Learners' Participation in Mathematics Spiral Curriculum and Academic Grit as Mediated by Parental Involvement: Basis for Action Plan

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ABSTRACT

The Department of Education of the Philippines introduced the Mathematics Spiral Curriculum to enhance learners' understanding by revisiting concepts with increasing complexity across grade levels. This study aimed to determine the mediating effect of parental involvement on the relationship between learners' participation in the Mathematics Spiral Curriculum and their academic grit among Grade 10 students in Inabanga North District during the first semester of School Year 2025–2026. It assessed participation in terms of discussion, peer collaboration, and problem-solving activities; parental involvement as motivator, resource provider, monitor, Mathematics content advisor, and learning counselor; and the level of academic grit, including the relationship among variables and the mediating role of parental involvement. A quantitative, non-experimental mediation design was employed using a structured survey questionnaire adapted from validated instruments. A total of 141 Grade 10 students from three secondary schools participated using purposive sampling Data were analyzed using weighted mean, standard deviation, Pearson Product-Moment Correlation, and Structural Equation Modeling (SEM). Findings revealed that learners' participation, parental involvement, and academic grit were at high levels. Moreover, parental involvement significantly mediated the relationship between participation and academic grit. The study concludes that active participation in Mathematics, supported by meaningful parental involvement, plays a vital role in strengthening learners' academic grit. However, lower engagement in problem-solving and the limited instructional role of parents indicate the need to enhance classroom strategies and home support. Future researchers may conduct similar studies across other grade levels and explore emotional resilience as a related variable to better understand how learners cope with academic challenges and sustain their learning efforts.

Keywords: Mathematics Spiral Curriculum, learner participation, academic grit, parental involvement, mediating effect, problem-solving

INTRODUCTION

Education plays a vital role in national development by equipping learners with the knowledge, skills, and values needed to succeed in a dynamic society. Mathematics, as a core discipline, fosters logical reasoning, analytical thinking, and problem-solving abilities essential for life. Under the K to 12 Curriculum, the Spiral Progression Approach was introduced to build mathematical understanding through the gradual reinforcement of concepts across grade levels.

Despite the intended benefits of the spiral curriculum in enhancing learners' understanding through continuous reinforcement of concepts, Filipino students continue to struggle in mathematics, as reflected in the 2022 PISA results where they scored 355, far below the OECD average of 472, indicating difficulties in applying learned concepts. Similarly, the 2023 NAT results in Inabanga North District on Mathematics show low proficiency in higher order thinking skills, with mean scores of 38.54% in problem solving, 37.50% in information literacy, and 41.88% in critical thinking. These findings suggest that current instructional approaches may be insufficient, highlighting the need for targeted, context specific interventions to improve learners' mathematical competencies.

Parental involvement has long been linked to academic success, as parents provide both academic and emotional support that sustain student engagement. Likewise, academic grit defined as perseverance and passion toward

long-term goals is vital in mastering mathematics. Yet, grit can be influenced by external factors such as parental guidance.

Although studies have examined the effects of curriculum design, parental involvement, and academic grit independently, there is a paucity of research exploring how these variables interact. In particular, there is limited empirical evidence on whether and how parental involvement mediates the relationship between the spiral curriculum in Mathematics and students' academic grit. Addressing this gap is essential to understand the mechanisms through which curriculum reforms and home-based support contribute to students' perseverance and mathematical competence.

The foundation of education in the Philippines is enshrined in the 1987 Philippine Constitution, Article XIV, which underscores the State's duty to protect and promote the right of all citizens to quality education at all levels. These constitutional provisions provide the overarching legal basis for curricular innovations, such as the spiral progression in Mathematics, ensuring that reforms are aligned with the broader national goal of accessible and quality education for all.

The spiral progression approach in Mathematics is primarily grounded in Republic Act No. 10533, or the Enhanced Basic Education Act of 2013, which mandates the K to 12 Basic Education Program. This law provides for a curriculum that is seamless, decongested, and developmentally appropriate, ensuring that competencies are introduced early and revisited with increasing depth and complexity as learners advance through grade levels.

