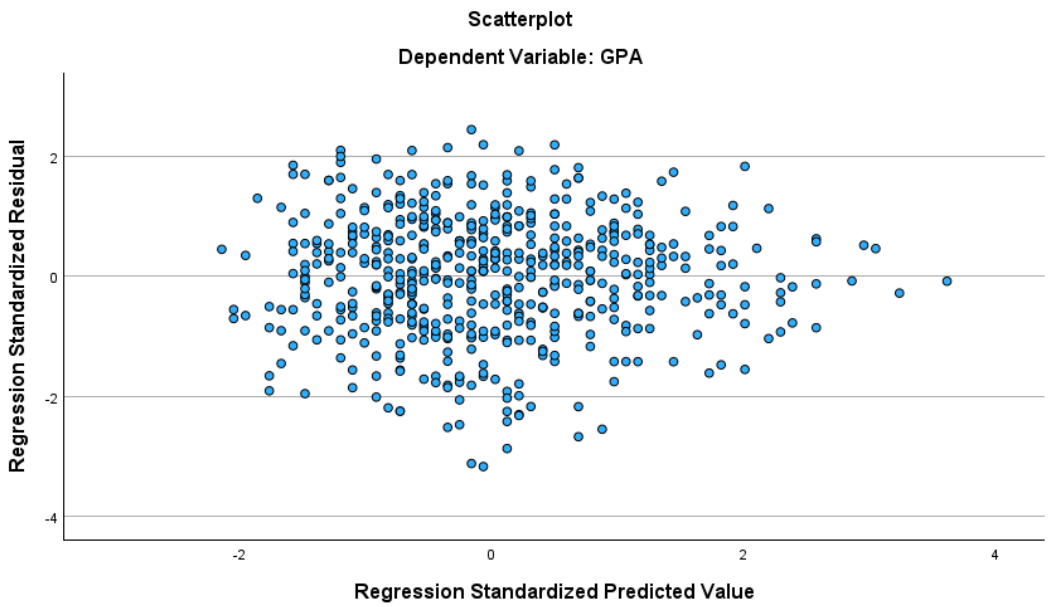
Normal P-P Plot of Regression Standardized Residuals for FLOW and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A7

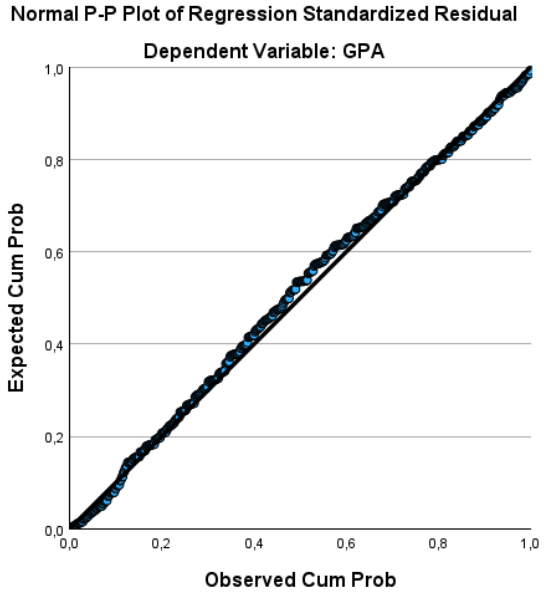
Scatterplot of standardized predicted values vs standardized residuals for EM and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A9

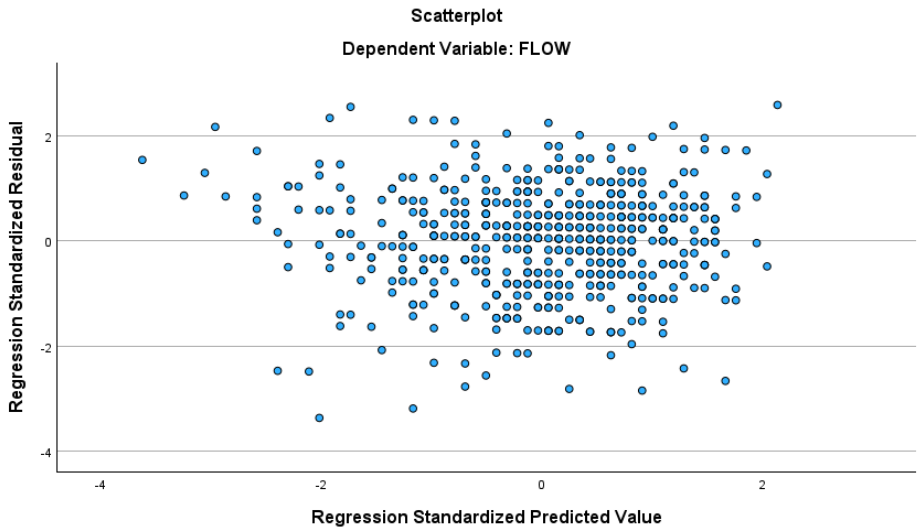
Normal P-P Plot of Regression Standardized Residuals for EM and GPA



