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Bringing Mathematics Outside of the Classroom: A Qualitative Analysis of Its Impact on Students' Motivation and Interest

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Abstract

Learning mathematics is not only confined to the four walls of the traditional classroom. Bringing mathematics outside of the classroom, as believed by the majority, can enhance students' motivation and interest. Thus, this qualitative research on bringing mathematics outside the classroom was conducted to explore its impact on student motivation and interest. To determine the impact, we used an open-ended questionnaire administered to the forty Bachelor in Mathematics and Science Education students of the Philippine Normal University Visayas. The qualitative responses of the participants generated five essential themes, namely: a) outdoor exploration and discovery; b) problem-solving and critical thinking; c) motivation and attitude; d) group dynamics and collaboration; and e) curiosity and lifelong learning. Along this line, bringing mathematics outside of the classroom can have a positive impact on students' motivation and interest. By providing opportunities for outdoor exploration, problem-solving, collaboration, and nurturing curiosity, educators can enhance students' engagement, foster a positive attitude toward mathematics, and promote a lifelong love for learning.

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Introduction

The ability to compute, problem-solve, and apply concepts and skills in mathematics influences multiple decisions in our lives. As reported by the National Research Council, mathematics in our technology-driven society has increased in importance and demands an advanced level of proficiency (Little, 2009). However, mathematics is often challenging for students to master. In other words, learning mathematics presents various difficulties and challenges for many students. One common hurdle is the abstract nature of the subject itself. Mathematics often deals with concepts and ideas that may not have a direct connection to everyday experiences, making it challenging for some learners to grasp and apply them (NCTM, 2007). Moreover, the sequential nature of mathematical concepts means that understanding one topic is often dependent on grasping previous ones, making it crucial to build a strong foundation (Fleming, 2019).

On the other hand, learning mathematics is not only confined to the four walls of the classroom. Mathematics educators believe that teaching and learning mathematics can be done outside of the classroom. Hubag (2006) states that mathematics can be fun and enjoyable when brought outside of the classroom. He also added that pupils' motivation, interest, and attitudes toward mathematics can be enhanced when mathematics is done outside of the classroom. Furthermore, engaging students in mathematics learning outside the classroom has been shown to have a positive impact on their motivation and interest in the subject.

Along this line, several studies have been conducted showing the impact of teaching mathematics outside of the classroom on students' motivation and interests. Carraher, and Schliemann (1985), for instance, found that children who regularly participated in informal mathematical activities while working as street vendors demonstrated higher levels of mathematical competence compared to their peers. This suggests that real-world applications of mathematics can stimulate students' interest and motivation to learn. Additionally, a review by Verschaffel, Greer, and De Corte (2000) emphasized the benefits of incorporating mathematics into real-life contexts, such as cooking or playing games. Such activities not only enhance problem-solving skills but also increase students' curiosity and desire to learn more about mathematics. By connecting mathematical concepts to authentic situations, students develop a deeper understanding and see the relevance of mathematics in their daily lives, leading to increased motivation and engagement (NCTM, 2014). These

findings highlight the importance of teaching mathematics outside the classroom to foster students' motivation and positive interest in the subject.

In addition, the Mathematics Association of America (MAA) promotes the idea of learning mathematics outside the classroom through various initiatives and resources. The MAA's publication, "Mathematics Outside the Classroom," emphasizes the importance of connecting mathematics to real-life situations and provides examples of engaging activities, such as measuring the height of trees, exploring geometric patterns in architecture, and analyzing sports statistics. These activities aim to ignite students' interest and curiosity in mathematics by demonstrating its relevance and applicability beyond the confines of the classroom.

Similarly, the National Council of Teachers of Mathematics (NCTM) supports the notion of teaching mathematics outside the classroom. In their publication, "Principles to Actions: Ensuring Mathematical Success for All," the NCTM emphasizes the importance of providing students with opportunities to apply mathematical concepts in authentic settings. They argue that such experiences foster a deeper understanding of mathematical concepts and promote positive attitudes toward mathematics, leading to increased motivation and engagement.

The literature reviewed underscores the significance of connecting mathematical concepts to authentic settings, enabling students to develop a comprehensive understanding of mathematics and recognize its relevance in their daily lives. These resources and publications further emphasize the importance of teaching mathematics outside the classroom, promoting positive attitudes, increased motivation, and enhanced engagement among students. Overall, these insights emphasize the need to explore and leverage real-world applications of mathematics to cultivate students' motivation and positive interest in the subject.

