Mathematics Learning Community: A Case Study

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Abstract: The desire to equip students with 21st-century skills has prompted teachers to find alternative ways to promote real learning of mathematics. One of these ways includes building communities of best practices, with the collaborative efforts of parents. This study aims to investigate how mathematics teaching communities develop mathematical knowledge and skills in students. This study interviewed four teachers for insights into their teaching practices, specifically, how they built a learning community to foster the learning of mathematics. The findings showed that the teachers, working with parents, provided substantial support to develop students' knowledge of mathematics and 21st-century skills, such as life skills. This study shows how mathematical knowledge and skills can be developed within a community with little access to advanced technology and how students can be supported to acquire life-long learning skills.

Keywords: Community, Mathematics, Parents, Teachers.

1. Background of the Study

Introduction to 21st-century skills among teachers has motivated teachers to address challenges of educating school children. Many schools now aim to equip students with 21st-century skills using advanced technological tools for more interactive instruction and learning (Shafie et al., 2019). Use of state-of-the-art tools makes linkages to global educational sites possible, providing students with online interactive learning experiences. However, feedback from teachers indicates that it may not always be possible to employ available tools in their schools due to the realities related to Internet connectivity, flexibility, high costs, among other factors (Cheok et al., 2017). Hence, students or teachers may not be able to apply any advanced tools in teaching. However, teachers still need to equip students with the advanced skills prescribed in the curriculum (Charleston., Moxley, & Batten, 2011). Hence, creative teaching practices need to involve entities within the community, to circumvent the lack of access to state-of- the-art technology, integrate ideas, and to develop learning communities, focusing on the development of the new world competencies. In other words, the community has become the backbone in developing 21st-century skills. The outcomes of interaction within the community may strongly be associated with different environments. Normally, educational decisions and implementation are always illustrated or reported according to two environmental conditions: urban and rural. It is acknowledged that schools' development and culture differ in urban and rural settings. Hence, educators

and researchers are starting to find alternatives and initiatives to develop 21st-century skills in rural schools to ensure that students in remote areas will not lag behind their counterparts in urban areas. Even though schools in remote areas lack access to advanced facilities and technology, available resources and cooperative efforts among teachers have made it possible to build communities of best practices within and outside the schools. On this matter, Tandas (2020) asserts that the teacher community as an entity plays a vital role in building 21st-century skills among students. These skills include creative learning skills, information management and life skills (Partnership for 21st Century Skills, 2004). The present study investigates how the entity of the mathematics learning community develops mathematical knowledge and skills in students living in a remote rural setting.

2. Literature Review

In many teaching contexts, teachers shoulder heavy responsibilities. Many guidelines are shared on teachers' roles to equip students with 21st-century skills, for example, those on applying IT instruments (Cueto et al., 2020) in mathematics classrooms. Nevertheless, it is less applicable for schools with low Internet accessibility to promote 21st-century teaching techniques like digital literacy as teachers in remote areas have fewer facilities than their counterparts in urban schools to achieve educational aims. Hence, it is time for educators to consider alternative ways to develop knowledge and skills in their students. Tandas (2020) states that teachers can focus on teaching activities such as engaging students, imagining, and aligning instruction to provide an educational framework for achieving 21st-century skills. The focus employs multiple resources, and takes into account students' individual needs to enable them to acquire 21st-century skills. Thus, it is essential to explore opportunities to engage students in learning, within the community and determines opportunities that are available. Figure 1 depicts the community's role in helping students to acquire 21st century skills.

