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EXPLORATION OF STUDENTS' MATHEMATICS LEARNING EXPERIENCES AND ENGAGEMENT OUTSIDE THE CLASSROOM

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ABSTRACT

In essence, a learning process involves students interacting with teachers, other students, and the learning environment in an educational setting. This study aimed to explore student learning experiences and the long-term impact of learning mathematics outside the classroom. This research is a longitudinal study, in which the research subjects change after a certain period of time. This study involved subjects as 208 male and female students. The author collected data through tests, questionnaires, and interview methods. The author then analyzed the data by comparing the same data over two periods. The results suggested that learning by utilizing learning resources outside the classroom in learning mathematics may help increase student engagement in the cognitive, affective, and conative dimensions. Changes shifted from learning inside classroom to learning outside classroom have created a different learning atmosphere and provided a lot of learning experiences for students, and also increased student engagement in the cognitive, affective, and conative dimensions. It indicated that learning mathematics outside the classroom has a long-term impact on student interaction in three dimensions, namely (1) the cognitive dimension; students can develop such as critical thinking, problem-solving skills, and reasoning abilities; (2) affective dimensions; students' positive disposition towards mathematics increases while students' mathematics anxiety levels decrease; and (3) the conative dimension; such as improvement in social skills, cooperation, better communication, confidence, and diligence in learning mathematics.

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1. INTRODUCTION

A learning process is basically an educational interaction between students and teachers, students and students, and students with the learning environment. These interactions in the teaching and learning process are not only to convey messages in the form of subject material but also to build positive behavior (positive disposition) for students in the learning (Hammond, et al., 2019; Puspitarini & Hanif, 2019). The learning process has comprehensive purposes in the cognitive, affective, and conative aspects. The essence of teaching and learning activity is to set a learning environment in which students interact and how students learn (Closs, et al., 2022; Martin & Bolliger, 2018; Neville, 2023).

Learning, whatever the purpose, is to acquire knowledge to solve problems in daily life. The problem faced by students while learning mathematics is that they did not own the capability to make a connection between what they have learned and how the knowledge will be used in the future (Li & Schoenfeld, 2019). This assumption arises because the practice of mathematics learning in the classroom has several weaknesses, including (a) the mathematics learning focuses only on procedural knowledge so that it distracts the comprehensive understanding of mathematical concepts (Kusumadewi & Kusmaryono, 2022); (b) mathematics learning is limited by rigid completion procedures, causing students to be incapable to critically create their own ideas and construct their own knowledge (Otte, et al., 2019); (c) mostly the learning follows teacher-centered model, restricts students' independence to have active engagement in emotion, cognitive and behaviors, and also inhibits critical and creative thinking attitudes (Dyment, et al., 2018); (d) presenting examples of mathematical problems that are not in the context of life so that it is difficult for students to understand (Dyment, et al., 2018; Otte, et al., 2019); (e) the learning is not fun, boring, high pressured and stressed for students (Prasetya, et al., 2020); and (6) learning only has a short-term impact, where students are proficient in memory skills but weak in understanding mathematical concepts (Kliziene, et al., 2022).

The purpose of learning mathematics in schools is to develop creative activities as student learning experiences that involve imagination, intuition, and discovery, develop divergent thinking, originality, curiosity, making predictions, critical attitude through problem-solving, and a positive mathematical disposition towards mathematics (Ulusoy & Argun, 2019). This fact suggests that there is a gap between the objectives of learning mathematics to be achieved and the practice of learning mathematics in schools. Therefore, the innovative cooperative learning model, namely learning mathematics outside the classroom, is an alternative solution to minimize the gaps that occur. Learning mathematics outside the classroom offers a varied and valuable learning experience for this type of learning (Otte, et al., 2019).