It is in these contexts that the researchers are interested in exploring the impact of learning mathematics outside of the classroom on the Bachelor of Mathematics and Science Elementary Education (BMSEE) students’ motivation and interests in learning mathematics.

Methodology

Approaches and Participants

To extensively describe students' motivation and interests in mathematics, more specifically in geometry, we used a qualitative approach. According to Creswell (2014), a qualitative type of study examines a natural situation and is suitable to describe the actual results of the participants. It is used to uncover trends in thought and opinions and dive deeper into the problem (Wyse, 2011). The participants of the study were 40 second-year BMSEE students of the Philippine Normal University Visayas. Since they specialize in elementary mathematics and science, we expect that bringing mathematics outside of the classroom will motivate them and develop an interest in learning mathematics. They were grouped according to their profile, such as sex and type of secondary school. Of the 40 participants, 32 (80.0%) were females, while 8 (20.0%) were males. When grouped by the secondary schools they came from, the majority of them, 28 (70.0%), were graduates of public high schools.

Data Collection

Data collection is a crucial component of qualitative research, playing a pivotal role in generating rich and in-depth insights into the research questions or objectives at hand. In this study, we aim to explore the impact of bringing mathematics outside of the classroom on BMSEE students' motivations and interests. By employing qualitative research methods, we can delve into the subjective perspectives of mathematics learning outside of the classroom on students' motivations and interests.

To gather comprehensive and rich insights into the impact of mathematics learning outside of the classroom on students' motivations and interests, we employed an open-ended questionnaire. According to Ballou (2008), one of the main advantages of using an open-ended structure is getting specific, individual information. The lists of verbatim answers need to be organized to be useful for data analysis and reports. Using an open-ended questionnaire, we distributed an open-ended questionnaire to a group of 40 BMSEE students of the Philippine Normal University Visayas recruited through purposive sampling since they are the groups that have specialization in elementary mathematics and science. The questionnaire consisted of a series of open-ended questions designed to elicit detailed responses about participants' motivations and interests in learning mathematics.

The questionnaire was developed based on a thorough review of existing literature, research objectives, and initial exploratory interviews conducted before the main data collection phase. The open-ended format allowed participants to freely express their thoughts and opinions, providing a rich source of qualitative data.

Participants were given a sufficient time frame of three days to complete the questionnaire at their convenience. The responses were collected electronically using an online survey platform, ensuring confidentiality and anonymity. Participants were encouraged to provide detailed and comprehensive responses to each question to capture a deeper understanding of their experiences when asked to move outside the classroom and learn geometry.

Ethical Considerations

Throughout the data collection process, we adhered to ethical guidelines and ensured the protection of participants' rights. Informed consent was obtained from all participants, outlining the purpose of the study, voluntary participation, confidentiality, and the right to withdraw at any time. The collected data, including questionnaire responses, were securely stored and accessible only to the research team. Any identifying information was removed or anonymized during the analysis phase to ensure confidentiality. Data were handled under ethical guidelines and regulations, and participants' privacy was prioritized throughout the research process.

The approach of an open-ended questionnaire provided a comprehensive and multi-dimensional understanding of participants' motivations and interests in learning mathematics outside the classroom. The rich qualitative data obtained through this method were analyzed to identify themes, patterns, and insights, contributing to a deeper understanding of the motivation and interests of the students in learning mathematics specifically geometry.

Data Analysis

Data analysis for this qualitative study aimed to explore the impact of bringing mathematics outside of the classroom on students' motivation and interest. Open-ended questionnaires were administered to the 40 BMSEE students capturing students' perceptions, experiences, and attitudes toward learning mathematics in real-life contexts. The data analysis involved a systematic procedure that included transcription, coding, theme development, data exploration, synthesis, interpretation, and discussion.

The data analysis followed a rigorous and systematic procedure to derive meaningful insights from the qualitative data collected in this study. Firstly, the open-ended responses were transcribed verbatim, ensuring the accuracy and fidelity of the data. Scholars and researchers in the field of qualitative research methodology, such as Creswell (2013) and Silverman (2016), emphasize the importance of accurate transcription in maintaining data validity and reliability. They highlight how verbatim transcription provides researchers with a reliable and rich dataset that can be analyzed and interpreted rigorously and systematically.