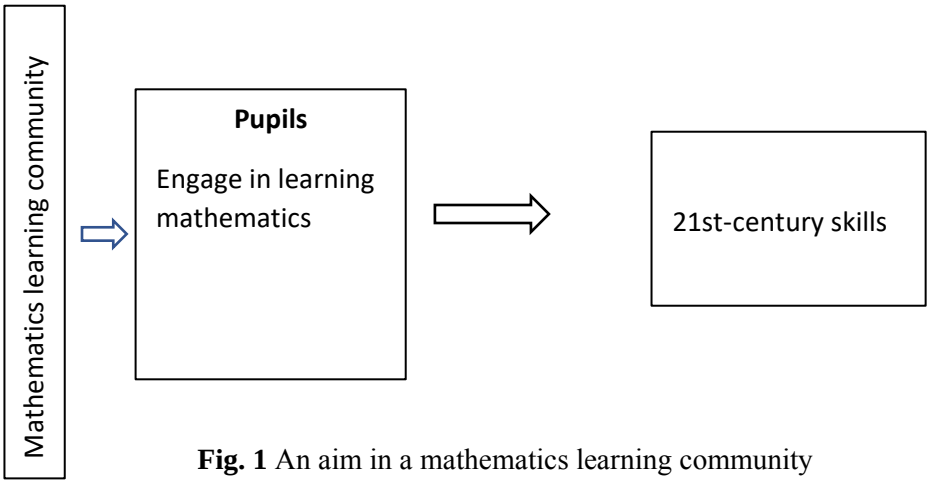

Fig. 1 An aim in a mathematics learning community

Figure 1 illustrates that students' engagement in learning mathematics is essential for thinking skills development and for honing 21st -century skills. Teachers, therefore, play an important role, in modelling reality, shouldering heavy responsibilities associated with a learning community (Viac & Fraser, 2020). As described by Blazar and Kraft (2017), teachers' involvement in the mathematics community may produce a strong effect in shaping students' attitudes to learning, which in turn could contribute to mathematics achievement (Mazana et al., 2019).

Mathematics and Community

Developing mathematics knowledge is essential. Students who possess good knowledge of mathematics tend to excel in most aspects of academic work in Science, Technology, Engineering, and Mathematics (STEM). Cognition development in STEM is an outcome of problem-solving activities, which are also platforms to build social skills (Schoenfeld, 2009). Hence, mathematics knowledge is socially constructed. Social interaction will not be fostered if the environment is not ready for mathematics development. The heavy task of facilitating the building of social skills and ethical responsibilities in learning mathematics has prompted teachers to work collaboratively and creatively within a community (Kim et al., 2019). Such activities include applying relevant knowledge, problem-solving strategies and monitoring. The activities constitute ways of engaging students to attain key goals for mathematical knowledge development (Brodie, 2020). Hence, teachers' effort to engage students is crucial for the development of mathematics knowledge. Conscientious teachers seek meaningful methods to engage students in learning. Using the right pedagogy of teaching mathematics aims to provide sustained efforts for meeting the challenges of educating underprivileged students. However, there are arguments on the responsibility for developing mathematics education nationally. In addressing this problem, much more cooperation from many parties is necessary than is seen in many contexts, for example, learning communities. Formally, mathematics learning communities encompass a team of teachers gearing to increase mathematics achievement by establishing a conducive school culture (Stoll et al. 2006) besides exploring alternative approaches (McLaughlin and Talbert 2008). Recent studies strongly recommend parents' involvement in mathematics education. Although the parental input may not replace the teacher, parents can provide much needed support for learning, with help from school teachers (Jay et al., 2018). Ideally, parents and teachers could intensify efforts made within the learning community to ensure learning truly takes place, especially among students who still lack sufficient mathematics skills and content knowledge.

Teachers' Role

In many educational settings, experts and resources are required to assist the parents and community in engaging students in mathematics education (Teoh et al., 2020). Hence, teachers play two vital roles in mathematics education. Firstly, teachers are leaders who are tasked with the responsibility of providing leadership in the community for developing knowledge and skills. They bear heavy responsibilities for handling teaching matters in school. They need to understand students' academic and family backgrounds. Besides, they need to build a good rapport among their students through frequent contact with students. It creates opportunities for teachers to provide more input for real learning. Ross (1994) investigated students' mathematics achievement and related the achievement to students' experiences in the cooperative learning environment. Students' past experiences mediate teachers' influence on mathematics achievement. Moreover, teachers, being experts in their profession, can introduce related and useful resources and guide parents. More important, teachers are experts to consult in any collaboration work for the development of mathematics education.