Learning mathematics could be conducted by learning outside the classroom (outdoor mathematics learning) because many mathematical objects that students learn are in the surrounding environment. For example, students measure the height of a tree (learn congruence), students calculate the area of a basketball court (learn flat shapes), students record the number of means of transportation (learn statistics), and many others. Through outdoor mathematics learning, students can be directly involved with the real objects around them. Learning mathematics outside the classroom is believed to be able to increase students' understanding of what they are learning (Pambudi, et al., 2022; Priyadi & Yumiati, 2021; Romar, et al., 2019).

According to constructivism theory, learning is a process of constructing knowledge from the abstraction of personal and social experience (Jumaat, et al., 2017). According to this flow, learning activities are not defined as the transfer of knowledge from teachers to students, but provide opportunities and learning experiences for students to build their own knowledge, so that learning becomes meaningful, has a high curiosity, and is able to critical thinking (Kusmaryono, et al., 2021). The teacher's role in the learning process is to direct students to be able to think, convey their ideas, concepts, or ideas, and critically students are able to analyze the knowledge they have prepared themselves (Darling-Hammond, et al., 2020). Learning based on the flow of constructivism occurs only when students actively process new information or knowledge so that the information becomes meaningful to them (Kusmaryono & Suyitno, 2016). One model of learning approach that is appropriate and in line with constructivism theory is contextual learning with an outdoor mathematics learning strategy (Priyadi & Yumiati, 2021).

The mathematics learning model outside the classroom (outdoor mathematics learning) is mathematics learning that is conducted outside the classroom by utilizing the environment outside the classroom as a learning resource (Priyadi & Yumiati, 2021; Romar, et al., 2019). The selection of an environment outside the classroom as a learning resource is adjusted to the mathematics subject materials. This learning model can facilitate students to develop their potential (Dyment, et al., 2018; Otte, et al., 2019).

Learning mathematics outside the classroom offers a new dimension to the student learning experience where student engagement and multi-sensory perception increase (Kuo, et al., 2019). Mathematics learning activities outside the classroom can take place in the schoolyard, school gardens, sports fields, or the school environment, and can even explore the natural environment. The advantages of learning mathematics outside the classroom (outdoor mathematics learning) include (a) creating conditions that are not too "formal" so that the learning atmosphere becomes interesting and fun (Sjöblom, et al., 2021); (b) students are more enthusiastic about learning because they are bored while studying in the classroom. the class can be treated (Dyment, et al., 2018); (c) make students' thinking power more developed and make students more active (Blaine & Akhurst, 2021); and (d) train students to be bolder in expressing opinions, so that it becomes meaningful learning for students (Otte, et al., 2019).

The meaningful learning process includes recognizing a relationship between new information and something already stored in long-term memory. Meaningful learning will work effectively if students can relate new ideas and their understanding to themselves as a result of practice or experience. In cognitive learning theory, it is conveyed

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that meaningful learning is a learning that has a positive impact on students after attending lessons (Watts, et al., 2018).

The impact of learning is everything that arises as a result of a business or learning activity (Watts, et al., 2018). The learning conducted outside the classroom has a positive impact on the process of learning activities, including (a) to provide easement for students in understanding the subject materials; (b) to provide meaningful learning experiences (according to real-life problems); (c) to attract attention and increase student learning activities, and (d) to improve social outcomes, including enthusiastic insights and communication (Pambudi, 2022). Learning mathematics at school is not only to develop thinking (reasoning) but also to increase students' interest and involvement in learning (Blaine & Akhurst, 2021). Developing student mathematics skills will bring a positive impact on the cognitive, social, emotional, physical, and literacy development they require in the future (Harris & Petersen, 2019). It appears to reliable advancements in social results counting enthusiastic insights and communication.

Student engagement is the intensity of behavior, emotional quality, and personal effort of active student involvement in learning activities (Huang & Wang, 2023). When students have good engagement in the learning process, they will commit full attention and participation in class discussions, and also interest and motivation during learning (Clarke & Roche, 2018). Student engagement can also measure how well the student's learning process is and is also a reference for effective teaching (Blaine & Akhurst, 2021).