Next, an inductive coding approach was employed, where two researchers independently read and coded the transcripts, focusing on identifying recurring patterns and themes related to students' motivation and interest in learning mathematics outside the classroom. An inductive coding approach, in the context of qualitative research, refers to a coding process that allows themes and categories to emerge directly from the data, rather than being predetermined or guided by pre-existing theories or frameworks (Charmaz, 2014). It involves analyzing the data in a bottom-up manner, allowing patterns, themes, and concepts to surface from the raw data itself. Research authorities and scholars in the field of qualitative research methodologies such as Creswell (2013) and Saldaña (2015) often discuss and endorse the use of inductive coding as a means to derive meaningful insights from the data.

Likewise, regular meetings were held to discuss and compare the codes, resolving any discrepancies through consensus. Following the initial coding, the researchers engaged in a collaborative process of theme development, grouping related codes into broader themes that captured the essence of the data. These themes were reviewed, refined, and validated through ongoing discussions and analysis of the interview data. The aim was to ensure that the identified themes accurately represented the experiences and perspectives of the participants. The data analysis procedure employed in this study adhered to rigorous qualitative research standards, ensuring the trustworthiness and credibility of the findings.

Results and Discussion

The analysis of the qualitative data offers valuable insights into the impact of bringing mathematics outside of the classroom on students' motivation and interest. This section presents the key findings derived from the thematic analysis of the open-ended questions and interview data. The discussion examines the themes that emerged, highlighting the experiences, perceptions, and attitudes of students toward learning mathematics in real-life contexts. The findings shed light on how bringing mathematics outside the classroom influences students' motivation and interest, contributing to the existing literature on innovative approaches to mathematics education. Through an exploration of the findings, this section aims to provide a comprehensive analysis of the impact of bringing mathematics outside the classroom on students' motivation and interest, opening avenues for further research and practice in mathematics education.

Outdoor Exploration and Discovery

Outdoor exploration emerged as a prominent theme in the data, reflecting students' experiences of engaging with mathematics in natural or outdoor environments. The participants described a range of activities that involved exploring the outdoors, such as nature walks, observing school surroundings, the structure of the buildings, and any other activities related to the objectives of the study. This theme captured several codes, including outdoor exploration, perception shift, curiosity and wonder, practical experiences, beauty, and symmetry, as well as appreciation and awareness. The code of outdoor exploration indicated that students found value in the hands-on experiences of exploring mathematical concepts in real-world settings. One student noted, *"Being able to find geometric shapes in nature helped me see how math is all around us."* This is also supported by another student stating that *"roaming around the campus reminds me that the things surrounding us have sides and we can consider it as polygon but we are not aware of them and we can say that geometry can be found in our daily lives"*. These responses demonstrate students' appreciation for the immersive learning experiences that outdoor exploration provided, allowing them to observe mathematical principles in action, especially in the study of geometry. Along this line, Kellert (2005) expressed that human-nature connection and its impact on various aspects of human life, including education can enhance learning experiences, including the study of mathematics and geometry.

The code of perception shift captured how students' perspectives on mathematics changed through outdoor exploration. They developed a new lens through which they viewed the subject, seeing it as more than just numbers and formulas. As one student reflected, *"Math used to feel abstract, but being outside and applying it to real situations made it tangible and meaningful."* Another participant noted *"I was able to realize that mathematics can be interesting in some ways and was able to realize also that mathematics is important. I did appreciate that learning math can be fun when it is taught outside of the four walls of the classroom."* These insights emphasize the value of outdoor learning experiences in fostering a positive and meaningful connection with mathematics, ultimately enhancing students' motivation, engagement, and appreciation for the subject.

Boaler (2015) discusses the importance of shifting students' perceptions of mathematics from a fixed mindset to a growth mindset. She emphasizes the value of real-world connections and authentic learning experiences in helping students view mathematics as meaningful and relevant. Further, Dole and Sinatra (1998) explore the role of cognitive change in learning and knowledge construction. It highlights the importance of real-world experiences in facilitating conceptual shifts and transforming students' understanding of a subject. Their cognitive change provides evidence to support the notion that outdoor learning experiences, such as applying mathematics in real-life situations, can contribute to a change in students' perceptions and increase their motivation and engagement.

Beauty and symmetry emerged as a code associated with the aesthetic aspects of outdoor exploration. Students expressed admiration for the natural patterns, symmetry, and harmonious designs they encountered. As quoted by one participant *"Moving outside of the classroom could motivate and facilitate the learning of geometry because their beauty and symmetry appeal to one's senses."* This appreciation for the aesthetic qualities of mathematics further enhanced their engagement and interest in learning geometry. In this regard, Stewart (2015) highlights that outdoor exploration can provide opportunities for students to encounter natural patterns, symmetry, and harmonious designs, fostering an appreciation for the aesthetic aspects of mathematics. Similarly, Hoffer (2013) on examining the role of aesthetic experiences in science education, including mathematics concludes that aesthetic experiences, such as encountering beauty and symmetry, can enhance students' engagement and interest in the subject.

