INVESTIGATES HOW INTRINSIC AND EXTRINSIC MOTIVATION INFLUENCE PARTICIPATION IN MATHEMATICS EXTRACURRICULAR ACTIVITIES IN BEIJING'S ELEMENTARY SCHOOLS

Zhang Xingshi

Universitas Pendidikan Ganesha, Bali, Indonesia
zxsh1299@hotmail.com

ABSTRACT

Al assistance and rewards (extrinsic motivation), predict participation in MEAs. As mathematics remains a foundational component of STEM education, encouraging early participation in mathematics extracurricular activities (MEAs) is increasingly seen as a strategy to deepen interest and strengthen skills outside of the formal classroom. This study investigates the predictive roles of intrinsic motivation (e.g., enjoyment, curiosity, and pride in math) and extrinsic motivation (e.g., parental encouragement, rewards, and recognition) in shaping participation in MEAs among elementary students in Beijing's Chaoyang District. Guided by Self-Determination Theory and Expectancy-Value Theory, the research employed a quantitative approach involving 200 students aged 9–13 from five public elementary schools. Data were collected using a structured Likert-scale questionnaire, and analyzed through descriptive statistics, Spearman correlation, and multiple regression analysis. Results revealed that both intrinsic and extrinsic motivation were strongly and positively correlated with participation in MEAs. However, multiple regression analysis showed that extrinsic motivation was the stronger and statistically significant predictor, while the effect of intrinsic motivation was weaker and not significant when both variables were analyzed together. These findings suggest that, within this population, external support mechanisms such as rewards, competitions, and adult encouragement play a more influential role than internal interest in driving participation. The study highlights the importance of leveraging extrinsic motivators to promote involvement in math ECAs during early education, while gradually nurturing intrinsic interest to support long-term mathematical development.

Keywords: Extracurricular Activities, Intrinsic Motivation, Mathematics Education, Student Motivation

INTRODUCTION

In an increasingly knowledge-driven global economy, mathematics education plays a crucial role in shaping cognitive development and preparing students for future academic and professional challenges. The ability to think critically, solve problems, and apply logic is not only central to mathematics but also essential for broader participation in the fields of science, technology, engineering, and mathematics (STEM). Recognizing this, many education systems around the world are placing greater emphasis on early mathematical engagement, particularly during elementary schooling, when foundational attitudes and skills are formed.

A growing body of educational research highlights the importance of extracurricular mathematics activities (MEAs), such as math clubs, contests, puzzles, and exploratory workshops, as a complementary strategy to classroom instruction. These activities provide students with informal, interest-driven opportunities to interact with mathematics in engaging and often collaborative environments. By doing so, MEAs can help demystify the subject, build confidence, and foster a sense of enjoyment and ownership in mathematical learning.

However, despite their potential benefits, not all students engage equally in MEAs. Participation rates vary significantly depending on several psychological and environmental factors. One of the most critical among these is motivation — the internal and external forces that influence a student's willingness to take part in and persist with learning activities. In the context of education, motivation is often conceptualized in two broad categories: intrinsic motivation, which refers to engagement driven by personal interest, enjoyment, or the inherent

value of the activity; and extrinsic motivation, which involves external rewards or pressures such as praise, parental approval, grades, or competition outcomes.

The current study is situated within this theoretical framework and seeks to explore how these two forms of motivation influence elementary students' engagement in MEAs. Specifically, the research is conducted in Beijing's Chaoyang District, a rapidly modernizing urban area where academic performance is highly emphasized, and parental involvement in education is substantial. This setting provides a unique context to examine how cultural, familial, and institutional dynamics intersect with student motivation.