Mathematics education aims to achieve competencies for life. Abilities in mathematics can be developed through mathematics formal or informal activities to engage students in problem solving. However, the ability to solve mathematics problems is related to students' family and educational backgrounds. It has been found that students' relationship with their peers and family influences their learning attitudes (Grootenboer & Zevenbergen, 2008). Equipped with knowledge of students' backgrounds, teachers can successfully engage students in mathematics activities and set up mathematics communities to foster meaningful learning (Bartell, Drake, Turner, & Foote, 2019). Collaborative activities are some good examples that can help students to be better in their mathematics learning as Saka (2021) found that those who are engaged in collaboration tend to perform better than those who do not. This is supported by Olanrewaju and Suleiman (2019) who found similar results for their study. Next, they can develop the culture of learning mathematics (Goos, 2004). Creative learning activities can be incorporated into the classroom, with input from community members . Suggestions have included using visuals to engage students (Halif et al., 2020). Increased interest in learning mathematics would promote students' engagement and facilitate the development of critical thinking (Salleh, 2019). It is clear that the keyword "engagement" is the major component to make a mathematics

learning community successful (Forman & Ansell, 2002), and it is argued that the integration of teachers' and students' roles will foster engagement.

Parents' Roles

Parents concerned about their children's development tend to make efforts to ensure their children thrive in and outside school. One of these efforts can be seen from their exploration of resources available in schools, which are exploited to maximise the children's learning. Another can be seen through active participation in parent-teacher meetings, where sharing of parenting and learning experiences is used to address problems related to the teaching and learning of mathematics. Even when the involvement is informal, communication between teachers and parents is important. Civil and Bernier (2006) actively encourage exchange of ideas on the teaching and learning of mathematics, pointing out that interactions produce positive effects on mathematics education. Examples of parental involvement in mathematics education are provided by Civil and Andrade (2003). The engagement between parents and teachers fosters the development of a mathematics community, which constitutes an important entity for improving mathematics education (Civil & Andrade, 2003). Hence, more collaborative practices between school and parents can be encouraged through this platform. Recent reports have drawn attention to the advantages of collaboration between parents and teachers (Sirvani, 2007; Smith & Sheridan, 2019) and parents' positive influence on their children's mathematics performance (Mistretta, 2013; Sirvani, 2007; Smith & Sheridan, 2019). These studies have underlined parents' role as intellectual resources (Civil & Andrade, 2003), providing input based on their perspectives and experiences, which teachers can harness to enhance instruction and the learning of mathematics.

3. Methodology

The present study was a case study to investigate the development of mathematics education within a community. This study was conducted in three schools located in a rural and remote area, far from an accessible town in Taman Negara, Pahang. The schools, with few students, were managed by very few teachers. Considering the remoteness of the schools, it was remarkable that students from a school performed well in mathematics On average, yearly, only 5 pupils sit for a standard examination, namely, Ujian Penilaian Sekolah Rendah (UPSR)., as indicated by the results displayed in the table below. Between 2012 and 2019, about 20% of students achieved the highest level in mathematics, namely grade A, in the standard examination UPSR.

Table 1: UPSR mathematics performance

Year	Average Percentage of students scored A in UPSR mathematics (%)
2012 -2019	20

The sample was made up of four teachers who were directly or indirectly involved in the teaching of mathematics. The teachers were randomly selected from three schools in Taman Negara, Pahang, Malaysia. Details are shown in Table 2.

Table 2: Samples

Teacher	School
T1	School 1 -Primary school
T2	School 1 – Primary school
T3	School 2 - Secondary School
T4	School 3 – Primary school

The schools, labelled as School 1, School 2 and School 3, were randomly selected. As the table above shows, Schools 1 and 3 were primary schools and School 2 was a secondary school. The school system (School 1) made it compulsory for the Year Six pupils to stay at the school hostel. Hence, the teachers had more responsibilities, teaching and providing pastoral care for the students. It was observed that the schools had few facilities. School 2 was a secondary school. The students in the schools were living in the villages nearby, and some were identified as indigenous. In this survey, four teachers teaching in the school were interviewed. As shown in the table, they were identified as T1, T2, T3 and T4.