Finally, the code of appreciation and awareness demonstrated how outdoor exploration fostered

an increased awareness of the presence of mathematics in everyday life. Students recognized and valued the connections between mathematics and their natural environment, leading to a deeper appreciation for the subject. This finding is supported by a statement from one participant stating that *"When we go around the classroom and find objects or things that are related to geometry, it makes me aware of the different kinds of polygons by counting their sides"*. Another participant noted that *"because of this activity, we become observant and aware of the things around us".* In this regard, Ernest (2019) contends that outdoor exploration can enhance students' awareness and appreciation of the presence of mathematics in everyday life. He further expressed that connecting mathematics to real-world contexts can impact students' perception of the subject.

Likewise, Hart, Albrecht, and Burts (2004) elucidate that spending time in natural environments increases awareness, attentiveness, and appreciation for one's surroundings. it heightened awareness and appreciation of various domains, including mathematics, as individuals recognize the presence of mathematical concepts in their natural environment.

The literature cited along this theme provides support for the idea that outdoor exploration fosters an increased awareness and appreciation of the presence of mathematics in everyday life. They emphasize the importance of connecting mathematics to real-world contexts and the natural environment, which enhances students' awareness of mathematical concepts and promotes a deeper appreciation for the subject.

Problem-solving and Critical Thinking

The theme of "Problem-Solving and Critical Thinking" captures the participants' experiences and perceptions regarding the application of problem-solving skills and critical thinking in real-life contexts. Several codes emerged under this theme, including problem-solving, insight, and realization, as well as practical relevance and application.

Problem-solving was a prominent code identified in the participants' responses. They expressed how engaging in real-life mathematical challenges required them to employ problem-solving strategies and techniques. Through these experiences, they developed a deeper understanding of problem-solving as an essential skill, essential in various aspects of life. As quoted by one participant *"Yes, this activity helped develop my interest in mathematics because it enhanced my skills in problem-solving and in measuring. I also feel the excitement in every moment of doing this activity."* Another student reflected *"Yes, the activity helps us know how to measure the*

dimensions of an object and be able to solve its perimeter, area, and volume."

In this regard, Jonassen, Strobel, and Lee (2006) emphasize the importance of real-life problem-solving experiences in developing problem-solving skills. They also confined to the idea that engaging in authentic problem-solving tasks enhances students' understanding of the problem-solving process and the transferability of these skills to various domains. Similarly, Hiebert and Grouws (2007) highlight the importance of providing opportunities for students to engage in real-world problem-solving tasks to develop problem-solving skills.

This literature provides support for the idea that engaging in real-life mathematical challenges enhances students' problem-solving skills. They emphasize the importance of providing authentic problem-solving experiences that require students to apply mathematical knowledge and strategies in real-world contexts. The findings along this line suggest that such experiences contribute to a deeper understanding of problem-solving as an essential skill and foster students' interest and excitement in mathematics.

Insight and realization emerged as a code associated with the participants' experiences of gaining new insights and realizations through problem-solving and critical thinking. They expressed how engaging in real-life problem-solving scenarios allowed them to see mathematical concepts from different angles and develop a deeper understanding of their applicability. One participant stated, *"Solving real-life problems made me realize how mathematics is not just a set of rules, but a tool for solving real-world challenges."* As also quoted by another participant *"In this activity, the part which I like the most is searching for the objects that we can visualize geometry and doing measurement on them. I realize that our environment is surrounded by geometry. We never notice it; we just never mind it but we can never change the fact that geometry is already a part of our daily life."*

The participants' responses along this line highlight the emergence of insight and realization through problem-solving and critical thinking in real-life contexts. They experienced a transformative shift in their understanding of mathematics, recognizing it as more than a set of rules, but rather as a powerful tool for solving real-world challenges. Engaging in authentic problem-solving scenarios allowed them to see mathematical concepts from different perspectives, deepening their understanding of their practical application. Boaler (2016) reinforces the importance of providing opportunities for students to engage in authentic problem-solving scenarios and critical thinking outside the traditional classroom setting, as it fosters transformative

shifts in their perceptions and understanding of mathematics.