The legal mandate of the spiral progression approach is further reinforced by the Department of Education Order No. 31, series of 2012, which lays out the policy guidelines for the implementation of the K to 12 curriculum. This order explicitly requires the use of a spiral curriculum in Mathematics and Science, where key concepts are taught progressively to strengthen mastery across grade levels.

According to Bruner's Spiral Curriculum Theory (1960), posits that subject can be taught effectively to learners at any stage of development, provided it is presented in an intellectually honest form and revisited over time. This framework supports the design of the K to 12 Mathematics curriculum, where concepts are introduced simply and expanded in greater sophistication across grade levels.

The Hoover-Dempsey and Sandler Model of Parental Involvement as emphasized by Hoover-Dempsey, et al. (2005) explains that family engagement is a continuous process that starts with parents' decisions to become involved in their child's education and ultimately leads to positive student outcomes. Parental engagement is therefore seen as a crucial factor in shaping students' motivation, attitudes, and performance in Mathematics.

Grit Theory as defined by Duckworth et al. (2021) defines grit as the combination of perseverance and passion for long-term goals, which directly influences a learner's ability to sustain effort and overcome academic challenges. Duckworth (2007) as cited by Harpas et al. (2024), grit is defined as the persistent effort and steady passion a person maintains in pursuing long-term goals, even when faced with obstacles and hardships. It asserts that it is the ability to keep working and stay passionate toward one's goals despite encountering problems, setbacks, or failures along the way.

Introducing the spiral curriculum, this approach has already been widely adopted around the world, serving as a framework in many educational systems that aim to promote continuous and progressive learning across grade levels. According to Bruner (1960) as cited by Ireland and Mouthaan (2020), learning is depicted as a spiral ascending from fundamental to advanced ideas, with subjects revisited at higher levels of complexity as the spiral turns.

Obinna (2021) discussed on the features of spiral curriculum: (1) topics are revisited; (2) increasing difficulty; (3) new learning is related to previous learning; and (4) the competence of students increase, as this progressive gain of competence will happen until the final objectives is attained.

Smith (2022) as cited by Baez, R., et al. (2025) presents the following five steps of the Spiral Teaching and Learning Method (Topics progressively with Increasing Complexity): (1) 'Start with the knowledge and

experience of the participants'; (2) 'Identify Patterns'; (3) 'Add new information and theory linked to the patterns in what people know'; (4) 'Practice skills, strategies, & plan for action'; and, (5) 'Apply what's been learned in the world'.

In Philippines, the government introduced Spiral Curriculum on Mathematics and Science in 2011 as it implemented a new curriculum in the country to cope with global challenges in education (Oliva, 2023). This approach aims to ensure that students develop a deeper understanding of concepts through continuous and progressive learning, where topics are revisited with increasing complexity.

Quijano and the Technical Working Group on Curriculum (2012) asserts that the spiral progression approach helps students retain and master lessons more effectively by allowing them to revisit and explore topics in greater depth as they move to higher grade levels. This means that students can better remember and understand lessons because they repeatedly study the same concepts at deeper and more advanced levels as they progress in school.

According to Angeles (2013) as cited by Hazel and Alegre (2019), the spiral progression approach, being child-centered, focuses on enhancing students' understanding through discussion, peer collaboration, and problem-solving activities. This means that the spiral progression approach promotes active learning by engaging students in interactive discussions, teamwork, and problem-solving to deepen their grasp of concepts.

There had been a lot of debates whether the DepEd's implementation of Spiral Curriculum on Mathematics is effective or not. Assessment like PISA on 2022 revealed that the Philippines scored 355 points, scored two points better that in 2018 which scored 353 points. In the OECD report, the Philippines, only 16% of students reached the basic proficiency level in mathematics, which is far lower compared to the 69% average among students from OECD countries. Also, in the National Achievement Test (NAT) results in 2024 reveals that in the national average of Mathematics for Grade 12 Math show that students are at a "Low Proficiency" level, with the national average score being 41.12%.

According to Igcasama (2021), teachers, students, and schools were not fully prepared for the transition to the Spiral Curriculum, as the shift demanded considerable adjustments in instructional strategies, learning approaches, and institutional readiness.