While there is substantial literature on motivation in general classroom learning, far less is known about its role in extracurricular academic participation, particularly in younger children and in non-Western contexts like China. Studies in Western contexts have found that intrinsic motivation tends to be a stronger and more sustainable predictor of long-term academic success. However, in East Asian societies, extrinsic motivators, especially parental expectations and achievement-based incentives, often play a prominent role. This creates an important area for empirical investigation: How do these motivational forces operate in tandem or in conflict when it comes to non-mandatory, math-focused extracurricular involvement among elementary-aged students? By examining this question, the study aims to contribute to both theoretical understanding and practical approaches to enhancing student engagement in mathematics. The findings could help educators and policymakers design interventions that effectively support student motivation, tailor extracurricular programs to developmental needs, and ultimately foster a positive and enduring relationship with mathematics from a young age.

Despite growing recognition of the importance of extracurricular mathematics activities (MEAs) in fostering deeper learning, creativity, and positive attitudes toward mathematics, there remains a limited understanding of what actually motivates elementary school students to participate in these programs. While numerous studies have explored the role of motivation in general academic achievement, much of the existing literature focuses on older students or formal classroom settings, often overlooking how motivational factors operate in informal or voluntary learning environments such as MEAs. This gap is particularly evident in the context of early education, where students are just beginning to form their academic identities, and where motivational influences can have long-lasting effects on their relationship with subjects like mathematics.

Furthermore, most studies on student motivation in mathematics have been conducted in Western contexts, where individualistic values and self-expression are often emphasized. In contrast, less is known about how intrinsic and extrinsic motivators function in collectivist cultures, such as China, where educational pressure, parental expectations, and societal emphasis on academic success may shape student behavior differently. In Beijing's highly competitive academic environment, where extracurricular activities are increasingly used to supplement academic performance, it is essential to understand whether students participate in MEAs because they genuinely enjoy mathematics (intrinsic motivation), or because of rewards, recognition, or parental influence (extrinsic motivation).

This lack of context-specific understanding poses a challenge for educators and policymakers seeking to design effective, developmentally appropriate interventions that enhance student engagement in mathematics. Without clarity on which motivational drivers are most influential, particularly in the elementary years, it becomes difficult to create programs that sustain long-term interest and avoid burnout or disengagement. Therefore, this study addresses a critical gap in the literature by investigating how intrinsic and extrinsic motivation influence student engagement in MEAs among elementary school students in Beijing's Chaoyang District. In doing so, it aims to provide evidence-based insights that can inform educational practice, enrich theoretical understanding, and support the design of more effective and motivating math enrichment opportunities for young learners.

This study holds both theoretical and practical significance in the fields of educational

psychology and mathematics education. From a theoretical standpoint, the research contributes to a deeper understanding of how intrinsic and extrinsic motivational factors influence student engagement, particularly in informal learning contexts such as mathematics extracurricular activities (MEAs). By grounding the study in Self-Determination Theory and Expectancy-Value Theory, it offers empirical evidence on how these frameworks apply to elementary-aged students in a non-Western educational setting. This is especially valuable given the current imbalance in the literature, where most studies on student motivation are centered in Western contexts and focus on older student populations. The study's focus on young learners in Beijing provides new insights into how cultural, social, and developmental factors interact with motivational constructs in the early stages of education.

Practically, the findings of this study offer important implications for educators, school administrators, and policymakers. Understanding the relative influence of intrinsic and extrinsic motivation can help schools design more engaging and developmentally appropriate MEAs that align with students' interests and needs. For instance, if intrinsic motivation proves to be a stronger predictor of engagement, educators might prioritize activities that promote curiosity, enjoyment, and autonomy in mathematical exploration. On the other hand, insights into the role of extrinsic motivators—such as rewards, recognition, or parental involvement—can guide the development of supportive structures that encourage participation without undermining students' internal drive to learn. Policymakers can also benefit from the findings by formulating policies that allocate resources to enrichment programs and teacher training focused on motivation-based strategies.

Overall, this study aims to bridge the gap between theory and practice, offering actionable knowledge that can enhance the quality and effectiveness of mathematics education. By focusing on the motivational foundations of student engagement in MEAs, it supports the creation of learning environments that not only improve academic outcomes but also nurture a lifelong interest in mathematics among young learners. To measure the levels of intrinsic motivation, extrinsic motivation, and engagement in mathematics extracurricular activities (MEAs) among elementary students in Beijing's Chaoyang District.

