

Metacognitive Awareness and Group Membership as Predictors of Academic Performance

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Abstract

Keywords:

metacognitive awareness, extracurricular activities, co-curricular activities, scientific group membership, academic achievement, moderation analysis

Numerous studies highlighted the role of higher-order cognitive processes and metacognitive awareness in academic performance and later careers. Similarly, extracurricular activities, such as various group memberships, have a positive impact on university success, enhancing cognitive abilities alongside social and emotional factors. The aim of this research is not only to uncover simple linear relationships but to examine the impact of group membership, as an extracurricular activity, on the relationship between metacognitive awareness and academic performance. We surveyed students from the Babeş-Bolyai University Faculty of Psychology and Educational Sciences, using the convenience sampling method and applying a correlational cross-sectional design. Positive, moderate-strength relationships were found between academic performance, metacognitive awareness, and group membership. According to the moderation model, group membership is not a significant moderator; however, based on the overall model, it can be concluded that group membership has a positive effect on academic performance. The study draws attention to the organization and support of extracurricular and co-curricular programs as activities that enhance metacognitive awareness and academic performance.

Zusammenfassung

Schlüsselworte:

Metakognitive Bewusstheit, außerschulische Aktivitäten, zusätzliche außerschulische Aktivitäten, wissenschaftliche Gruppenmitgliedschaft, akademischer Erfolg, Moderationsanalyse

Eine Vielzahl von Studien hat die Rolle höherer kognitiver Prozesse und metakognitiver Bewusstheit für die akademische Leistung und spätere Karrieren hervorgehoben. Ebenso haben außerschulische Aktivitäten wie verschiedene Gruppenmitgliedschaften einen positiven Einfluss auf den Studienerfolg an Universitäten, indem sie kognitive Fähigkeiten neben sozialen und emotionalen Faktoren stärken. Ziel dieser Forschung ist es nicht nur, einfache lineare Beziehungen aufzudecken, sondern den Einfluss von Gruppenmitgliedschaft als außerschulische Aktivität auf die Beziehung zwischen metakognitiver Bewusstheit und akademischer Leistung zu untersuchen. Wir haben Studenten der Fakultät für Psychologie und Erziehungswissenschaften der Babeş-Bolyai-Universität befragt, wobei wir eine Bequemlichkeitsstichprobe verwendeten und ein korrelationales Querschnittsdesign anwandten. Es wurden positive, mäßig starke Beziehungen zwischen akademischer Leistung, metakognitiver Bewusstheit und Gruppenmitgliedschaft festgestellt. Gemäß dem Moderationsmodell ist die Gruppenmitgliedschaft kein signifikanter Moderator; basierend auf dem Gesamtmodell kann jedoch geschlossen werden, dass die Gruppenmitgliedschaft einen positiven Einfluss auf die akademische Leistung hat. Die Studie lenkt die Aufmerksamkeit auf die Organisation und Unterstützung außerschulischer und außercurricularer Programme als Aktivitäten, die metakognitive Bewusstheit und akademische Leistung fördern.

1. Introduction

The students' academic performance is influenced not only by social, emotional, and motivational factors but also by higher-order cognitive processes. Determining factors include not only attention and memory capabilities but also the degree to which students are aware of the learning process, requirements, and their own abilities. Metacognitive skills contribute to effective self-regulated learning, planning the learning process, selecting applied strategies, controlling their effectiveness, evaluating results, and identifying applied declarative, procedural, and conditioned knowledge.

Participation in extracurricular and co-curricular activities, such as after-school preparatory programs, scientific, artistic, and sports groups, and participation in conferences and competitions, also affects students' academic performance as they develop cognitive, motivational, emotional, and social skills that contribute to successful school and university adaptation and learning.

Extracurricular and co-curricular activities not only directly lead to increased academic performance but also indirectly develop cognitive abilities that contribute to effective learning. The main purpose of extracurricular activities is to deepen students' interest



in a particular field of science or activity, develop explicit and implicit knowledge, and continue the learning process in an informal environment, such as groups, laboratories, and conferences. Extracurricular activities require students to engage in individual planning, time management, and develop time management strategies, i.e., metacognitive skills.

2. Theoretical foundation

2.1. *The role of metacognition in academic performance*

Numerous previous studies have highlighted the positive relationship between metacognition and academic performance. In their study, Amrin et al. (2020) examined the relationship between metacognition and academic performance in 11th-grade students, operationalizing academic performance with English grades. The results of the study revealed a positive moderate-strength relationship between metacognition and English grades, with higher metacognition associated with higher English grades. The study emphasizes the importance of metacognition in academic performance and language learning.