In a similar vein, Yap (2019) emphasized that it remains uncertain whether teachers are effectively conveying the fundamental principles of mathematics and whether students are comprehensively grasping these concepts during their formative years, which may hinder their progression in higher mathematics.

Furthermore, Futalan and Mamhot (2018) revealed that some mathematical topics introduced in higher grade levels were not adequately taught or reinforced in preceding years, resulting in learning gaps that contribute to students' mathematical anxiety and diminished confidence in the subject.

Reynoso (2024) reveals that while teachers possess a moderate understanding of the principles of spiral progression and content mapping, they continue to encounter major challenges in its implementation. On the students' part, issues such as low motivation, limited parental support, and lack of learning continuity hinder effective learning. Teacher-related difficulties include insufficient training opportunities, limited instructional time, and an overloaded curriculum that restricts focused instruction. Additionally, schools struggle with inadequate instructional materials and the practice of mass promotion, both of which further compromise the effectiveness of the spiral curriculum.

On a positive note, the Spiral Curriculum in Mathematics has been observed to yield beneficial effects on students' academic performance. According to Bautista (2025), students are developing effective problem-solving skills and satisfactory critical thinking abilities, alongside a solid understanding of mathematical concepts. Also, students indicated that their Mathematics teachers provided them with adequate support to work collaboratively during the discussion and problem-solving activities under the implementation of the Spiral Progression Approach (Rico & Baluyos, 2021).

On the other hand, grit is also described as the passion and determination to pursue long-term goals despite

hardships and obstacles. It serves as a dynamic personal strength that helps individuals cope with their own struggles and handle challenging or critical situations (Lozano-Jiménez et al., 2021). Determination and resilience are associated with perseverance of effort (PE) as they involve sustained effort in overcoming challenges to achieve long-term goals, while resilience and focus align with consistency of interest (CI) since they reflect continuous commitment and prioritization of academic goals over time (Clark & Malecki, 2019).

Oriol, et al. (2017) as cited by Allen, et al. (2021) asserts that their perseverance in continuing the pursuit of academic goals results in a heightened belief in their own academic abilities, which in turn increases their chances of achievement.

Tudy (2014) supports the present findings by emphasizing that positive perception and engagement in Mathematics learning improve student performance. This implies that active participation in the spiral progression approach enhances understanding and sustained effort, leading to better academic outcomes.

In the same vein, Veladat and Mohammadi (2011), as cited in Batidor and Casinillo, (2021) describe the spiral progression approach as a teaching strategy that continuously challenges learners through questioning and reflection to achieve learning goals.

Cai, Moyer and Wang (1996) as cited by Asenjo and Regidor (2024) talks on the roles of parental involvement in learning Mathematics. According to them, there are five roles of parental involvement in learning Mathematics: motivator, resource provider, monitor, mathematics content advisor, and mathematics learning counselor. In a similar vein, Asenjo and Regidor (2024) revealed that motivator is the highest among the five while motivator is the lowest. Also, it reveals overall level of parental involvement in learning Mathematics signifies a high level of parental engagement to the students who learns Mathematics.

Fan and Chen (2001) as cited by Salido et al. (2024) stated that motivation is a critical factor in academic achievement in Mathematics. Parents who encourage perseverance and celebrate small successes help sustain student engagement in mathematics.

According to Lachica (2024), parents' monitoring role helps ensure that their children adhere to moral and ethical standards while guiding them through the necessary processes to become proficient in Mathematics, enabling them to apply mathematical concepts and procedures effectively in solving real-life problems.

On the other hand, according to Garcia and Thornton (2014) as cited by Ntekane (2018), involvement of family in learning helps to improve student performance, reduce absenteeism and restore parents' confidence in their children's education.

In addition, according to Chun and Devall (2019) as cited by Nigussie (2021), parental involvement in education with their children in school appears to be a crucial factor for the continuing educational development and success of children in school. Regular and good communication and partnership between teachers and parents are essential for consistent positive experiences both at home and in school.

Furthermore, according to Lemessa et al. (2023), parent involvement is also related to children's behavior in school. As parent involvement increases, children receive higher social skills ratings and show fewer problem behaviors.