The code of practical relevance and application captured the participants' recognition of the practical relevance of mathematics in their daily lives. Through problem-solving and critical thinking, they experienced firsthand how mathematical concepts and skills could be applied to real-life situations. This practical application enhanced their perception of the value and importance of mathematics in their lives. As what have said by one participant *"Yes, for me this activity helps us gain interest in geometry. I admit discussing and applying geometry in the four walls of the classroom is such a boring thing, so it is a good exposure that we also discover and appreciate how geometry works in our daily lives."* This is also supported by another participant when she says *"Yes, this activity helps develop my interest in mathematics because I learned that geometry is everywhere."*

The participants' responses highlight the practical relevance and application of mathematics in their daily lives. Through problem-solving and critical thinking experiences, they recognized firsthand how mathematical concepts and skills could be applied to real-life situations. This practical application not only deepened their understanding but also enhanced their perception of the value and importance of mathematics in their lives. They expressed a newfound interest and appreciation for geometry, realizing that it extends beyond the confines of the classroom. Engaging in real-world contexts allowed them to discover the ubiquity of geometry and sparked a desire to learn and explore more. Along this line, Seeley (2009) highlighted the transformative impact of problem-solving and critical thinking experiences on students' perception of mathematics and its practical relevance in their daily lives. Engaging in real-world contexts allows students to recognize and appreciate the ubiquity of mathematics, thereby fostering a deeper interest and understanding of mathematical concepts like geometry beyond the traditional classroom boundaries.

Motivation and Attitude

The theme of "Motivation and Attitude" encompasses the participants' experiences and perceptions regarding the impact of bringing mathematics outside of the classroom on their motivation to learn and their overall attitude towards the subject. Several codes emerged under this theme, including willingness to learn and a positive attitude.

The code of willingness to learn reflects the participants' expressed eagerness and enthusiasm to

engage with mathematics when it was brought outside of the classroom. They conveyed a strong desire to explore and delve deeper into mathematical concepts when presented in real-life contexts. This willingness to learn demonstrated their intrinsic motivation and openness to actively participate in mathematics learning. This is supported by a statement of one participant *"Yes because in just a simple way of cooperating with classmates and being confident to develop interest in mathematics, I learn by simply listening and applying it. Though it's hard to study if you have the willingness to develop an interest, you can learn it by doing and by applying."* Another participant said *"Yes, for me this activity helps me and my groupmates gain interest in geometry.* One participant added *"Yes, it helps develop my interest in mathematics, especially in geometry because it makes me wonder and become curious that everything, I saw in the school has its measurement. And it makes me interested more to learn and study."*

The participants' responses underscore their willingness to learn and their eagerness to engage with mathematics when presented outside of the traditional classroom setting. They expressed a strong desire to explore and delve deeper into mathematical concepts when presented in real-life contexts, demonstrating their intrinsic motivation and openness to actively participate in mathematics learning. They acknowledged the limitations of discussing and applying mathematics solely within the four walls of the classroom and welcomed the exposure to real-world applications of geometry. This willingness to learn was fueled by their curiosity, wonder, and appreciation for the presence of mathematics in their daily lives. Lockhart (2012) supports the idea that presenting mathematics in real-life contexts outside of the traditional classroom setting can foster intrinsic motivation and willingness to learn. He emphasizes the importance of curiosity and wonder in mathematics education, which aligns with the participants' expressions of a strong desire to explore and delve deeper into mathematical concepts when presented in real-life situations.

A positive attitude was a prevalent code mentioned by the participants. They described how the experience of learning mathematics outside the classroom fostered an optimistic mindset toward the subject. They expressed a shift in their attitude from viewing mathematics as daunting or boring to perceiving it as interesting, relevant, and enjoyable. One student noted *"Yes, this activity motivated me to develop a positive attitude towards the subject. Through this activity, I was motivated to know how to measure the radius, perimeters, and areas of the mirror, machine stand, steel, and stand of the bulletin board. It helps me to enhance my critical thinking skills."* This is also supported by another participant saying *"Yes, this activity motivates me to develop a positive*

attitude towards the subject realizing that mathematics is not about solving problems, not all about numbers. If you are observant about your environment, you will appreciate that the things around are connected to mathematics."