In their study, Khan et al. (2020) examined the impact of self-regulated learning, based on metacognition, on university students' academic performance. The research highlighted the contribution of self-regulated learning to academic performance and called attention to the creation of programs aimed at developing students' self-regulation. The effects of self-regulated learning and metacognition on academic performance in university students with test anxiety were also examined (Onwunyili & Onwunyili, 2020). During the intervention, members of the experimental group participated in a program aimed at developing self-regulation and metacognition. After the program, there was a significant difference in academic performance between the experimental and control groups, leading to the conclusion that the training aimed at developing self-regulation and metacognition can be effectively applied to increase academic performance.

In their study, Cherrier et al. (2020) tested the effect of the NeuroStratE program's metacognitive approach on increasing students' academic performance. They found no significant difference between the academic performance of students participating in the program and students in the control group. However, the research highlighted the relevance of the program and the importance of acquiring metacognitive knowledge about brain

function, which increases students' self-efficacy, a well-known determinant of academic success (Cherrier et al., 2020).

2.2. *The role of extracurricular and co-curricular activities in academic performance*

In a study examining the relationship between co-curricular activities and academic performance (Sami et al., 2020), it was found that the more students engage in such activities, the better their academic performance. Additionally, the study highlighted the role of the government and educational institutions in creating and organizing programs that include such activities and motivating students to participate. In their research, Batool and Ahmad (2020) found that students who participate in more co-curricular activities have higher academic performance compared to those who do not engage in such activities. The relationship between participation in extracurricular activities and academic performance was also examined among medical university students (Utomo et al., 2019). For healthcare professionals, the transfer of knowledge to everyday situations is highly important, and participation in extracurricular activities enhances knowledge transfer, social skills, and time management among students. Medical students who were active participants in extracurricular activities had higher average grades than their passive peers.

Sabirov (2019) investigated the impact of extracurricular activities on students' academic performance and the development of their communication skills. Activities requiring sports and organization develop leadership skills, while participation in lectures, conferences, and competitions enhances communication skills. Students' creativity can be developed through reading fiction books, scientific magazines, and technology-related literature. Participation in various programs requires planning, which enhances students' strategic thinking.

Morris (2019) conducted a systematic review of studies examining the impact of various types of extracurricular activities on academic performance. Participation in extracurricular activities is associated with positive academic outcomes, such as higher average grades, better performance on standardized tests, increased likelihood of completing school, and pursuing higher education. Furthermore, these positive correlations appeared regardless of the type of activity, indicating that not only the type of activity matters, but

also the experience gained from participating in various types of activities.

2.3. The relationship between extracurricular activities and metacognitive awareness

Belonging to groups contributes to achieving common goals and engaging in activities that require teamwork. Group activities not only develop social skills but also contribute to the awareness of individual cognitive abilities by allowing group members to take on roles that contribute most to the group's functioning and success, thereby identifying their outstanding abilities. Through gaining experience, their declarative knowledge develops, as well as their procedural metacognitive knowledge, as they can apply their consciously acquired knowledge of their cognitive abilities in practice, and their conditional knowledge increases as they learn which strategies to employ in different situations.

The effects of participation in extracurricular activities on the cognitive, linguistic, and socio-emotional development of children in large groups have been examined. After controlling demographic variables and children's prior performance, participation in extracurricular activities positively correlated with cognitive and linguistic abilities. The diversity, intensity, and number of activities also influence the development of cognitive abilities. The long-term effects of extracurricular activities on children's later academic performance are evident. Long-term participation in extracurricular activities enhances cognitive and linguistic abilities to a greater extent, as children are exposed to more learning activities and social interactions with teachers and peers (Ren et al., 2020). The effects of past and present participation in extracurricular activities on adaptive self-regulation goals were also examined, as well as how the adaptive self-regulation goals associated with extracurricular activities are related to academic performance and emotional well-being (Guilmette et al., 2019). Positive correlations were found between past and present participation in extracurricular activities and the use of self-regulation strategies. University students who apply self-regulation strategies have better academic outcomes and higher emotional well-being.