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A10

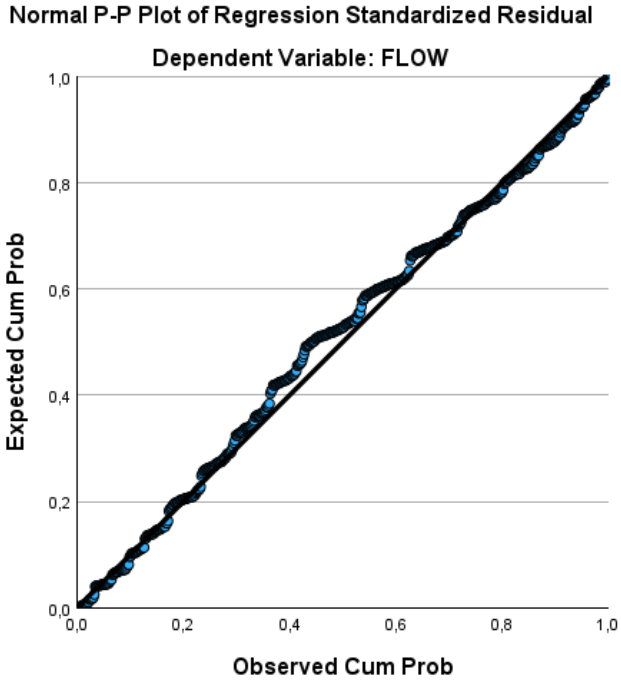
Scatterplot of standardized predicted values vs standardized residuals for EM and FLOW



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A11

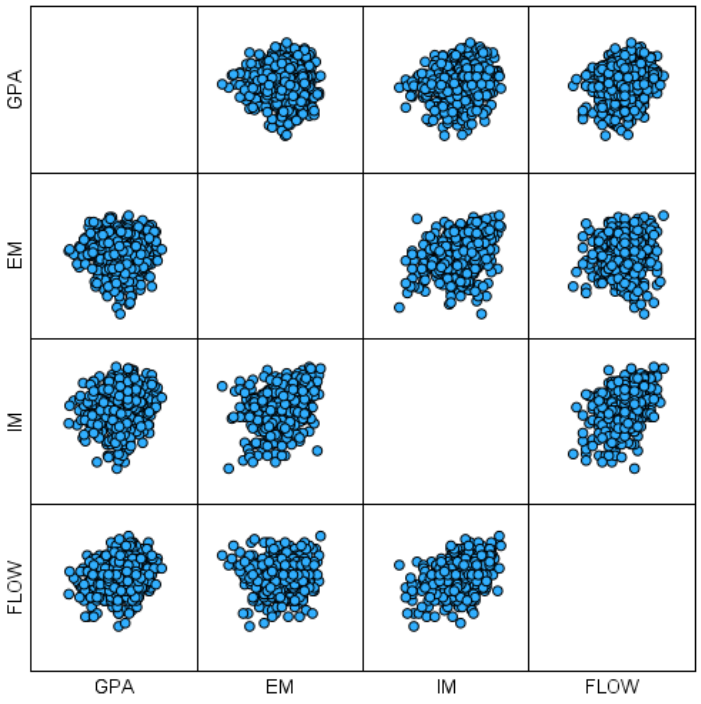
Normal P-P Plot of Regression Standardized Residuals for EM and FLOW



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average

Figure A5

Scatterplot Matrix for IM, EM, GPA, and Flow



Note. IM=Intrinsic Motivation, EM= Extrinsic Motivation, Flow=occurrence of flow states, GPA= grade point average