THEORETICAL FRAMEWORK

Expectancy-Value Theory (EVT)

Expectancy-Value Theory (EVT), developed by Eccles and her colleagues (Eccles et al., 1983), is a widely recognized theoretical framework for understanding student motivation and achievement-related behavior. According to EVT, individuals are more likely to engage in a task if they believe they can succeed at it (expectancy beliefs) and if they value the task (subjective task values). These two dimensions—expectancy and value—not only predict students' academic performance but also their decisions to engage in academic behaviors such as course selection, persistence, and participation in enrichment programs.

Expectancy beliefs refer to students' perceptions of their own competence or likelihood of success in a specific activity. A student who believes they are capable of succeeding in mathematics, for example, is more likely to invest effort and voluntarily participate in math-related extracurricular activities. Complementing expectancy, task values are defined in four subcategories: intrinsic value (interest or enjoyment in the task), utility value (perceived usefulness for future goals), attainment value (importance of doing well to affirm identity), and cost (perceived negative aspects such as effort, time, or emotional strain) (Wigfield & Eccles, 2000). These components jointly influence a student's motivation to pursue learning opportunities, especially those that are optional or voluntary.

In mathematics education, EVT has been used extensively to explain students' choices and motivation. Eccles and Wigfield (2002) found that students with high perceived ability and value for mathematics were significantly more likely to persist in math-related activities and

courses. Similarly, Simpkins, Davis-Kean, and Eccles (2006) demonstrated that expectancy-value constructs predicted not only classroom engagement but also students' participation in mathematics extracurricular programs over time. These findings support the view that when students believe in their capabilities and see personal value in the subject, they are more inclined to engage deeply, even outside of required coursework.

Further extending this perspective to informal or extracurricular learning, Nagengast et al. (2011) investigated students' participation in out-of-school STEM programs and found that both intrinsic and utility value significantly predicted sustained involvement. Likewise, Lau and Roeser (2002) observed that middle school students with high interest and self-perceived competence in mathematics were more likely to join math clubs and competitions. These studies affirm the relevance of EVT in understanding not only formal academic behaviors but also voluntary extracurricular engagement.

However, despite its widespread application, several gaps remain in EVT research, particularly as it pertains to younger learners and non-Western contexts. Much of the existing literature focuses on adolescents or high school students, while elementary-aged children—who are still forming their academic self-concept and task values—remain underrepresented. Additionally, most EVT-based studies are situated in Western education systems where individual interest and self-directed learning are emphasized. In collectivist cultures like China, external influences such as parental expectations and academic pressure may play a more prominent role in shaping students' decisions to participate in extracurricular activities (Chen & Ho, 2012). Yet few studies have quantitatively explored how these extrinsic factors interact with internal task values in predicting student engagement.

This study addresses these gaps by applying the EVT framework to elementary school students in Beijing, with a specific focus on their participation in mathematics extracurricular activities. By investigating both intrinsic motivators (e.g., interest and enjoyment) and extrinsic influences (e.g., parental involvement and rewards), the study provides a more nuanced understanding of how expectancy-value beliefs operate in early educational contexts. In doing so, it contributes to the limited body of research on motivation and engagement in MEAs among young learners, particularly within East Asian academic cultures, and offers evidence that can inform both theory and educational practice.

Expectancy-Value Theory (EVT)

Self-Determination Theory (SDT), developed by Deci and Ryan (1985), is a leading theoretical framework for understanding motivation in educational settings. At its core, SDT posits that human motivation is driven by the satisfaction of three basic psychological needs: autonomy, competence, and relatedness. Autonomy refers to the individual's need to feel agency and ownership over their actions; competence involves the need to feel effective and capable of achieving outcomes; and relatedness pertains to the need to feel connected and accepted by others (Deci & Ryan, 2000). When these needs are fulfilled, learners are more likely to develop intrinsic motivation, which is characterized by engaging in an activity out of interest, enjoyment, or inherent satisfaction rather than for external rewards or pressures.