The participants' responses reveal a prevalent code of a positive attitude towards mathematics, which was nurtured through learning experiences outside the classroom. They described a shift in their perception of mathematics from daunting or boring to interesting, relevant, and enjoyable. Engaging in real-life mathematical activities sparked their curiosity and motivation, leading to a positive attitude toward the subject. They recognized that mathematics goes beyond problem-solving and numbers; it is intricately connected to the world around them. By observing and appreciating the mathematical aspects of their environment, they developed a newfound appreciation and positivity toward mathematics. Burns (2015) supports the idea that learning experiences outside the classroom can nurture a positive attitude toward mathematics. Likewise, Delvin (2000) emphasized extensively the importance of real-life mathematical experiences and the need to promote a positive attitude towards mathematics

Generally, these findings suggest that bringing mathematics outside of the classroom can have a profound impact on student's motivation to learn and their overall attitude toward the subject. The practical applications and real-life contexts provide a meaningful framework that fosters intrinsic motivation, enthusiasm, and a positive mindset toward mathematics.

Group Dynamics and Collaboration

The theme of "Group Dynamics and Collaboration" explores the participants' experiences and perceptions related to the dynamics and collaborative aspects of learning mathematics outside the classroom. Several codes emerged under this theme, including group cooperation, cooperative learning, and collaboration, as well as social interaction and collaboration.

The code of group cooperation highlighted the participants' experiences of actively cooperating with others within their groups. They emphasized the importance of teamwork, mutual support, and shared responsibility. By working collaboratively, students found that they could effectively tackle complex mathematical challenges and achieve collective success. As one participant said, *"Yes cooperating with your classmates and being confident to develop your interest in mathematics, you can learn by simply listening and applying it."* Likewise, another participant indicated that "*the part of the activity that I like most is when we are roaming around from the*

third floor down to the first floor and then moving around the campus to look for objects or items that we can utilize or make as a basis for our activity. The activity is interesting as well as exciting. After all, we were able to develop cooperation and collaboration among the members of our group because we helped one another and did our tasks and performed our roles together."

The participants' responses shed light on the significance of group cooperation in their experiences of learning mathematics outside the classroom. The code of group cooperation emerged as a key aspect, emphasizing the importance of teamwork, mutual support, and shared responsibility. By actively cooperating with their classmates, students recognized the value of working collaboratively to effectively tackle complex mathematical challenges and achieve collective success. They highlighted the benefits of sharing ideas, listening to one another, and applying their knowledge together. Through cooperation and collaboration, the participants found that their interest in mathematics was developed and sustained. The activity provided an exciting and engaging environment where they could develop teamwork skills, support one another, and fulfill their roles within their groups. Along this line, Cohen (1994) supports the idea that group cooperation plays a significant role in students' experiences of learning mathematics outside the traditional classroom setting. Her research in this regard sheds light on the importance of teamwork, mutual support, and shared responsibility in fostering a positive and engaging learning environment. The benefits of sharing ideas, listening to one another, and applying knowledge together, as highlighted by the participants, resonate with the principles of cooperative learning.

Cooperative learning and collaboration emerged as a code closely related to group dynamics. Students described the benefits of cooperative learning strategies and the collaborative nature of mathematics learning outside the classroom. They noted how collaborative tasks and activities fostered a sense of shared responsibility and accountability, leading to increased engagement and a deeper understanding of mathematical concepts. According to one participant, "*I liked the part when we surveyed the school's surroundings. I enjoyed pointing out the object that we have to measure. It made me that all the things that we measured were useful in our activity. I like when each one of us shares ideas on how to figure out the activity. Each one of us is enjoying at the same time cooperating, that's why we finished it immediately."* Another participant also added *"The part of the activity that I like most is when we are roaming around from the third floor down to the first floor and then moving around the campus to look for objects or items that we can utilize or*

make as a basis for our activity. The activity is interesting as well as exciting because we were able to develop cooperation and collaboration among the members of our group."

The participants' responses underscore the importance of cooperative learning and collaboration in the context of mathematics learning outside the classroom. Students described how collaborative tasks and activities fostered shared responsibility, accountability, and a sense of engagement. By actively participating in group dynamics, they experienced the power of collective thinking and problem-solving, which deepened their understanding of mathematical concepts. The participants expressed enjoyment in sharing ideas, cooperating with their peers, and contributing to the successful completion of tasks. Through this collaborative process, they developed a sense of camaraderie, support, and shared achievement. Slavin (1994) highlights the importance of shared responsibility, accountability, and engagement in group dynamics, which aligns with the experiences described by the participants. The enjoyment expressed by the students in sharing ideas, cooperating with peers, and contributing to successful task completion resonates with the positive outcomes often observed in well-structured cooperative learning environments.

