JOURNAL OF RESEARCH IN SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION
DOI: 10.31756/jrsmte.616SI

Indonesian Curriculum 2013 Ten Years On: Its Impact on Mathematics Teaching

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Abstract: The Indonesian Government introduced the 2013 Curriculum as an attempt to improve education within Indonesia. International comparisons showed that mathematics was a subject in which there was much room for improvement. As it is now ten years since the introduction of the new curriculum, it is timely to review its implementation. A key element of the 2013 curriculum is using the Scientific Approach (observing, asking, exploring, associating, and communicating) as the fundamental pedagogy with a general emphasis on active learning. This study explores the extent to which this has been implemented and the challenges within the classroom by utilizing various data sources, including student focus group discussions, classroom observations, documentation reviews and teacher interviews. This produced a multi-dimensional data set which reveals that ten years on from its introduction, the implementation of the Scientific Approach in mathematics teaching is, at best, inconsistent. In practice, there is still a great reliance on teacher-centred pedagogies, although lesson plans indicate an intent to promote more active learning. Students tend to remain passive and individual learners, although they express a strong desire to work together. Teachers report difficulties in finding appropriate learning media to facilitate active learning pedagogies and school infrastructures are often a hindrance to the use of the Scientific Approach.

Keywords: *Scientific Approach, 2013 Curriculum, Active Learning in Mathematics*

Introduction

According to the PISA[1] results, Indonesian students do poorly in mathematics compared to students in other nations (Wulandari & Jailani, 2015). The PISA process is widely considered to have strong legitimacy in describing a country's educational quality (Pratiwi, 2019). Indonesia has taken part in PISA since 2000. Based on the results of the 2012 PISA, in which 65 countries participated, Indonesia was ranked 64th in mathematics out of 65 participating nations (OECD, 2012). One of the Indonesian government's attempts to respond to the low PISA outcomes was to transform the curriculum by implementing the 2013 Curriculum in educational units (Pratiwi, 2019). However, the same pattern has continued. Indonesia's achievements remain far behind those of other participating nations. In the most recent PISA iteration, conducted in 2018, the average position of Indonesian students in mathematics was 72nd out of 78 countries participating (OECD, 2019).

[1] PISA: Program for International Student Assessment

The Indonesian 2013 Curriculum was introduced as an improvement on the previous Indonesian curriculum. According to the Permendikbud[2] No. 65 of 2013 on the standard process of teaching and learning, the Scientific Approach shall be used as the primary pedagogical strategy for all subjects, including mathematics (Ministry of Education and Culture, 2013). The Scientific Approach to teaching has similarities with the scientific method used in scientific research (Tang et al., 2010 and Edmund, 1994). In this article, the phrase "the Scientific Approach" is used to refer to the pedagogical strategy set out in the 2013 Curriculum. The Scientific Approach set out in the 2013 Curriculum is a learning process that encourages students to participate in meaningful learning through five steps: 1) observing, 2) asking, 3) exploring, 4) associating, and 5) communicating. The learning process is directed at developing three areas: attitudes, knowledge, and skills (Ministry of Education and Culture, 2013). Curriculum 2013 implementation is characterized by a fundamental shift in the learning process, emphasizing active learning.

However, some studies indicated that many teachers, including mathematics teacher have trouble putting the Scientific Approach into practice (Hasanah et al., 2020; Retnawati, 2015). Mathematics learning in Indonesia still tends to be 'mechanistic', placing more emphasis on students remembering, memorizing or rote learning and less (or not even emphasizing at all) students' reasoning, problem-solving or understanding of the context (Shadiq, 2009). Anintention of the 2013 Curriculum is that learning should offer students opportunities to construct knowledge in line with the growth of their cognition (Haq & Murdiono, 2019).