In school settings, SDT has been widely used to explain students' motivation, engagement, and performance. Numerous studies demonstrate that when students perceive their learning environments as autonomy-supportive, they exhibit higher levels of engagement and academic achievement (Ryan & Deci, 2002). For example, Guay et al. (2008) found that high school students who felt their teachers supported their autonomy were more motivated to engage in learning and performed better academically. Similarly, Niemiec and Ryan (2009) emphasized the importance of classroom contexts that support all three SDT needs in promoting self-regulated learning. In mathematics education specifically, Jang, Reeve, and Deci (2010) showed that when math teachers encouraged student choice and provided meaningful rationales for tasks, students experienced enhanced autonomy and engagement.

While most SDT-based studies focus on formal classroom settings, emerging research has begun to explore how the theory applies to extracurricular academic contexts, such as math clubs and competitions. Jeno et al. (2018) applied SDT to out-of-school science learning and found that students' intrinsic motivation was significantly higher in autonomy-supportive environments. Similarly, Wang and Liu (2020) reported that students participating in voluntary math programs showed greater persistence and enjoyment when their competence and relatedness needs were fulfilled. These findings suggest that SDT is a valuable lens through which to understand voluntary academic participation, where students are not bound by curriculum but instead choose to engage based on personal interest or support structures.

Despite these promising results, several gaps remain in the application of SDT to younger students and to extracurricular academic engagement. Much of the literature centers on adolescents or college students, with less attention given to elementary-aged children who are in the early stages of forming motivational orientations. Additionally, most research is based in Western contexts, where individual autonomy is highly valued. In contrast, in collectivist cultures such as China, relatedness and external expectations—especially from parents—may play a stronger role in shaping motivation. This raises questions about the universality of SDT's constructs and their relative influence in different cultural and developmental settings.

This study addresses these gaps by applying Self-Determination Theory to the examination of motivation among elementary school students engaged in mathematics extracurricular activities in Beijing. By quantitatively assessing how autonomy, competence, and relatedness influence engagement in MEAs, this research contributes to a more context-sensitive understanding of intrinsic motivation in early education. Furthermore, it extends the use of SDT beyond the classroom and into informal learning environments, thereby offering insights that are both theoretically significant and practically relevant for educators and program designers seeking to foster lasting engagement in mathematics.

Intrinsic and Extrinsic Motivation in Mathematics Education

Motivation plays a central role in shaping students' learning behaviors, attitudes, and long-term engagement with academic subjects—particularly mathematics, a discipline often perceived as abstract and challenging. Within the framework of educational psychology, motivation is commonly categorized as either intrinsic or extrinsic, each offering distinct pathways to engagement. While intrinsic motivation stems from internal satisfaction and interest in the task itself, extrinsic motivation is driven by external factors such as rewards, recognition, or social approval. Understanding how these motivational types function in mathematics education—especially in the context of extracurricular learning—is essential for designing effective and developmentally appropriate interventions.

Intrinsic motivation is characterized by a student's natural curiosity, enjoyment, and desire to explore or master a task. In mathematics, intrinsic motivation is often reflected in behaviors such as voluntarily solving puzzles, engaging with math games, or asking exploratory questions that go beyond the curriculum. Core components include enjoyment, curiosity, challenge-seeking, interest, and a sense of purpose in learning (Ryan & Deci, 2000). Research has consistently shown that students who are intrinsically motivated in math demonstrate higher levels of cognitive engagement, greater persistence when faced with difficult problems, and deeper conceptual understanding (Middleton & Spanias, 1999). For instance, Gottfried (1990) found that intrinsic math motivation in elementary school predicted later achievement and positive attitudes toward math throughout secondary education.