Multiple group memberships have a positive impact on cognitive performance (both verbal and mathematical abilities). For boys, there is a stronger relationship between physical group activities (participation in sports groups) and cognitive abilities compared to girls, who can gain the same benefits

from participating in other types of groups (e.g., art groups, music groups) (Beadleston et al., 2019). Participation in scientific research groups was also examined regarding personal and cognitive development, professional experience, and job placement (Hunter et al., 2007). Participants were provided with a learning environment where they could try themselves as researchers, see step-by-step how to conduct scientific research, and gain research experience. The authentic research environment allowed them to acquire professional intellectual and practical skills. Situated learning was facilitated by research advisors and mentors who provided instructions, advice, and professional experience to students, acting as direct role models. The main goal of the project was to develop students' skills, considering their personal development level, targeting the zone of proximal development. Such programs develop students' metacognitive abilities, as research work requires highly developed regulatory skills, planning, effective strategy selection, continuous monitoring, tracking, precision, error detection, correction, critical thinking, evaluation, and analysis of results.

Robotics is a prevalent extracurricular activity today. In some cases, it is not related to the school or university curriculum; however, many robotics programs and groups aim to develop skills related to the curriculum, which students can use after school or university, such as metacognition, critical thinking, creativity, problem-solving, and technological thinking. In their research, Komis et al. (2017) developed a robotics program for students based on cooperative, creative problem-solving strategies to solve poorly defined problems. This approach greatly enhanced students' cognitive abilities, which can be useful in both learning and everyday life. These activities also have a positive impact on students' metacognitive abilities, as applying creative problem-solving skills to robotics tasks requires control of cognitive processes. Students' mathematical and metacognitive abilities were developed within extracurricular activities based on robotics activities (La Paglia et al., 2017). The conclusion of the research is that robotics activities can be applied as tools that allow monitoring of learning, application of higher-level control processes such as planning, evaluation of exercises, and testing of everyday problem-solving strategies. Students in the experimental group were able to correctly identify problems, modify designs and programming, and make changes to perform activities with robots.

3. Research objectives and hypotheses

One of the main objectives of our research is to explore the relationships between metacognitive awareness, academic performance, and group membership as an extracurricular activity, as the information available in the literature is contradictory. Additionally, our aim is to supplement the literature with findings that highlight the moderating effect of extracurricular activities on the relationship between metacognitive awareness and academic performance. Our results can serve as the basis for further research, and practical studies and interventions can be implemented based on them. Methodologically, we aim to examine the internal consistency of the applied tools.

Based on the research results presented above, which highlighted that both metacognitive abilities and extracurricular activities are significant predictors of academic performance, we formulated the following hypotheses:

1. We hypothesize that a positive relationship can be identified between metacognition, academic performance, and group membership as an extracurricular activity.

2. We hypothesize that group membership is a significant moderator of the relationship between metacognition and academic performance, with a stronger correlation between metacognition and academic performance observed among students belonging to groups.

4. Research methodology

4.1. Participants

Using the G*Power program, we determined that 92 participants are needed to conduct the moderation analysis (actual power: .80). In our study, 103 Psychology and Special Education students from Babeş-Bolyai University participated, comprising 74 females and 29 males, with 36% residing in rural areas and 64% in urban areas. The average age of the participants was 20 years, with the youngest being 18 and the oldest 28 years old.

4.2. Instruments

Demographic questionnaire

In our demographic questionnaire, we recorded the participants' age, gender, and place of residence. Additionally, we asked whether they were involved in any scientific or volunteer groups. Participants could answer yes/no to the question regarding group

membership. In this questionnaire, we also recorded the participants' average grades from the previous semester.

Metacognitive Awareness Inventory

To measure metacognitive awareness, knowledge, and regulation, we used the Metacognitive Awareness Inventory developed by Schraw and Dennison (1994), which consists of a total of 52 items. Metacognitive knowledge is assessed by 3 subscales: declarative, procedural, and conditional knowledge, while metacognitive regulation is measured by 5 subscales: planning, comprehension monitoring, information management strategies, debugging strategies, and evaluation. Metacognitive knowledge is represented by a total score of 17 items, while metacognitive regulation is represented by a total score of 35 items. Participants could respond with yes/no to each statement. The questionnaire was considered reliable in the examined sample based on the Cronbach's alpha coefficient ($\alpha = .752$), with acceptable dimensions for both metacognitive knowledge ($\alpha = .612$) and metacognitive regulation ($\alpha = .683$).

4.3. Design and data analysis

We employed a cross-sectional correlational design in our research as we aimed to uncover the relationships between metacognitive awareness, group membership, and academic performance. We conducted moderator analysis in which metacognitive awareness served as the predictor variable, group membership as the moderator variable, and academic performance as the outcome variable. We performed moderator analysis using the bootstrapping method.

4.4. Procedure

After obtaining informed consent, participants completed the demographic questionnaire, followed by the questionnaire assessing metacognitive awareness. The questionnaires were completed in a paper-and-pencil format, taking an average of 20 minutes, and no time limit was applied.