Student engagement in learning includes cognitive, affective, and conative dimensions (Jimenez-Liso, et al., 2022; Joshi, et al, 2022; Scott, et al., 2019). Cognitive engagement focuses on students' investment in learning and the self-regulation strategies used. Cognitively engaged students have a desire to engage in learning and a desire to successfully master knowledge. Affective engagement (emotional engagement) focuses on students' emotional reactions including interest, boredom, joy, sadness, and anxiety. Conative engagement (behavior engagement) focuses on student participation such as trying, being serious, concentrating, paying attention, obeying rules, contributing to discussions, asking questions, and paying attention to lessons.

This study aimed to explore student learning experiences and the long-term impact of learning mathematics outside the classroom in terms of student engagement in the cognitive dimensions, affective dimensions, and conative dimensions. The results of this study may be valuable input for (1) teachers to manage mathematics learning outside the classroom according to learning objectives; (2) the students obtain a meaningful learning experience, active student engagement, and increased students' positive disposition toward learning mathematics; and (3) the importance of achieving mathematics learning objectives with a positive long-term impact on students.

2. METHOD

2.1 Research Method

This research is longitudinal research, which is a type of research that investigates changes in research subjects after a certain period of time (Caruana, et al., 2015). The focus of the research is to explore the learning experience and the long-term impact of applying mathematics learning outside the classroom in terms of student engagement in the cognitive (mathematical ability), affective (emotional), and conative (behavioral) dimensions. This research was conducted over two time periods, namely in odd semester and even semester (2 x 6 months). Each research period was observed from time to time to obtain accurate research data and to ensure that changes (positive impacts) that occur on students are permanent in the long term.

2.2 Research Subject

This research was conducted in schools in the city of Semarang, Indonesia. This study involved 208 male and female students. They are spread over three different school levels, namely 72 elementary school students, 72 junior high school students, and 64 high school students. Student ages ranged from 10 to 18 years. In this study, students received mathematics learning treatment outside the classroom, namely contextual teaching and learning with an inquiry approach for two periods (two semesters). This study also involved three mathematics teachers and three learning observers as participants.

2.3 Instruments and Data Collection

Data were collected for each research variable in two specific time periods. Instruments for collecting research data include mathematics test sheets, observation sheets, questionnaires, and interview guidelines. The test question items were composed according to the mathematics learning materials at school. The test instrument was to determine the level of understanding of mathematical concepts. Observation sheets were used to record student activities and student engagement during the learning. Table 1 exhibits the questionnaire as the research instrument. The questionnaire consisted of open-ended questions to determine student responses to the cognitive, affective, and conative dimensions. The interview guideline was arranged semi-structured to explore and obtain more in-depth information about student engagement and what students obtained from learning mathematics outside the classroom.

Table 1.
Data collection method

Dimensions	Data collection method	Data type
Cognitive	*Written test: examples of student worksheets in completing assignments (understanding mathematical concepts).*	*Quantitative and Qualitative*

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Affective	*Questionnaire: interest and motivation to learn.*	*Qualitative*
	Interviews: student engagement in learning.	*Qualitative*
Conative	*Observation: student activity (behavior) while learning mathematics outside the classroom.*	*Qualitative*

2.4 Procedure

This research was conducted at three different school levels within 2 periods (two semesters: 2x6 months). Students at the three school levels received similar treatment, namely the settings for learning mathematics outside the classroom. The implementation of mathematics learning outside the classroom follows the following variables. (1) the teacher conveyed the objectives of learning mathematics outside the classroom; (2) the teacher provided instructions for the implementation of learning; (3) students from small groups consisted of 5 students; (4) the teacher provided an assignment sheet containing student activities; (5) students prepared to learn tools and materials based on the tasks that should be completed; (6) the students and their groups' study objects (learning resources) outside the classroom; (7) the students completed the assignments with their groups; (8) the observers supervised and recorded the students' learning activities; (9) the teacher served as a learning facilitator; (10) the students reported and presented their findings; (11) the teacher guided the discussion; (12) the teacher conducted an assessment; and (13) the teacher drew learning conclusions.