The influence of intrinsic motivation extends beyond the classroom and into extracurricular learning environments. Voluntary participation in mathematics extracurricular activities (MEAs)—such as math clubs, competitions, or enrichment workshops—is often driven by a student's internal desire to engage with the subject in a meaningful and enjoyable way. Autonomy-supportive environments, where students are given choice, challenges, and

encouragement to explore math creatively, have been found to foster intrinsic motivation in such settings (Deci et al., 1991). A study by Grolnick and Ryan (1987) highlighted that students participating in enrichment math programs reported higher levels of interest and self-directed learning compared to those involved in only traditional instruction. These findings suggest that nurturing intrinsic interest is not only crucial for academic success but also a key factor in sustained engagement with mathematics outside of formal education.

In contrast, extrinsic motivation involves performing a task to obtain external rewards or avoid negative consequences. In the context of mathematics education, this includes parental encouragement, grades, competition results, praise from teachers, and material rewards. Extrinsic motivators can play a functional role in initiating student engagement, particularly for tasks that students may not initially find enjoyable or valuable. For example, students may join a math competition to gain recognition or meet parental expectations, rather than from a genuine interest in the subject. While such motivations can boost short-term engagement, research has raised concerns about their sustainability and potential unintended effects. Lepper et al. (1973) found that excessive reliance on extrinsic rewards could undermine intrinsic motivation, particularly when the activity is initially enjoyable. This phenomenon, known as the "overjustification effect," suggests that if students begin to associate math engagement primarily with rewards or pressure, their internal interest may diminish over time.

Empirical evidence on the effectiveness of extrinsic motivation in math education presents conflicting findings. Some studies report that extrinsic motivators—such as parental involvement and academic pressure—positively correlate with math achievement, especially in high-stakes educational cultures (Ng, 2003). However, others caution that an overemphasis on performance and external approval can lead to anxiety, surface learning strategies, and disengagement when rewards are removed (Tang & Chaw, 2016). These discrepancies may be partly explained by cultural variations in motivational norms. In East Asian societies, including China, extrinsic factors such as family expectations and societal pressure are deeply embedded in the educational experience. Within such contexts, extrinsic motivators may not necessarily conflict with learning goals but rather coexist with internalized values, a phenomenon referred to as "integrated regulation" in Self-Determination Theory (Chirkov et al., 2003).

Despite growing awareness of these motivational dynamics, relatively few studies have directly compared the predictive strength of intrinsic versus extrinsic motivation on elementary students' engagement in MEAs—particularly within non-Western settings. Moreover, there is limited quantitative research investigating how these motivational factors interact to influence voluntary academic participation at early developmental stages. This study responds to these gaps by examining how both intrinsic and extrinsic motivation predict student engagement in mathematics extracurricular activities among elementary school students in Beijing's Chaoyang District. In doing so, it contributes to a deeper and more culturally grounded understanding of how motivation shapes learning beyond the classroom and offers implications for educators designing enrichment programs that foster both immediate involvement and long-term interest in mathematics.

METHOD

This study employed a quantitative correlational research design to explore the relationship between intrinsic and extrinsic motivation and student engagement in mathematics extracurricular activities (MEAs) among elementary school students in Beijing's Chaoyang District. The approach allowed for the systematic measurement of motivational constructs and engagement levels, and the identification of statistically significant relationships among these variables.

The participants were 200 students aged 9 to 13 years, drawn from five public elementary schools selected through purposive sampling. These schools were chosen based on the availability of active mathematics extracurricular programs and their willingness to

collaborate with the study. The participant group included students from Grades 4 to 6, who were in a developmental stage where motivational patterns and learning preferences are particularly influential.

The main data collection instrument was a structured Likert-scale questionnaire, designed to quantitatively capture levels of motivation and engagement. The questionnaire was divided into three sections. The Intrinsic Motivation Scale included items that measured students' interest, enjoyment, curiosity, and willingness to engage with mathematics for its own sake. The Extrinsic Motivation Scale assessed students' motivation driven by external rewards and expectations, including parental encouragement, grades, and competition. The Student Engagement Scale focused on behavioral, emotional, and cognitive indicators of participation in MEAs. Each item was rated on a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree, enabling standardized measurement and comparative analysis.