According to DeMolen (2023), students have higher academic achievement when parents are involved in their education. When parents are actively engaged in their child's education, it can have an impact on their attendance, behavior, grade retention, and performance.

Lastly, Kang (2022) indicated that both parents' grit and parenting style have a long-term influence on enhancing children's grit. According to him, parents' persistence of interest was found to directly influence children's grit.

Objectives

This study sought to determine the mediating effect of parental involvement on the level of participation of the Mathematics Spiral Curriculum in Mathematics and the academic grit of Grade 10 Junior High School learners in Inabanga North District, 1st semester in the school year 2025-2026.

Specifically, it aimed to answer the following questions:

1. What is the level of learners' participation of the Mathematics Spiral Curriculum in terms of discussion, peer collaboration, and, problem-solving activities?
2. What is the level of parental involvement in Mathematics in terms of motivator; resource provider; monitor; mathematics content advisor; and, mathematics learning counselor?
3. What is the level of academic grit of the learners?
4. Does parental involvement mediate the relationship between the level of participation in Mathematics Spiral Curriculum and academic grit of learners?
5. What action program can be proposed based from the findings of the study?

METHODOLOGY

This study applied a quantitative approach utilizing a non-experimental mediation design. According to Shrout and Bolger (2002), mediation occurs when the effect of an independent variable on an outcome is explained through an intervening variable. In this study, parental involvement served as the mediating variable in the relationship between learners' participation in the Mathematics Spiral Curriculum (independent variable) and academic grit (dependent variable). The study was conducted in the Municipality of Inabanga, Bohol, particularly in the Inabanga North District, which consists of three secondary schools: Cuaming High School, located at Cuaming, Inabanga, Bohol, one of the two islands belong in the municipality of Inabanga, Inabanga North Central Integrated School – Secondary located at Lapacan, Inabanga, Bohol, and San Jose National High School located at San Jose, Inabanga, Bohol.

These schools were selected as they offer classes implementing the spiral curriculum in Mathematics. The respondents of the study were Grade 10 students from the three identified schools. Out of 189 students, only 141 (74.60%) were included in the final sample due to absences and voluntary non-participation. The respondents were chosen as they are direct recipients of the spiral curriculum and can provide relevant data on participation, parental involvement, and academic grit. The study utilized adapted survey questionnaires consisting of three main parts: participation in the Mathematics Spiral Curriculum by Hazel and Alegre (2019) with a reliability index of 0.89 using Cronbach's Alpha, parental involvement by Asenjo and Regidor (2024) with a reliability index of 0.88 using Cronbach's Alpha, and academic grit by Clark and Malecki (2019) with a reliability index of 0.90 using Cronbach's Alpha. The participation instrument included indicators on discussion, peer collaboration, and problem-solving activities; the parental involvement questionnaire covered roles such as motivator, resource provider, monitor, Mathematics content advisor, and learning counselor; while the academic grit scale measured perseverance and consistency of effort.

All instruments used a 5-point Likert scale and were derived from previously validated studies with acceptable reliability indices. In the conduct of the study, the researcher secured permission from the Department of Education – Bohol Division officials, school heads, and concerned authorities. The purpose of the study was explained to the respondents, and informed consent was obtained prior to data collection. The questionnaires were administered personally, and respondents were given sufficient time to answer honestly. Collected data were then organized, tabulated, and prepared for analysis. To analyze the data, weighted mean and standard deviation were used to determine the levels of participation, parental involvement, and academic grit. Pearson Product-Moment Correlation was utilized to examine relationships among variables, while Structured Equation Modeling (SEM) was employed to determine the mediating effect of parental involvement. Ethical considerations were strictly observed, ensuring confidentiality, voluntary participation, and proper handling of respondents' data.