2.5 Data Analysis

The data obtained from formative test and questionnaire were analyzed by using descriptive statistics. Data analysis also involved the activity of comparing the same data collected over two periods. Data from the interview was recorded and transcribed in descriptions, then analyzed thematically by coding to identify similar and repeated patterns (Lester, et al., 2020)**.** The data was then validated through theoretical triangulation, and source triangulation (Miles & Huberman, 2016), and based on the results of the research and the previous experts' opinions.

3. RESULTS

In the first period of the study (odd semester), the students received mathematics learning outside the classroom for 6 months. During this period, the implementation of mathematics learning in the classroom was observed seriously. Student achievement in this period was also reported. The following is an example of the activities elementary school students had while having mathematics learning outside the classroom.

Fig. 1a shows the students' findings in the form of a school terrace floor that has a geometric shape. The results of the assignment are presented in Fig. 1b and then students discussed in groups to discuss the names of the geometric shapes found.

The following is an example of the activities junior high school students had while having mathematics learning tasks outside the classroom.

Example 1: The task of finding a geometric shape

In the school environment, many geometric models are found. Try to find and draw the names of the geometric shapes that you find. Then present your findings in class discussion.

Fig. 1a – Real geometric model

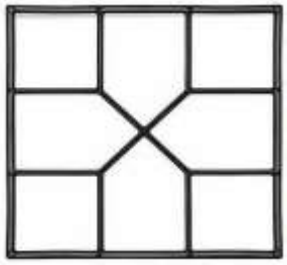

Fig. 1b – 2D geometric model

Fig. 2a shows student activities while having the task of measuring the area of the basketball court. The results of the task were presented in Fig. 2b and then students discussed to find solutions.

The following is an example of the activities senior high school students had while having mathematics learning tasks outside the classroom.

The school has a basketball court. A group of students got the task of measuring the area of a basketball court. Then students make a sketch of a basketball court picture as shown in the picture below. Students will calculate the area of the red basketball court and the area of the white area.

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Fig. 2a – Student activity

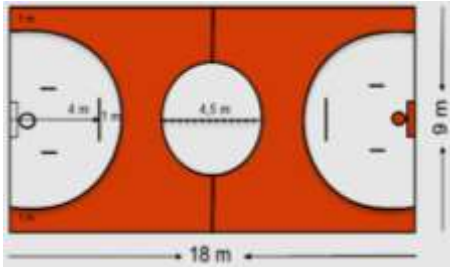

Fig. 2b – Specification of the field

Fig. 3a shows student activities while doing the task of estimating tree height using a simple clinometer. The results of the assignment are presented in Fig. 3b and then students discussed to find solutions.

Example 3: The task of estimating the height of an object

There is a tree in front of the school. Students will estimate the height of the tree. The distance of a tree with a student (as a measure meters). The student's height is 1.60 meters. Students measure the height of the tree from where it stands. The top of the tree is seen at an elevation angle of 30° from the eye's point of view. How tall is the tree?

Fig. 3a – Student activities

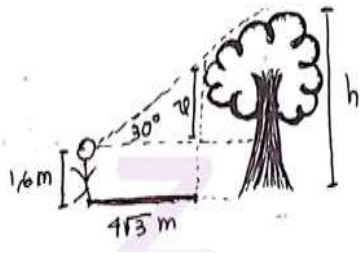

Fig. 3b – Student's work

While having mathematics learning outside the classroom, students observed an object (Fig. 1a; 2a; and 3a) and devoted their potentials to find out the whys and hows. Results of the student assignments were recorded in working papers (Fig. 1b, 2b, and 3b). Meanwhile, students' activities during learning outside the classroom were observed and recorded by observers. The results of the observation were reported as learning experiences outside the classroom, as shown in the following Table 2.