5. Results

The average academic performance of the participating students is 8.69 (SD = .968), with the lowest average grade being 6 and the highest 10. The student with the lowest metacognition scored 11, while the highest scored 50 points. The mean score for metacognitive awareness among students is 36.96 (SD = 6.751). Based on the Skewness and Kurtosis indices, the distribution of continuous variables conforms to the normal distribution (see Table 1). 68% of the

participants are members of some scientific or volunteer groups.

Table 1. Descriptive statistics and normality

	Min	Max	M	SD	Skewness	Kurtosis
GPA	6.00	10.00	8.69	.968	-.284	-.572
Metacognitive awareness	11	50	36.96	6.751	-.903	1.981

To determine the relationships between metacognitive awareness, academic performance, and group membership, we employed Pearson correlation. A positive moderate strength correlation was found between academic performance and metacognitive awareness [$r(101) = .357, p < .001$]. Similarly, we identified a positive moderate strength correlation between average grade and group membership [$r(101) = .347, p < .001$], as well as between metacognitive awareness and group membership [$r(101) = .448, p < .001$] (see Table 2).

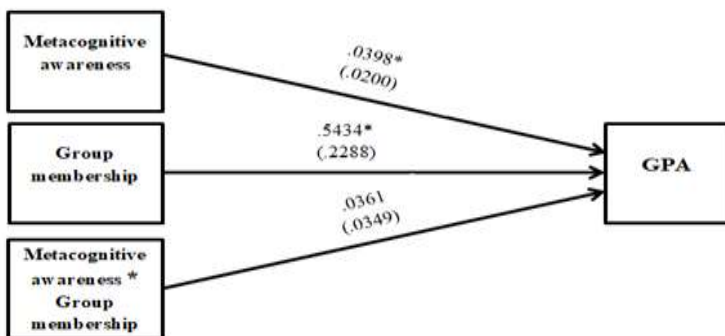
Table 2. Correlations between metacognitive awareness, GPA and group membership

	GPA	Metacognitive awareness	Group membership
GPA	--		
Metacognitive awareness	.357***	--	
Group membership	.347***	.448***	--

Note. *** $p < 0.001$

A bootstrapping test with 10000 re-samples was used for the moderation analysis. In our moderation model we tested the moderating effect of group membership on the relationship between metacognitive awareness and academic achievement (see Figure 1).

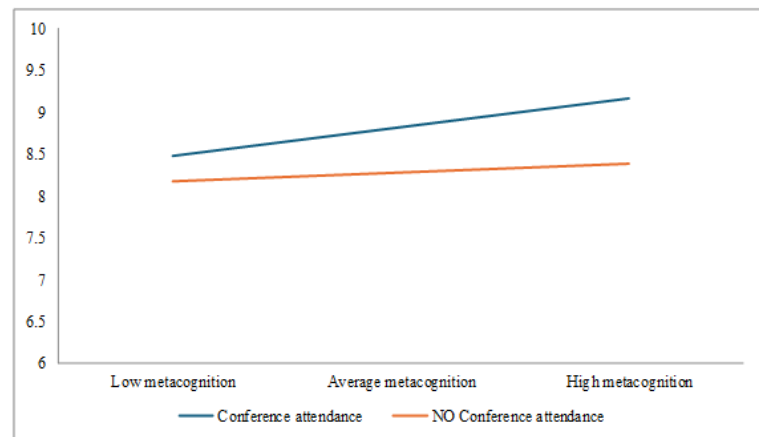
Figure 1. Group membership as the moderator between metacognitive awareness and GPA



Notes. * $p < .05$; All presented coefficients and standard errors (in parenthesis) are unstandardized.

Our moderation model is significant, predicting academic performance by 18.33% [$F(3, 99) = 7.34, p < .001, R^2 = .1833$]. In our model, metacognitive awareness emerged as a significant predictor of academic performance [$b_1 = .04, t(99) = 1.98, p < .05$]. Group membership also proved to be a significant predictor [$b_2 = .54, t(99) = 2.37, p < .05$]. The interaction effect between metacognitive awareness and group membership is not significant [$b_3 = .03, t(99) = 1.03, p = .30$], indicating that group membership is not a significant moderator of the relationship between metacognitive awareness and academic performance. For group membership, as metacognition increases, academic performance also increases. A similar trend is observed among students who were not members of scientific or voluntary groups, although the increase is higher among group members (see Figure 2).