The questionnaire was adapted from validated instruments in existing educational psychology literature and translated into Mandarin Chinese to ensure cultural and linguistic relevance. Prior to full deployment, a pilot test was conducted with a sample of 30 students to evaluate item clarity, internal consistency, and overall reliability. Based on the pilot results, minor revisions were made for clarity, and Cronbach's alpha coefficients exceeded 0.70 for all subscales, indicating acceptable levels of reliability.

The data collection procedure was conducted in coordination with participating schools. The questionnaires were administered during school hours in a controlled setting by trained research assistants. Students were briefed about the study's purpose and assured that their responses would remain confidential and used solely for research. Participation was voluntary, and consent was obtained from both students and their guardians. For data analysis, the responses were entered into SPSS statistical software. Descriptive statistics were calculated to summarize the overall levels of intrinsic motivation, extrinsic motivation, and engagement. Pearson correlation analysis was employed to explore the strength and direction of the relationships among the variables. Additionally, multiple linear regression analysis was used to assess the predictive power of intrinsic and extrinsic motivation on student engagement in MEAs. This analysis enabled the identification of which type of motivation had a stronger statistical influence on engagement, while controlling for the other.

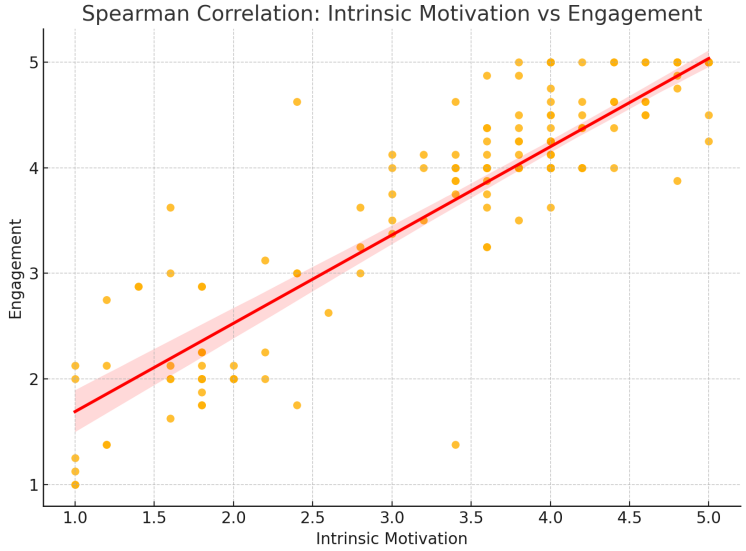
FINDINGS AND DISCUSSION

This section presents and interprets the results of the study, organized around the research questions. The findings are discussed in relation to previous literature and theoretical frameworks, particularly Self-Determination Theory (SDT) and Expectancy-Value Theory (EVT). The results provide insights into how intrinsic and extrinsic motivational factors influence elementary students' engagement in mathematics extracurricular activities in the Chaoyang District of Beijing.

Results related to RQ1

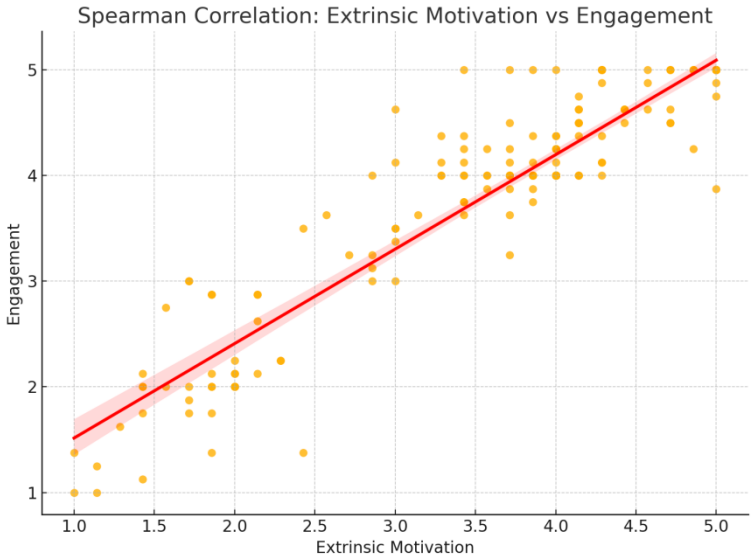
To address Research Question 1, which explored the relationship between intrinsic motivation and student engagement in mathematics extracurricular activities (MEAs), a Spearman correlation analysis was conducted due to the non-normal distribution of at least one variable. The results revealed a very strong positive correlation between intrinsic motivation and engagement, with a Spearman's rho (ρ) of 0.834 and a p-value < 0.000001, indicating that the association is not only statistically significant but also highly robust. This finding suggests that students who report higher levels of intrinsic motivation—such as enjoying math challenges, taking pride in solving problems, and feeling curious about mathematical concepts—are substantially more likely to be engaged in MEAs. The strength of the correlation confirms that intrinsic factors are a major driver of participation, particularly in voluntary, enrichment-based learning contexts. This aligns with Self-Determination Theory, which