The code of social interaction and collaboration captured the participants' experiences of meaningful social interactions while learning mathematics in real-life contexts. They expressed how collaborating with peers in authentic settings fostered a sense of community, belonging, and support. Students valued the opportunities to exchange ideas, seek assistance, and build relationships with their peers, creating a positive and supportive learning environment. As stated by one participant *"Yes, because it helps me develop my knowledge in this subject. During this activity, I could voice out my ideas with my classmates which developed my social interaction with my other classmates."* Another participant disclosed *"Yes, it motivates me because it provides me a sound learning and understanding. The activity made me realize that it is easy and enjoyable to do such activity if there is involvement in the sharing of ideas."*

These responses highlight the importance of voicing out ideas, social interaction with classmates, and involvement in a group activity to develop a positive attitude towards the subject and enhance learning. Group dynamics and collaboration play a crucial role in the learning experiences of students when mathematics is brought outside the classroom. Collaborative interactions, cooperative learning strategies, and social engagement contribute to enhanced problem-solving skills, a deeper understanding of mathematical concepts, and a supportive learning environment.

Curiosity and Lifelong Learning

The theme of "Curiosity and Lifelong Learning" explores the participants' experiences and perceptions regarding the role of curiosity in fostering lifelong learning when mathematics is brought outside the classroom. Several codes emerged under this theme, including curiosity and further learning, curiosity and wonder, exploration and discovery, as well as enjoyment and fun.

Curiosity and further learning emerged as significant codes in the participants' responses. They described how engaging with mathematics in real-life contexts sparked their curiosity and ignited a desire for further learning. Participants expressed a natural inclination to explore and investigate mathematical phenomena, prompting them to seek additional information or engage in self-directed learning beyond the classroom. This is supported by the statement of one participant *"Yes, this activity helps develop my interest in mathematics because I learned that we can find geometry everywhere. So, I want to learn and discover more about geometry."* Another participant noted *"Yes, this activity helped develop my interest in mathematics because I learned that we can find geometry anywhere else. It also enhanced my skills in problem-solving and in measuring. I also feel the excitement in every moment of doing this activity."*

These responses show a genuine interest in learning and developing a positive attitude towards the subject of mathematics, particularly geometry. The students express the importance of mathematics in everyday life and its relevance to problem-solving and practical applications. They demonstrate an eagerness to enhance their mathematical skills, understand mathematical concepts, and appreciate the value of geometry in real-world contexts. Johnson and Johnson (1994) support the idea that voicing out ideas, social interaction with classmates, and involvement in group activities are crucial elements in developing a positive attitude towards mathematics and enhancing learning experiences outside the traditional classroom. They underscore the importance of group dynamics, collaborative interactions, and cooperative learning strategies in promoting problem-solving skills, a deeper understanding of mathematical concepts, and a supportive learning environment.

Exploration and discovery were additional codes highlighted by the participants. They described the experience of actively exploring mathematical concepts and discovering new insights through real-life applications. Engaging in hands-on exploration allowed them to develop a sense of ownership and autonomy in their learning, contributing to a lifelong learning mindset. This is supported by the statement of one participant *"As we roamed around the school campus, I realized*

that everything surrounding us has its purpose and use. Everywhere, we can see the different sizes, shapes, and forms of geometric figures and patterns emerge in nature, particularly man-made objects like benches, windows, tables, mirrors, and anything that is being utilized by humans to serve their function in our daily living. These things are also useful in performing some daily activities or help us make our daily routine easy and purposeful." Another participant reflected "*Through this activity, we were able to explore our campus and was able to appreciate the things that sometimes we found very unusual and we tend to neglect those things which helps us widen our knowledge.*

The participants' responses shed light on the significance of exploration and discovery in their experiences of learning mathematics outside the classroom. The codes of exploration and discovery highlighted their active engagement with mathematical concepts and the discovery of new insights through real-life applications. By actively exploring the environment and encountering geometric figures and patterns, they developed a sense of ownership and autonomy in their learning. Through this hands-on approach, they realized the practicality and purposefulness of mathematics in their daily lives. The participants expressed appreciation for the opportunity to explore their school campus and discover the presence of geometric shapes in various objects and structures. This exploration broadened their knowledge and deepened their understanding of mathematics beyond the traditional classroom setting. Lockhart (2012) supports the idea that exploration and discovery play a vital role in mathematics learning outside the classroom. His perspective aligns with the experiences described by the participants, where they actively explored their environment, encountered geometric figures, and made real-life connections, leading to a deeper understanding and appreciation of mathematics.