RESULTS AND DISCUSSION

Table 1. Level of Participation of Learners in Mathematics Spiral Curriculum

n = 141

Indicators	Composite Mean (wx)	SD	Interpretation
DISCUSSION	3.67	0.58	High Participation
Peer Collaboration	3.67	0.66	High Participation
Problem-Solving Activities	3.42	0.64	High Participation
Overall Composite Mean	3.59	0.63	High Participation

Table 1 presents the level of participation of learners in the Mathematics Spiral Curriculum in terms of discussion, peer collaboration, and problem-solving activities using weighted mean and standard deviation. Among the indicators, "discussion" obtained the highest composite mean of 3.67 (SD = 0.58) and was interpreted as "high participation". On the other hand, "problem-solving activities" obtained the lowest composite mean of 3.42 (SD = 0.64), though still interpreted as "high participation". All indicators obtained a high level of participation, with an overall composite mean of 3.59 (SD = 0.63), indicating that learners are generally actively engaged in the spiral progression approach. The overall result indicates that learners are generally engaged in the Mathematics Spiral Curriculum, with stronger participation in receptive and interactive activities such as discussion compared to higher-order tasks like problem-solving. This pattern suggests a gap between conceptual understanding and independent application. In line with Bruner's Spiral Curriculum Theory (1960), learning is viewed as a continuous process where concepts are revisited and gradually increased in complexity. This explains why learners show stronger performance in discussion, which relies on recall and reinforcement of prior knowledge, while problem-solving requires deeper cognitive processing and integration of concepts. Furthermore, Bruner (1960), as cited by Ireland and Mouthaan (2020), emphasizes learning as a progressive spiral where understanding deepens over time. While the results show that the spiral approach supports knowledge reinforcement through discussion, the relatively lower performance in problem-solving implies the need for stronger scaffolding to support learners' transition toward higher-order thinking. In support of this, Quijano and the Technical Working Group on Curriculum (2012) assert that spiral progression enhances mastery by revisiting concepts at increasing levels of complexity; however, true mastery is achieved when learners can apply these concepts in varied and complex situations. Therefore, the findings highlight the importance of strengthening guided and scaffolded problem-solving activities to bridge the gap between understanding and application within the spiral curriculum.

Table 2. Parental Involvement of Learners in Mathematics

n = 141

Indicators	Composite Mean (wx)	SD	Interpretation
Motivator	3.69	0.93	High Involvement
Resource Provider	3.52	0.90	High Involvement
Monitor	3.43	0.91	High Involvement
Mathematics Content Advisor	3.48	0.93	High Involvement
Mathematics Learning Counselor	3.43	0.90	High Involvement
Overall Composite Mean	3.51	0.92	High Involvement

Table 2 presents the parental involvement of learners in Mathematics in terms of motivator, resource provider, monitor, mathematics content advisor, and mathematics learning counselor using weighted mean and standard deviation. Among the indicators, "motivator" obtained the highest composite mean of 3.69 (SD = 0.93) and was

interpreted as "high involvement". On the other hand, "monitor" obtained the lowest composite mean of 3.43 (SD = 0.91), though still interpreted as "high involvement". All indicators were interpreted as High, with an overall composite mean of 3.51 (SD = 0.92), indicating that parents are generally highly involved in supporting their children's learning in Mathematics. The overall result indicates that parental involvement in Mathematics is generally strong, with parents more actively engaged as motivators than as monitors or academic supervisors. The closeness of the composite mean values further suggests a generally balanced but slightly uneven distribution of parental roles. In relation to the Hoover-Dempsey and Sandler Model of Parental Involvement (Hoover-Dempsey et al., 2005), parental engagement is driven by parents' belief in their role and their perception of its impact on student success, which ultimately influences learners' academic outcomes. The findings support this model, as parental involvement is shown to positively influence learners' engagement and performance in Mathematics. Similarly, Abera (2018) noted that parental involvement affects both academic and non-academic outcomes, including behavior, attendance, and attitudes toward schooling. Therefore, the results highlight that sustained and balanced parental involvement, particularly strengthening monitoring practices alongside motivation, is essential in enhancing learners' success in Mathematics.