Table 2.
Learning experiences outside the classroom

Subjects observed	Learning experiences outside the classroom
Elementary School Students	○ Students explore geometric shapes outside the classroom; ○ Students document geometric shapes found outside the classroom; ○ Students discuss the properties of geometric shapes; ○ Students prepare the presentation of the results of the task; ○ Students communicate the results of their work.
Junior High School Students	○ Students discuss to determine the object to be studied; ○ Students prepare the measurement tools and writing instruments; ○ Students find geometric shapes in the school environment; ○ Students do the task in groups; ○ Students discuss in groups; ○ Students solve mathematics problems.
Senior High School Students	○ Students prepare the necessary equipment; ○ Students discuss the object to be studied; ○ Students work together to complete the task; ○ Students discuss in groups; ○ Students discuss to prepare reports; ○ Students represent their assignments.

Questionnaires were spread to respondents (students) through online method. The questionnaire contained 4 (four) open-ended questions. The respondents should respond to the question in written answers. The following

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is a recap of the results of the questionnaire which presents the top 3 (three) respondents' answers, as shown in Table 3.

Table 3.
Recap of the questionnaire response on student engagement

No.	Open-Ended Questions and Respondents' Answers
A.	Cognitive engagement:
1.	***What mathematics skills did you acquire while learning outside the classroom?***
R-a.	I have a better understanding of mathematics than before.
R-b.	I have a more rational predicting ability.
R-c,	I can represent mathematical problems in different forms.
B.	Affective engagement:
2.	***What feelings (emotions) did you experience while learning outside the classroom?***
R-a.	I enjoy learning mathematics outside classroom.
R-b.	I don't feel stressed and my interest in learning increases.
R-c.	I don't have mathematics anxiety.
3.	***What learning experiences did you get after learning mathematics outside the classroom?***
R-a.	I can communicate mathematical ideas freely.
R-b.	I feel valued in group work.
R-c.	I can apply mathematical theory to solve problems directly.
C.	Conative engagement:
4.	***What is the change in your behavior after taking mathematics lessons outside the classroom?***
R-a.	I don't skip mathematics class.
R-b.	I am more confident and do not shy away from mathematics assignments.
R-c.	I am more diligent in studying mathematics.

In the second period of the study (even semesters), students still received treatment for learning mathematics outside the classroom based on the characteristics of the mathematics subject material. During this period, the implementation of mathematics learning in the classroom was observed seriously. Student achievement in each period was also reported in Table 4.

Table 4.
Student achievement for two periods

Subject	First Period (Odd Semester)				Second Period (Even Semester)			
	N	Mean	Range	SD	N	Mean	Range	SD
Elementary School Students	72	73.4	67 – 82	13.02	72	75.8	70 – 90	10.19
Junior High School Students	72	81.6	74 – 90	11.99	72	83.0	81 – 92	10.35
Senior High School Students	64	80.7	76 – 88	12.55	64	84.2	80 – 90	9.64
Mean		78.6	-	-		81.0	-	-

To support data on the long-term impact of learning mathematics outside the classroom, the researcher conducted interviews with teachers and students. The following is an excerpt from the interview.

Researcher : *In your opinion, what is the long-term impact of learning mathematics outside the classroom?*
Teacher 01 : *I am more enthusiastic about inviting students to learn mathematics outside classroom.*
Teacher 02 : *Learning mathematics is more creative and very motivating for student learning.*
Teacher 03 : *Students can be actively involved in learning mathematics.*
Student 01 : *I became more confident while studying mathematics.*
Student 02 : *I became more comfortable learning math.*
Student 03 : *I have a positive disposition toward mathematics.*
Student 04 : *I can understand mathematical concepts.*
Student 05 : *I feel that my mathematical reasoning skills have improved.*
Student 06 : *I became convinced of mathematics as a future career choice.*

Information : Teacher (01) is an elementary school teacher
Teacher (02) is a junior high school teacher
Teacher (01) is a senior high school teacher
Student (01 and 02) are elementary school students
Student (03 and 04) are junior high school students

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Student (05 and 06) are senior high school students

Student behavior is one way that enjoyable learning outside of the classroom can promote opportunities for cognitive engagement. Table 5 illustrates the long-term effects of mathematics learning outside of the classroom on students' engagement in three dimensions.