4. Findings

This study aims to investigate how the entity of the mathematics community develops mathematics education. The following results are based on the analysis of the data from the interviews conducted from February to October 2020.

Research Question One: How do the teachers engage the students in the learning community?

The finding on teacher engagement was derived from teachers' reports on their own practices in the schools. Their practices drew attention to their roles as educators. Overall, the teachers who taught mathematics assumed full responsibility for the pupils' development of mathematics knowledge and motivating students to learn mathematics.

Students' achievements in mathematics can provide an indication of teachers' commitment to providing a good environment for learning. The following feedback from T1 indicates that the teachers were well acquainted with the pupils' backgrounds, and teaching methodologies adopted were tailored to meeting individual needs, possibly facilitated by the small number of students taught.

> *T1: We are aware that our pupils need help. All the teachers are ready to accept all backgrounds of students. (sic)*

It was clear that knowledge of pupils' backgrounds was considered important for teachers to adopt practices and procedures to enable their pupils to learn and for teachers to provide adequate support. It was also revealed that pupils were educated to be responsible for themselves. Older pupils namely, the Year 6 students, apparently, had engaged in all activities to achieve the targeted level in mathematics. Teachers ensured that they created a supportive environment for students to engage actively in the activities planned by the school. The teachers were found to be very committed, making sacrifices, and doing all that was necessary to fully engage the pupils. To them, engagement made learning tasks meaningful. The teachers revealed that the pupils were appreciative of the sacrifices they made, and the good reputation they built up, among students and parents, motivated them to spend more time with the pupils. T1 explained that the teachers conducted many activities after school, for Year 6 pupils staying at the school hostel. T2 revealed that all pupils were motivated to engage in the learning activities since they felt that they were well cared for in many aspects. T3 provided examples of the efforts made by teachers to help students learn mathematics. The engagement outside the classroom seemed to promote much learning. The following excerpts highlight the teachers' commitment to the community:

> *T1: We have Year 6 pupils. They all stay in the hostel. They work hard and are committed. Hope they are well guided in doing exercises.*
> *T2: I make sure that all pupils engage in whatever activities we conduct. In the classroom, most of the pupils are passive, but since we have built our relationship, the pupils can get along with the teachers.*
> *T3: We have a tuition class. There are gaps among the students. We will divide the students according to their ability. Many are not well exposed. They need teachers' guidance. For example, I asked them to make a model system planet. They need a lot of guidance. We are trying group discussion. Teachers need to trigger their thinking (provide stimulus). In the*

syllabus, we have many questions about higher-order thinking. Teachers need to put more effort to provide clear situations to develop their thinking. (sic)

Research Question Two: How do the teachers engage the parents in the learning community?

Although parents were not interviewed, their willingness to engage in their children's learning activities could be inferred from the teachers' responses. It was revealed that the school management addressed parents' concerns through frequent communication. Besides, it was found that parents were very supportive of the schools' efforts and their children's learning activities. These revelations suggest that a collaborative learning community making up of teachers and parents could be established. The interview answers also showed that teachers were ready to involve parents who had received formal education. These parents could be facilitators to assist teachers and other parents in helping students learn mathematics. The interviews revealed that teachers wanted to work closely with parents to create a supportive community:

T1: We have pupils who are currently studying in this school. The parent can become a facilitator for mathematics education and workshops for other parents in the community. (sic)

Studies conducted in other settings suggest that parental involvement is associated with environmental development. Parents who care about their children's achievement in mathematics need resources to help their children maximise learning. To access reliable resources, parents need to communicate frequently with teachers. T2 explained that he helped several parents to obtain reference books. T2 also felt very proud of the proactive parents' involvement in the learning community, and pointed out that their participation in the learning community was purely voluntary and the parents were concerned about their children, which was also conveyed through their willingness to spend time with the children to achieve learning outcomes. Specific contributions of parents were clarified by Teachers T2 and T4, but T3 and T4 revealed that despite their attempts to reach out to parents, there were parents who were not ready to participate in the learning community:

T2: We have parents who are not only caretakers but also tutors to their children. Some parents seek help from me to get or buy references. They have difficulty traveling to town which is located about 80 km from here. I used to travel back to my hometown after a week working here. I am not a resident here. I have family in the town. Some parents get themselves references and their children always work for extra practices, and the parents' guide them.(sic)

T4: *Not all responded to teachers' messages in WhatsApp. About 50% will cooperate with teachers. For example, some parents did extra such as guiding their children in learning. Only pupils whose parents are active in guiding their children, their children engage themselves in learning. (sic)*

T3: *We communicate with the parents through WhatsApp, but not all parents are cooperative. The students' attendance rate has a problem too*.(sic)

The relationship between teachers and parents may build representative identities in the community. The interviews revealed that the parents trusted the teachers and assisted them whenever it was possible. Even though not many parents could directly contribute to improving their children's mathematics performance or participate actively in learning sessions such as mathematics workshops, they encouraged their children to get involved in the activities. Their support prompted the school to organize academic activities to increase motivation, as revealed by T2 and T4. The interest shown by parents also prompted teachers and school counsellors to provide needed support for parents, to enable them to help their children learn mathematics.

T2: Yes. Universities or organization did conduct motivational talk in the previous years.

T4: *Counsellors are active in guiding. They provide brochures to parents on how to guide their children at home*

5. Discussion

Figure 2 illustrates the findings in this study. These findings have illuminated the practices of a learning community in a remote setting in Malaysia. Despite encountering challenges in teaching the students in schools that lacked state-of-the-art technological resources, teachers were found to be committed, expending much effort to ensure the learning of mathematics was effective, by engaging students through learning activities that were often conducted outside school hours, to develop the students' knowledge and skills. The teachers believed that these activities would develop skills necessary for solving higher order thinking questions and provide opportunities for students to engage fully in learning. Parents' involvement in the learning community, while voluntary, was found to depend on the teachers' initiatives and commitment.