Table 3. Academic Grit of Learners

n = 141

Indicators	Mean (wx)	SD	Descriptive Value	Rank
1. I push myself to do my personal best in school.	4.09	0.93	Mostly like me	2
2. I work toward my academic goals no matter how long they take to reach.	4.09	0.86	Mostly like me	1
3. Even when I could do something more fun, I give schoolwork my best effort.	3.89	0.88	Mostly like me	7
4. I complete my schoolwork no matter how difficult it is.	3.82	0.95	Mostly like me	9
5. I am determined to give my effort in schoolwork.	3.99	0.91	Mostly like me	5
6. Once I set a goal in school, I try to overcome any challenges that arise.	3.79	0.94	Mostly like me	10
7. I am able to balance working hard in school with my other hobbies and interests.	3.89	0.91	Mostly like me	8
8. Even if I am struggling in school, I keep trying my best.	4.06	0.90	Mostly like me	3
9. When it comes to completing work in school, I always try my hardest.	3.94	0.97	Mostly like me	6
10. In school, I work hard to achieve challenging goals.	4.06	0.97	Mostly like me	4
Composite Mean	3.96	0.75	High Grit	

Table 3 presents the academic grit of learners using weighted mean and standard deviation. Among the indicators, the statement number 2 "I work toward my academic goals no matter how long they take to reach" obtained the highest composite mean of 4.09 (SD = 0.86) and was interpreted as "Mostly like me." On the other hand, the statement number 6 "Once I set a goal in school, I try to overcome any challenges that arise" obtained the lowest composite mean of 3.79 (SD = 0.94) and was still interpreted as "Mostly like me." All indicators were interpreted as "High Grit," with an overall composite mean of 3.96 (SD = 0.75), indicating a high level of

academic grit among learners. The overall result indicates that Grade 10 learners demonstrate a generally high level of academic grit, characterized by goal orientation, persistence, and sustained effort in academic tasks. This supports Duckworth's Grit Theory (Duckworth et al., 2007; Duckworth et al., 2021), which defines grit as sustained passion and perseverance toward long-term goals, highlighting that success is achieved through consistent effort over time despite challenges. Also, this is consistent with Oriol et al. (2017) and Clark and Malecki (2019), who argue that grit interacts with environmental conditions, cognitive demands, and motivation levels rather than functioning as a fixed trait. Therefore, the results imply that strengthening learners' resilience and self-regulation strategies may further enhance their academic grit and overall performance in Mathematics.

Table 4. Parental Involvement Mediates the Relationship Between the Level of Participation in Mathematics Spiral Curriculum and Academic Grit of Learners

n = 141

Mediation/Path Estimates

Effect	**Estimate**	**SE**	**Z**	**p-value**
Indirect	0.382	0.0882	4.33	<.001
Level of participation in Mathematics Spiral curriculum → academic grit	0.351	0.1211	2.90	0.004
Parental involvement → academic grit	0.509	0.1071	4.75	<.001
level of participation in Mathematics Spiral curriculum → parental involvement	0.751	0.0712	10.55	<.001
Direct	0.351	0.1211	2.90	0.004
Total	0.733	0.0975	7.52	<.001

Variable	**p-value**	**p-crit**	**Interpretation**	**Decision**
Mediation Analysis Summary	<.001	0.05	Significant	Reject H_0

Table 4 presents the mediating effect of parental involvement on the relationship between the level of participation in the Mathematics Spiral Curriculum and academic grit of learners using structural equation modeling (SEM). On the relationship between the level of participation in the Mathematics Spiral Curriculum and academic grit, the finding shows (Estimate = 0.351, Z = 2.90, p = 0.004). This shows that there is a significant correlation between the level of participation in Mathematics Spiral Curriculum and academic grit. In addition, the finding on the relationship between parental involvement and academic grit which shows (Estimate = 0.509, Z = 4.75, p < .001). This shows that there is a significant correlation between the parental involvement and academic grit. Also, the result on relationship between the level of participation in the Mathematics Spiral Curriculum and parental involvement is significant and positive (Estimate = 0.751, Z = 10.55, p < .001). This demonstrates that there is a significant correlation between the level of participation in Mathematics Spiral Curriculum and parental involvement. The results show a significant indirect effect (Estimate = 0.382, Z = 4.33, p < .001), indicating that parental involvement partially mediates the relationship between learners' participation in Mathematics Spiral Curriculum and their academic grit. This finding supports Bruner's Spiral Curriculum Theory (1960), which emphasizes that learning is strengthened through repeated exposure to concepts with increasing complexity, promoting deeper understanding and persistence over time. It also aligns with Duckworth's Grit Theory (2007), which explains that sustained engagement in challenging academic tasks fosters perseverance and long-term goal commitment. Furthermore, this result is consistent with Tudy (2014), who found that active engagement in Mathematics learning enhances students' performance and perseverance.