Table 5.
Impact of Learning Mathematics outside the classroom

Dimensions	Impact of Mathematics Learning outside the classroom for students	Data Source
Cognitive	(a) The ability of students' mathematical understanding increased to be better; (b) Students acquire more complex mathematical representation skills; (c) Student achievement increases; (d) Students' cognitive structure increases in long-term memory.	Written test Questionnaire Observation
Affective	(a) Students are more enthusiastic about learning and students do not feel high pressure; (b) Students obtain meaningful learning security; (c) Students can avoid mathematics anxiety; (d) Students have a high interest in learning.	Questionnaire Observation
Conative	(a) Students participate actively in learning; (b) Students can work together in teams; (c) Students have confidence in expressing opinions; (d) Students have a positive mathematical disposition.	Questionnaire Observation

4. Discussions

4.1 Cognitive Engagement

Based on the data in Tables 2, 3, and 4 as well as the results of interviews, learning mathematics outside the classroom has provided a positive impact on students' cognitive development. In questionnaire data (see Table 3), most of the respondents suggested that learning mathematics outside the classroom contributed to improving the ability to understand mathematics (Hoogland, et al., 2018), students become more critical in arguing during discussions by making assumptions (see Table 2) (Rustam & Ramlan, 2017), and students can develop mathematical representation skills (see Figure 1b, 2b, and 3b) (Clarke & Roche, 2018). Student engagement in the cognitive dimension has brought an impact on increasing mathematics learning achievement from the first period to the second period (see Table 4). In the interview session, students 04 and 05 added that, through learning mathematics outside the classroom, they had the opportunity to understand mathematical concepts and develop adaptive reasoning (Dyment, et al., 2018). They could discuss arguments to explain each other and attempt logical thinking by justifying their thinking and choosing different solutions for mathematical tasks (see Table 2) (Laird & Grootenboer, 2021).

4.2 Affective Engagement

Emotional engagement refers to students' emotional reactions while participating in mathematics learning outside the classroom. Emotional engagement may be a situational state, bound by time and environment, related to an individual in general non-situational influence toward a subject (Lee, et al., 2019). This refers to interests and values the students possessed and led them to feel happy or enthusiastic about doing the tasks given by the teacher (see Figure 2a, and 3a). Based on the data from Table 3 and the results of interviews, learning mathematics outside the classroom has a positive impact on the emotional development of students (Pambudi, 2022; Prasetya, et al., 2020). They can learn together without any pressure and are not really stressed by plenty and boring mathematics tasks that it is meaningful for them (Clarke & Roche, 2018). They also feel valued for their ideas when they study together outside the classroom. Learning mathematics outside the classroom tends to reduce the level of students' mathematics anxiety (Mann, et al., 2022).

4.3 Conative Engagement

The results of the conative engagement questionnaire (see Table 3) indicated a change in student behavior after participating in mathematics learning outside the classroom. Changes in student behavior include: students did not leave during mathematics lessons, students did not avoid mathematics tasks, students were more confident, and students were more diligent in learning mathematics. Conative engagement could be seen in the participation of students while completing tasks and contributing to group discussions (See Table 2). On the other hand, learning outside the classroom has facilitated areas that support social development and provide opportunities for students to socialize with other people in the community (Romar, et al., 2019). Learning mathematics outside the classroom is also beneficial for students to learn about safety and monitoring because students learn in new situations with higher risk (Pambudi, 2022; Prasetya, et al., 2020). This change suggested that conative engagement in learning mathematics outside the classroom has been manifested in the form of positive behavior in students' daily lives (Romar, et al., 2019).