Enjoyment and fun were also prevalent codes associated with curiosity and lifelong learning. The participants expressed how the enjoyment and fun derived from learning mathematics outside the classroom played a significant role in fostering their curiosity and motivation to continue learning. They described how the engaging and interactive nature of real-life applications made mathematics an enjoyable and exciting subject to explore. One participant stated that *"Yes because it's a group activity. It involves enjoyment while we are doing our activity. There is no tension involved because we are sharing our ideas on how to accomplish our activity. And most especially, our teacher let us explore our environment and I can say that it's real-world learning, that's why it made us more excited and interested in the things that we are going to do.* This is also supported by another

participant saying "*Yes, this activity helps develop my interest in mathematics more specifically geometry because this activity provides so much fun and excitement especially when we roamed or tour around the campus to look for some objects having geometrical shapes.*

Participants' responses in this regard clearly illustrate the positive impact of learning mathematics outside the classroom through exploration and real-world application. Their engagement with hands-on activities and the opportunity to share and exchange ideas with their peers fostered a sense of enjoyment and excitement. The supportive and tension-free learning environment allowed them to appreciate mathematics as a practical and purposeful tool in their daily lives. By exploring their environment and discovering geometric shapes in various objects and structures, their interest in mathematics, especially in geometry, was ignited. These experiences demonstrate the value of experiential learning and how it can effectively develop students' interest, curiosity, and enthusiasm for mathematics, making the subject come alive beyond traditional classroom boundaries.

Dewey (1938) emphasizes the importance of experiential learning and the integration of education with real-life experiences. His ideas have had a lasting impact on educational philosophy and the promotion of hands-on learning. Likewise, his work supports the idea that learning mathematics outside the classroom through exploration and real-world application is beneficial for students' engagement and understanding. His emphasis on experiential learning and creating a supportive, tension-free learning environment aligns with the positive impact highlighted in the participants' responses.

Conclusion

This qualitative study on bringing mathematics outside the classroom has provided valuable insights into the impact on student motivation and interest. The five emerging themes, namely Outdoor Exploration and Discovery, Problem-Solving, and Critical Thinking, Motivation, and Attitude, Group Dynamics and Collaboration, and Curiosity and Lifelong Learning, offer a comprehensive understanding of the student's experiences and perceptions.

The results of this study highlight the significant impact of outdoor exploration and discovery on students' experiences of learning mathematics outside the classroom. Engaging with mathematics in real-life environments fostered several positive outcomes for the participants. Firstly, the hands-

on experiences of outdoor exploration provided students with immersive learning opportunities, allowing them to observe mathematical principles in action, especially in the study of geometry. This appreciation for the practical applications of mathematics sparked their curiosity and awareness of its presence in the world around them.

Secondly, outdoor exploration led to a shift in students' perception of mathematics. They no longer viewed mathematics as abstract and disconnected from real life; instead, they saw it as tangible, meaningful, and relevant. This transformation in perception deepened their motivation, engagement, and appreciation for the subject.

The aesthetic aspects of outdoor exploration, such as beauty and symmetry, further enhanced students' interest and engagement in mathematics. Observing the natural patterns and harmonious designs in their surroundings contributed to their appreciation for the aesthetic aspects of mathematics, making it more enjoyable and captivating.

Moreover, the participants' experiences of collaboration and group dynamics in outdoor learning settings were essential in developing their problem-solving skills and understanding of mathematical concepts. Working together in cooperative learning environments encouraged shared responsibility, accountability, and a sense of camaraderie, leading to positive outcomes in their learning experiences.

Furthermore, the study revealed that outdoor exploration ignited a desire for lifelong learning in mathematics. The participants expressed genuine curiosity and enthusiasm for further learning beyond the classroom, seeking additional information and engaging in self-directed exploration of mathematical phenomena.

Ultimately, the findings underscore the importance of experiential learning and the integration of real-world contexts in mathematics education. By bringing mathematics outside the classroom, students not only gained a deeper understanding of the subject but also developed a positive attitude and appreciation for its practical relevance in their daily lives. The study supports the idea that real-life applications and hands-on experiences can effectively foster students' interest, curiosity, and enthusiasm for mathematics, making the subject come alive beyond traditional classroom boundaries. As such, educators can leverage outdoor exploration and discovery as powerful tools to enhance students' motivation, engagement, and overall learning experiences in mathematics.

COMPETING INTERESTS

The author has no competing interests to declare.

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