It implies that as learners continuously participate in spiral learning experiences, they gradually develop resilience and determination, which are key components of academic grit. Additionally, it supports Hoover-Dempsey and Sandler's Parental Involvement Theory (2005), which explains that parents increase their involvement when they perceive that it positively influences their child's academic development.

Despite the significant mediating role of parental involvement, the direct effect of participation on academic grit remains significant, indicating partial mediation and suggesting that other factors also influence this relationship. This implies that participation in the Mathematics Spiral Curriculum independently contributes to the development of academic grit through learners' direct engagement in meaningful learning tasks. Thus, schools may strengthen classroom-based strategies such as enhancing learners' self-efficacy, providing consistent teacher encouragement, promoting collaborative learning, and fostering intrinsic motivation and emotional resilience to further support the development of academic grit beyond parental involvement.

SUMMARY OF FINDINGS

This section provides the summary of findings in this study.

1. The level of participation of Mathematics Spiral Curriculum of Grade 10 students was described as "high participation" with (wx=3.59 & SD=0.63).
2. The parental involvement in Mathematics was described as "high involvement" with (wx=3.51 & SD=0.93).
3. The academic grit was described as "high grit" by the Grade 10 students with (wx=3.96 & SD=0.75).
4. Parental involvement partially mediates (p-value < .001) on the level of participation in Mathematics Spiral Curriculum and the academic grit of Grade 10 students.

CONCLUSION

Based on the findings of the study, the following conclusions are drawn:

The study concludes that active participation in the Mathematics Spiral Curriculum significantly strengthens the academic grit of Grade 10 learners, with parental involvement playing a crucial mediating role. While students show general engagement, their lower participation in problem-solving tasks and the motivational (rather than instructional) nature of parental support highlight areas for improvement in both classroom practices and home involvement. These findings underscore the importance of coordinated efforts between teachers and parents to enhance persistence and resilience in learning. However, the study is limited by its use of self-reported data gathered from the same group of respondents, which may introduce response bias and affect the objectivity of the findings. In addition, the focus on Grade 10 learners in selected schools within Inabanga North District may limit the generalizability of the results to other contexts or grade levels.

RECOMMENDATIONS

Based on the findings and conclusions, the researcher recommends the following:

1. Teachers may design and implement activities that enhance students' critical thinking and creativity by developing contextualized learning materials that relate mathematical concepts to real-life situations. In addition, they may construct assessments aligned with PISA-type formats, incorporating stimuli-based questions that promote higher-order thinking skills.
2. Parents may extend full support to their children by collaborating with Mathematics teachers, particularly in addressing concepts that learners find difficult. Furthermore, they may engage in consistent monitoring of their children's study habits and progress in Mathematics through the use of planners, charts, and other tracking tools.
3. Teachers may reinforce students' goal-setting and perseverance by integrating structured goal-setting activities, reflective practices, and challenge-based tasks in Mathematics.
4. Schools may strengthen parental involvement programs by encouraging parents to actively monitor, guide, and support their children's mathematics learning at home. Conducting parent orientations, workshops, and

regular communication between teachers and parents can help maximize their role, thereby enhancing students' participation and ultimately improving their academic grit.

5. Schools may implement the action plan through collaboration among teachers, parents, and administrators to enhance learners' participation in Mathematics and strengthen academic grit.
6. Future researchers may conduct similar studies involving other grade levels to further validate and generalize the findings across different groups of learners. They may also explore emotional resilience as a dependent variable in relation to participation in the Mathematics Spiral Curriculum and other relevant factors, to better understand how students cope with academic challenges and sustain their learning efforts.

Implication

These findings imply that strengthening collaboration between teachers and parents is essential in improving learners' perseverance and resilience in Mathematics. Schools may need to enhance classroom strategies that emphasize higher-order thinking skills, particularly problem-solving, while also encouraging parents to take a more active instructional role at home. Moreover, coordinated home–school interventions may further support the development of both cognitive skills and non-cognitive traits such as academic grit among learners.

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