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4.4 Learning Experience and Long-Term Impact

Learning mathematics outside the classroom provides students the opportunity to have direct contact with the real world and provides a unique experience not found in the classroom or in textbooks (Pambudi, 2022; Prasetya, et al., 2020). The quality of learning mathematics outside the classroom in real situations will provide increased capacity for learning achievement through the objects studied and can build better social and personal skills. The change from learning in the classroom to learning outside the classroom brings a difference learning atmosphere, a lot of learning experiences for students, and student engagement in the cognitive, affective, and conative dimensions (Laird & Grootenboer, 2021; Otte, et al., 2019; Romar, et al., 2019).

In mathematics learning outside the classroom, there is a close relationship between emotional (affective), behavioral (conative), and cognitive engagement. Many students are willing to take greater risks and persist while learning outside the classroom (Avci & Gümüş, 2020; Remmen, 2022). Emotionally, they feel happy, comfortable, and without high pressure (not stressed) when learning outside the classroom. Fun learning outside the classroom can facilitate opportunities for cognitive engagement and is manifested in the form of student behavior (see Table 5). The findings of previous experts provide data support for the results of observations and interviews with students and mathematics teachers (Teachers 01; 02; and 03) for two periods (semesters), that learning mathematics outside the classroom has a significant impact on students' positive behavior (Picknoll, et al., 2023; Romar, et al., 2019).

The student's cognitive, affective, and behavioral reactions suggested a tendency to respond positively to learning mathematics outside the classroom. Students were more confident and more motivated in dealing with mathematical tasks. Aspects of student behavior and attitudes had a positive impact on cognitive aspects. When students had a view about the importance of mathematics in real life, they feel involved, confident, and connected to learning mathematics. Thus, these three aspects, (cognitive, affective, and conative) were interrelated in shaping learning experiences and student engagement in learning mathematics (Li, et al., 2023; Sanchal & Kuiti, 2017).
Learning mathematics outside the classroom had a long-term impact on student engagement in three dimensions (see Table 5): (a) the cognitive dimension; students were able to develop mathematical abilities such as critical thinking, problem-solving skills, and reasoning abilities; (b) affective dimensions; students' positive disposition towards mathematics increased and students' anxiety levels towards mathematics decreased; and (c) the conative dimension; improvement in social skills, cooperation, better communication, confidence, and diligence in learning mathematics (Uwerhiavwe, 2023). The results of this study had implications for the learning process. Teachers require to be optimistic to practice mathematics learning outside the classroom. It suggested the importance of improving teacher teaching skills in managing to learn outside the classroom. Therefore, teachers require to receive skills training in managing mathematics learning outside the classroom as a teaching competency that must be mastered.

5. CONCLUSION

Outdoor mathematics learning is a key feature for students to realize their mathematical potential and abilities. Managing mathematics learning by using resources outside the classroom can help increase student engagement in the cognitive, affective, and conative dimensions. The change from learning in the classroom to learning outside the classroom provided a different learning atmosphere and a lot of learning experiences, and increased student engagement in the cognitive, affective, and conative dimensions. Mathematics learning outside the classroom has a long-term impact on student engagement in three dimensions, namely (1) the cognitive dimension; students are able to develop mathematical abilities such as critical thinking, problem-solving skills, and reasoning abilities; (2) affective dimensions; students' positive disposition towards mathematics increased and students' anxiety levels towards mathematics decreased; and (3) the conative dimension; improvement in social skills, cooperation, better communication, confidence, and diligence in learning mathematics. Apart from that, the present study does not explore the role of the teacher in learning mathematics outside the classroom. Therefore, in upcoming research, the future researchers who are interested in this topic can review the engagement of teachers in learning mathematics outside the classroom. Besides, for teachers who are eager to apply mathematics learning outside the classroom, it is recommended that (1) the teacher gives clear activity instructions to students according to the learning objectives to be achieved; (2) teachers require to provide adequate support for learning facilities and infrastructure to implement this learning, and (3) teachers must supervise and act as facilitators in student activities during learning outside the classroom (in an open environment).

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