As discussed above, during the ten years of implementation of the 2013 Curriculum in Indonesia, numerous challenges have been encountered. These have resulted in a curriculum implementation that fell far short of expectations. Curriculum 2013 has not yet had the desired effect. This may be because teachers have not yet been able to fully implement it. This case study will explore the state of implementation ten years on in one province of Indonesia. The results of the study may provide pointers to the position nationally.

Background and Previous Studies

The 2013 Curriculum

The 2013 Curriculum focuses on mindset development, strengthening curriculum governance, deepening, and expanding material, strengthening the learning process, and adjusting the learning burden in order to ensure compatibility between the aims and outcomes. On this basis, the implementation and adoption of the 2013 Curriculum was seen as a strategic step for preparing Indonesian citizens to face the globalization challenges of the future. This was to be achieved by integrating three domains of competence including attitudes, knowledge, and skills (Ministry of Education and Culture, 2013). Furthermore, according to Ministry of Education and Culture (2013), the

[2] Permendikbud: Regulation of The Minister of Education and Culture of The Republic of Indonesia

implementation of the 2013 Curriculum was expected to be characterised by a thematic-integrative learning model, the Scientific Approach, active learning, and authentic assessment.

The Scientific Approach

Permendikbud No 22 in 2016 (about the standard process of primary and secondary education) underlined the necessity for a learning process based on the Scientific Approach. The Scientific Approach is designed to help students learn, understand, and apply what is being studied. In the learning process, it is therefore planned that students acquire knowledge from various sources by observing, asking, exploring, associating, and communicating (Ministry of Education and Culture, 2013). More details of the five stages of the Scientific Approach are provided in Appendix 1.

Teacher Competency in Implementing Curriculum

Teacher competence is the capacity of teachers to carry out their professional responsibilities as educators. Competence encompasses knowledge, abilities, attitudes, and values, which are acquired through education, one's profession, and life experience (Zaragoza et al., 2021). According to Indonesia Law No 14 Year 2005 about teachers and lecturers, teacher competence includes pedagogical competence, personality competence, social competence, and professional competence obtained through professional education (The Indonesia Law of teacher and lecturer, 2005). Pedagogic competence is the educator's capability to lead learning. This competency can be seen in the planning of teaching and learning activities, engagement with or managing the learning process, and assessment of student performance (Akhyak, 2013). The attitude of mathematics instructors is a significant determinant of students' attitudes and performance in these subjects (Henderson & Rodrigues, 2008). Mathematics teachers with good pedagogical knowledge can understand students' difficulties in learning mathematics (Tsafe, 2013).

As part of implementing the 2013 Curriculum, the government provided nationwide training courses on the Scientific Approach for teachers. However, according to Suryadi et al. (2019) despite extensive training in teaching and learning, teachers' abilities to implement the 2013 Curriculum have not improved significantly. Changing the teacher paradigm is not easy to do. Purwoko (2015) reported that teachers were not ready to switch from traditional methods of instruction to the Scientific Approach. Hasanah et al., (2020) identified some problems of mathematics teachers in implementing the Scientific Approach in the learning of geometric sequences and series. Teachers are not successful in prompting the students to construct appropriate questions. This difficulty in the second stage of the Scientific Approach then impacts the following exploring stage.

Furthermore, in practical teaching, teachers must understand their students' abilities in mathematical problem-solving. In order to teach problem-solving effectively, a teacher must possess a specific form of knowledge that should be more than just being able to solve standard problems (Ball et al., 2008). However, a study by Mutia, (2019), reported that mathematics teachers struggle with using problem-solving when teaching mathematics, which has an impact on the development of students' problem-solving skills.

Research Question

In this study, the researchers will examine the implementation of the 2013 Curriculum and the barriers encountered in implementing the 2013 Curriculum in teaching mathematics in three junior high school in Lampung Province, Indonesia.

This paper seeks to address the research questions:

1. Has Curriculum 2013 been implemented into the practice of mathematics teachers in Lampung Province?
2. If not, what are the barriers to the implementation of the Scientific Approach in teaching mathematics?