Figure 2. The effect of students' metacognition level on academic achievement depending on group membership



6. Discussions

Based on the results of our study, we can conclude that a positive, moderate strength relationship exists between metacognitive awareness and academic performance. This finding aligns with previous research (Farnam & Anjomshoaa, 2020; Hayat et al., 2020; Khan et al., 2020). Students with high levels of metacognitive awareness possess more knowledge about their cognitive abilities and applied learning strategies. They can more effectively identify the most useful strategies for task-solving, exert greater control over and regulate their cognitive processes and applied learning strategies, meticulously plan the steps of learning, employ efficient strategies for organizing information, searching for errors, modifying strategies as needed, correcting errors, monitoring the entire learning process, and evaluating their outcomes. These regulatory strategies all contribute to more effective learning and higher grades (Amrin et al., 2020; Cherrier et al., 2020; Onwunyili & Onwunyili, 2020).

Similar to previous research (Balaguer et al., 2020; Meadows, 2019; Myers, 2019; Ren & Zhang, 2020; Salmeen et al., 2019), a positive relationship can be observed between academic performance and group membership as an extracurricular activity. Engaging in co-curricular and extracurricular activities after mandatory schooling contributes to a deeper, more detailed processing of the curriculum, exploration of connections between curriculum and real-life situations, problems. The practical application of what is learned in groups enables students to internalize acquired lexical knowledge, transforming declarative knowledge into procedural, and then into conditional knowledge. In group activities, students can learn new learning strategies that can be effectively applied to university learning as well. Thus, belonging to groups is positively associated not only with academic performance but also with metacognitive awareness, as previous research has indicated (Díaz-Iso et al., 2019; Guilmette et al., 2019; Ren et al., 2020).

In our study, we aimed not only to uncover simple linear relationships but also to examine the extent to which group membership, as an extracurricular or co-curricular activity, strengthens or weakens the relationship between metacognitive awareness and academic performance. The model proved to be significant, with both metacognitive awareness and group membership significantly predicting academic performance (Utomo et al., 2019). However, the interaction effect between metacognitive awareness and group membership was not significant, indicating that group membership is not a significant moderator of the relationship between metacognitive awareness and academic performance. Combined, metacognitive awareness and group membership do not have a significantly greater impact on academic performance than metacognitive awareness alone. The results indicate that activities in extracurricular or co-curricular groups enhance students' academic performance (Beadleston et al., 2019; Bowman et al., 2016), and there is a tendency that as metacognitive awareness of group members increases, academic performance also increases, although this trend appears to be less pronounced among non-group members.

Limitations and future directions

Among the limitations of the study are factors that reduce the external validity of the research, such as convenience sampling. Psychology and special education students may participate in different types of groups than students in other fields. There are also

shortcomings in the measurement of the moderator variable, as group membership as an extracurricular activity was examined with only one question. More precise conclusions could be drawn by specifying the exact type of group. Additionally, it would be worth investigating how participation in different types of groups (Behtoui, 2019; Morris, 2019) influences the relationship between metacognitive awareness and academic performance. Co-curricular group membership, scientific group memberships may have a greater impact on academic performance than voluntary or other non-scientific group memberships. Clarifying these data would enhance the interpretation of the results and the internal validity of the research. Additionally, it would be worthwhile to examine how the number of groups (Batool & Ahmad, 2020; Sami et al., 2020), their diversity (different types), and the duration of group memberships influence the relationship between metacognitive awareness and academic performance.

7. Conclusions

The results of the study draw attention to the beneficial effects of various extracurricular and co-curricular groups on the development of higher-order cognitive processes and metacognitive awareness. Establishing, organizing, and supporting post-schooling learner or other types of groups are opportunities for developing metacognition, which contributes to both increased academic performance and success in later life. Group memberships enhance the understanding of lexical knowledge, facilitate the transformation of declarative knowledge into procedural and then into conditional knowledge. The practical application of knowledge learned in groups for solving real-life situations draws students' attention to the practical applicability of what they have learned, providing a fertile ground for the development of metacognitive regulatory skills.

Authors note:

Andrea Barta is an Assistant Professor with a Ph.D. at the Babeş-Bolyai University. She has participated in national and international conferences and has published articles in national and international scientific indexed journals and volumes. Mainly conducts and publishes cognitive psychological research focusing on the study of metacognitive processes and critical thinking.

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Borbála Tamás is an Assistant Professor at the Babeş-Bolyai University. Borbála has participated in national and international conferences and scientific research groups. Her scientific interest involves aesthetic judgment, decision-making, and the investigation of the effect of visual art education on several cognitive processes.

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