emphasizes the role of internal psychological needs—such as autonomy, competence, and enjoyment—in promoting sustained engagement. The strong association also reinforces earlier findings by Gottfried (1990) and Jang et al. (2010), who identified intrinsic interest as a reliable predictor of academic persistence and enthusiasm. Practically, the results underscore the importance of designing math programs that not only teach skills but also foster joy, curiosity, and a sense of personal challenge. Initiatives that emphasize creative problem-solving, hands-on exploration, and learner autonomy may be especially effective in cultivating deeper, more enduring engagement among elementary students in MEAs.



Results related to RQ2

To examine Research Question 2, which investigated the relationship between extrinsic motivation and student engagement in mathematics extracurricular activities (MEAs), a Spearman correlation analysis was conducted due to the non-normal distribution of the dataset. The analysis revealed a very strong positive correlation between extrinsic motivation and engagement, with a Spearman's rho (ρ) of 0.858 and a p-value less than 0.000001, indicating an exceptionally high level of statistical significance. This result confirms that students who are more influenced by external motivators—such as rewards, teacher and parent encouragement, or the perceived real-world value of math—are also more likely to be engaged in MEAs. The strength of this relationship highlights the powerful role that structured support, recognition, and incentive-based strategies can play in enhancing student participation, especially in early educational stages. These findings align with previous research (e.g., Ng, 2003; Chirkov et al., 2003), which suggests that in collectivist cultures like China, extrinsic motivators are often internalized and can effectively drive academic behavior. Interestingly, this correlation ($\rho = 0.858$) is even stronger than that observed for intrinsic motivation ($\rho = 0.834$), suggesting that external factors currently exert a slightly greater influence on engagement than internal enjoyment or curiosity. This may reflect the developmental stage of elementary students, who often respond more immediately to external validation and structure. From a practical perspective, the results suggest that MEAs designed to incorporate competition, public recognition, real-world relevance, and family or teacher support may be especially effective in increasing student participation. However, while extrinsic motivation appears to be a strong driver, educators should be mindful of balancing it with strategies that gradually cultivate intrinsic interest to promote deeper and longer-lasting engagement.



Results related to RQ3

To address Research Question 3, which sought to determine which type of motivation—intrinsic or extrinsic—better predicts student engagement in mathematics extracurricular activities (MEAs), a multiple regression analysis was conducted. The model yielded a very high R^2 value of 0.862, indicating that 86.2% of the variance in student engagement could be explained by the combination of intrinsic and extrinsic motivational factors. This suggests an excellent model fit and confirms that motivation, in both its forms, plays a substantial role in shaping engagement levels. However, when analyzing the unique contribution of each predictor, extrinsic motivation emerged as the dominant factor, with a standardized coefficient (β) of 0.733 and a p-value < 0.001, confirming it as a statistically significant and strong predictor of engagement. In contrast, intrinsic motivation showed a much smaller coefficient ($\beta = 0.162$) and a p-value of 0.058, indicating it was not statistically significant at the conventional alpha level ($\alpha = 0.05$). These results suggest that while intrinsic motivation correlates positively with engagement, its unique predictive power diminishes once extrinsic motivation is accounted for.