Methodology

To address RQ 1 and 2, the researchers used a qualitative research method to focus on individuals' first-hand experiences. Purposive sampling was used to collect views and experiences of mathematics teachers who teach grade VII and of students in grade VII. The data-gathering was conducted online because of the pandemic situation. The gatekeeper (headmaster) and mathematics teacher were emailed at the beginning of March 2021 with a request to participate in this study and three junior high schools in Lampung province agreed to participate. These schools will be referred to as Schools A, B and C in the discussion below. School A is located in Bandar Lampung, the provincial capital of Lampung. This school is an Islamic boarding school. School B is in the southern portion of Lampung province, and this school is a public school. In addition, school C is in the south of Lampung province and this school is private Islamic school.

In this study, data was gathered from March to June 2021. Qualitative data were obtained from student group discussions with 24 students (eight from each participating school). In addition, three teachers (one from each school) who teach seventh-grade mathematics participated. The three teachers were honorary[3] and only one is a certified teacher. The study employed in-depth interviews, curriculum documentation review and classroom observation to explore the mathematics teachers' perspectives, experience, and thoughts about teaching mathematics in the classroom, Figure1 shows the research procedure of data collection of this study.

Data collection was carried out in a series of sequential data-gathering activities. These began with student group discussions, followed by classroom observations, documentation review and, finally, teacher interviews. More details of these activities are given below.

Focus Group Discussion

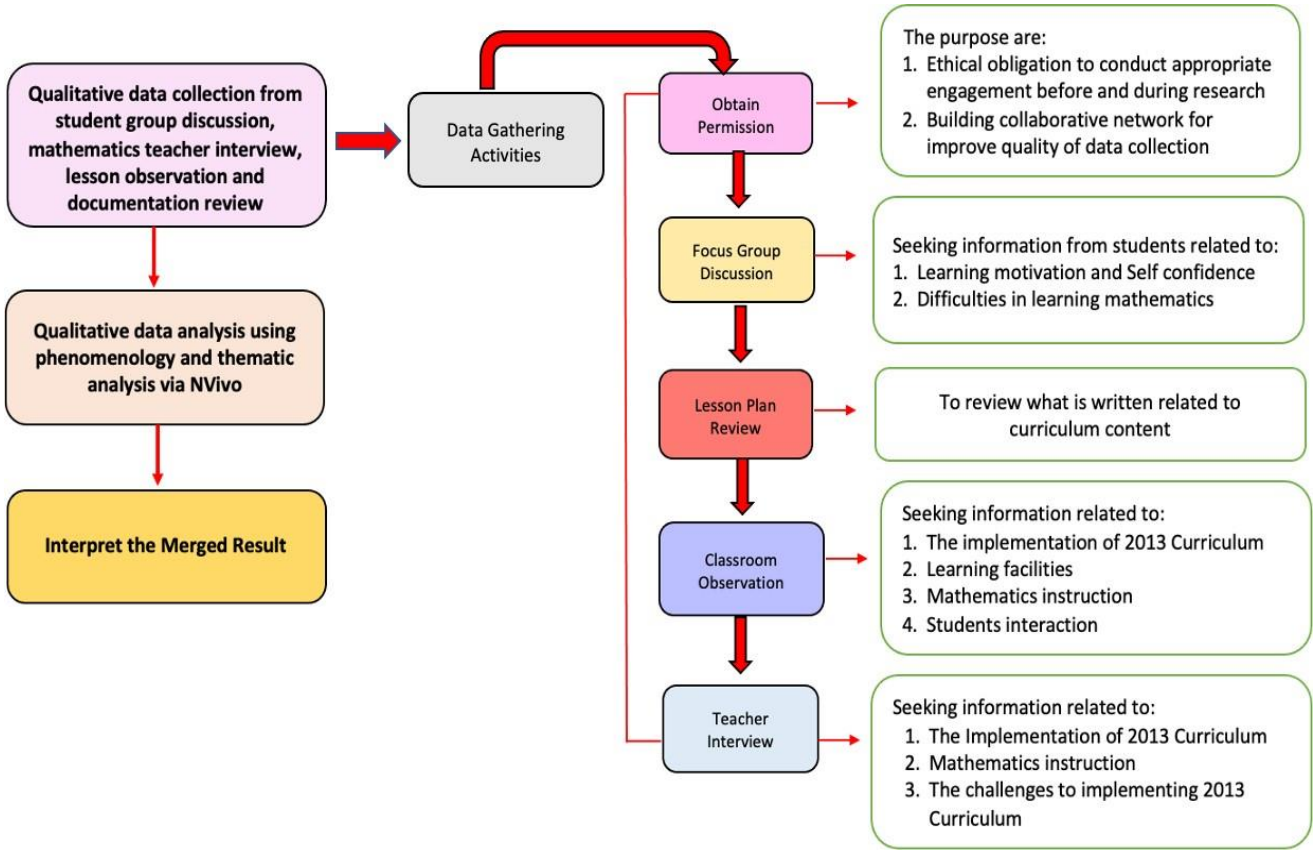
A total of 24 students from grade VII participated in the focus group discussions. The participants were 50% males and 50% females to avoid gender bias. Students were asked to volunteer to participate in focus group discussion. In