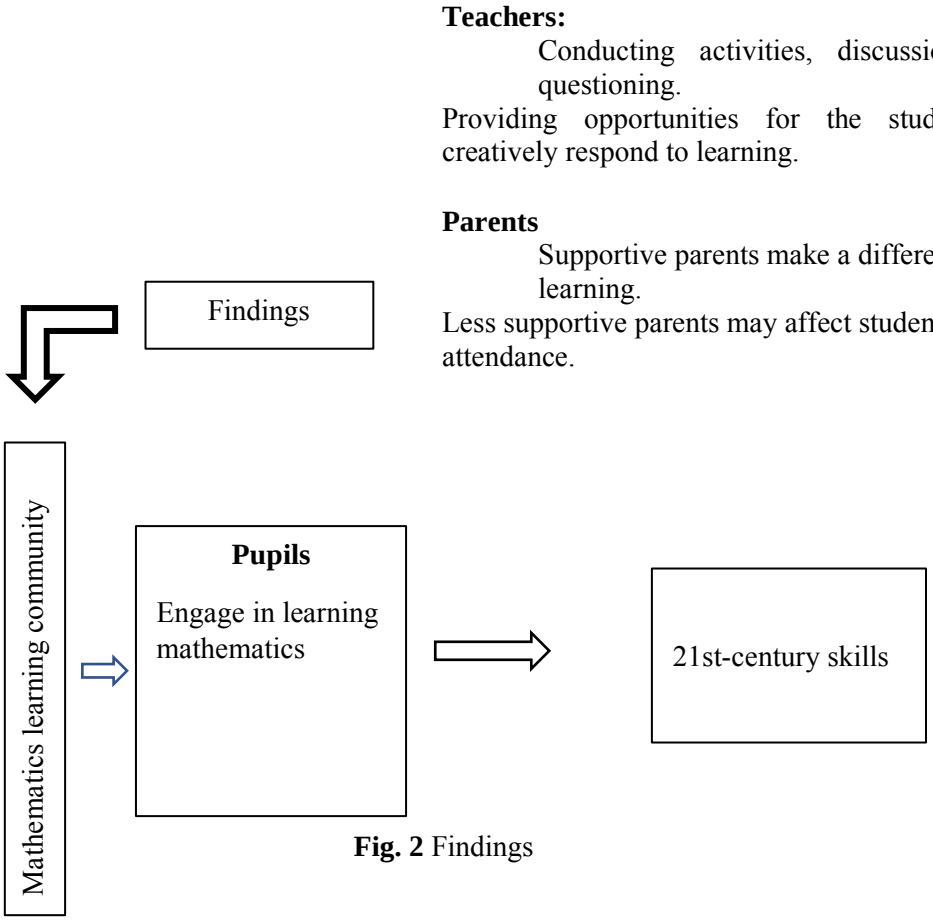

Fig. 2 Findings

These findings draw attention to the important role played by teachers. In the context of the present research, they suggest that teachers provide the impetus towards the development of a collaborative learning community, which is helpful for the development of knowledge and skills among learners (Guven & Dede, 2017). Nevertheless, it is acknowledged that developing students' mathematical thinking in many contexts remains challenging, but dedicated and caring professionals can spark change, through creating an adaptive and nurturing environment (Pirie & Kieren, 1992; Walshaw & Anthony, 2008) which sees parents working closely with teachers to participate actively in skill and knowledge development among students. There are certainly advantages to involving parents in mathematics education. Firstly, Gay (2000) found that parents, as motivators and facilitators, can

enhance student learning, confirming an earlier finding on the important role played by family members (Taylor, 1997). Since this study has drawn attention to the importance of a learning community with parental involvement, more initiatives need to be undertaken to build strong learning communities to support mathematics education. Secondly, the study has also highlighted the importance of print resources in schools and communities that lack access to technological tools and online resources. These traditional resources have been found to be relevant and reliable, essential for helping students learn concepts in mathematics. Supportive parents depend more on print resources than on online resources. They ask teachers for work books, work sheets and printed references which they can use to work with their children. It can be concluded that parents are not formally involved, but they offer vital support. Their participation in their children's learning has strengthened educational practices and illuminated contributions that can be provided by the community. The contributions of a learning community to mathematics education can be seen from projects done (Barton, 1996; González, Moll, & Amanti, 2005). All these projects have provided insights into ways in which teachers as leaders have moved away from the enclosed area of classrooms to involve the community and make the teaching and learning of mathematics effective and meaningful to students.

Furthermore, this study has also revealed that schools can yield impressive results in mathematics examinations without depending on social media or any online resources. It was shown that 20% of the students from the schools in the study obtained grade A in UPSR mathematics over a number of years. This finding suggests that traditional forms of learning mathematics remain relevant, and that students need to experience learning and find the learning of mathematics meaningful. Teachers and parents in the learning community need to create opportunities for pupils to experience learning themselves. It echoes Dewey's (1938) emphasis on giving students experiences of learning to increase students' understanding. However, it is acknowledged that students' attitudes may change from time to time; hence, the mathematics community needs to be alert to the changes and make adjustments whenever necessary. Available literature also shows that meaningful activity has the potential to change learners' mindsets (Cole, Engestrom, & Vazquez, 1997). It is essential for teachers, as leaders, to help students adopt positive attitudes to learning and ensure that all pupils are actively engaged in the learning. Teachers' commitment and dedication are also contributions to the mathematics community as they can bring about positive change through their leadership and initiatives.

6. Conclusion

This study investigates the practices of a mathematics learning community in Taman Negara Pahang. It shows that all the parties, namely teachers, parents, and pupils put in a lot of effort in developing mathematics education. The teachers, as leaders, play a leading role to establish relationships in a learning community. Hence, they create a conducive culture for the learning of mathematics. This study has shown that a learning community does not need to rely on advanced technological tools to develop good learning practices. Instead, it draws attention to good practices seen in the dedication and commitment of teachers, and collaboration between teachers and parents. It has also shown that these practices can help students living in disadvantaged settings to perform well in mathematics.

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