One limitation observed in the model is the presence of high multicollinearity, as reflected in Variance Inflation Factor (VIF) values of approximately 11.8 for both predictors. This indicates that intrinsic and extrinsic motivation are strongly related constructs, which may affect the stability of their individual coefficients. Nonetheless, the regression clearly demonstrates that, in this context, extrinsic motivation contributes more substantially to explaining engagement than intrinsic factors. This outcome is particularly relevant given the developmental stage of the participants—elementary school students—who are likely more influenced by external structures such as praise, rewards, and adult encouragement. These findings are consistent with cultural expectations in East Asian education systems, where external reinforcement is deeply embedded in learning environments (Ng, 2003; Chirkov et al., 2003).

In conclusion, the results indicate that extrinsic motivation is the stronger predictor of engagement in MEAs among elementary students in Beijing. Educational programs aiming to increase participation should continue leveraging external supports such as structured guidance, competitions, and recognition. However, it is equally important to gradually integrate intrinsic motivators, such as autonomy and curiosity, to foster deeper personal investment in mathematics over time. Doing so may ensure not only initial participation but also sustained and meaningful engagement as students mature.

Predictor	Coefficient (b)	Std. Error	t-value	p-value
Intrinsic Motivation	0.162	0.085	1.911	0.058
Extrinsic Motivation	0.733	0.088	8.338	< 0.001

CONCLUSION

This study explored the role of intrinsic and extrinsic motivation in shaping student engagement in mathematics extracurricular activities (MEAs) among elementary school students in Beijing's Chaoyang District. Grounded in Self-Determination Theory (SDT) and Expectancy-Value Theory (EVT), the research examined the extent to which students' internal desires (e.g., curiosity, enjoyment) and external influences (e.g., rewards, recognition, and parental or teacher support) predict their level of engagement in voluntary math-based enrichment activities.

The findings reveal several important insights. First, both intrinsic and extrinsic motivation were found to be strong and statistically significant predictors of student engagement in MEAs. Spearman correlation analysis showed that intrinsic motivation had a robust positive relationship with engagement ($\rho = 0.834$), indicating that students who enjoy math for its own sake, take pride in problem-solving, and prefer challenging activities are more likely to participate actively in MEAs. Likewise, extrinsic motivation demonstrated an even stronger positive correlation ($\rho = 0.858$), highlighting the powerful role of structured rewards, encouragement, and contextual supports in fostering engagement.

However, when the predictive strength of both motivational types was examined together through multiple regression analysis, extrinsic motivation emerged as the stronger predictor. With a standardized beta coefficient of 0.733 ($p < 0.001$), extrinsic factors exerted a more dominant influence than intrinsic motivation, which had a non-significant coefficient ($\beta = 0.162$, $p = 0.058$). This suggests that, within this population, students are more likely to engage in math enrichment activities in response to external validation and structured reinforcement than to internal enjoyment alone. This finding aligns with the cultural and developmental context of the study—elementary school children in a collectivist, high-performance academic environment—where external expectations and structured supports play an influential role in shaping behavior.

Despite this, the role of intrinsic motivation should not be understated. While it may not have shown the strongest predictive power in the regression model, it still demonstrated a substantial positive correlation with engagement and remains essential for sustaining long-term interest, deeper learning, and personal growth. Programs that over-rely on extrinsic motivators may risk undermining internal interest over time if not carefully balanced.

In conclusion, this study emphasizes the need for a dual approach to motivation in MEAs. While leveraging extrinsic motivators such as recognition, rewards, and parental involvement can effectively boost participation in the short term, embedding opportunities for autonomy, curiosity, and personal relevance is crucial for developing enduring engagement. For educators and policymakers, the results underscore the importance of designing MEAs that align with both external support structures and internal motivational needs to optimize student participation and foster a meaningful relationship with mathematics from an early age.

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