[3]A term for non-permanent teachers who are seconded to schools to address teacher shortages; they receive low wages and lack of job protection.

those schools where there too many volunteers, the teachers selected the actual participants. The instruments used in the focus group discussion are provided in Appendix 2.

Figure 1

Research Procedure



Lesson Plan Review

The review of lesson plans aimed to determine whether the teachers' lesson plans match the components outlined in the 2013 Curriculum. The design instrument of the curriculum document checklist, provided in Appendix 3, was adapted from the Ministry of Education (2013).

Classroom Observation

Observational data were collected using video recordings from three different schools. The data collection was facilitated by local research assistants who had been provided with a research protocol to follow. Observations were conducted once at each school in this study. Furthermore, because these three schools were in different COVID

zones[4], schools A and B conducted face-to-face lessons whilst the school C conducted online teaching. The observed mathematics lessons were 30 minutes long, and the topics presented during the class observation were triangles and quadrilaterals. Data were gathered through observation using a checklist sheet from schools A, B and C. The checklist sheet used to record findings during the classroom observation, provided in Appendix 4, was adapted from the Ministry of Education (2014).

Teacher interview

The interviews used in this study were semi-structured. The design of the teacher interviews is provided in Appendix 5.

The data obtained were analysed using Thematic analysis techniques utilising NVivo. Using thematic analysis in this study makes it possible to link different concepts and opinions of the participants and compare them with data collected in different situations at different times during the study. The thematic analysis in this study has six stages, adopted, following Braun & Clarke (2006), specifically RecognisingData, Coding, Searching for Themes, Reviewing Themes, Defining and Naming themes and Producing theReport (writing up).

Results

Focus Group Discussion

Students' attitudes towards mathematics appear to be influenced by how they conceptualize mathematics and the value they place on its role in their lives (Daud et al., 2020). Figure 2 shows key findings related to the perspectives of mathematics of the students in this study, derived from analysis of the data gathered from the students' group discussions related to the questions "How do you feel about learning mathematics in class?" and "What do you like or dislike about learning mathematics?"

The thematic analysis revealed that all perceptions that were expressed more than once were negative: students regarded mathematics as boring, complicated, scary, and having too much material to memorise. The only positive perceptions that were mentioned were interesting, easy to understand and fun but each of these was mentioned by only one student. Students' perceptions of mathematics influence their motivation to learning mathematics. The more positive a student's view of mathematics, the more motivated he or she is to study mathematics (Syamarro, 2015).

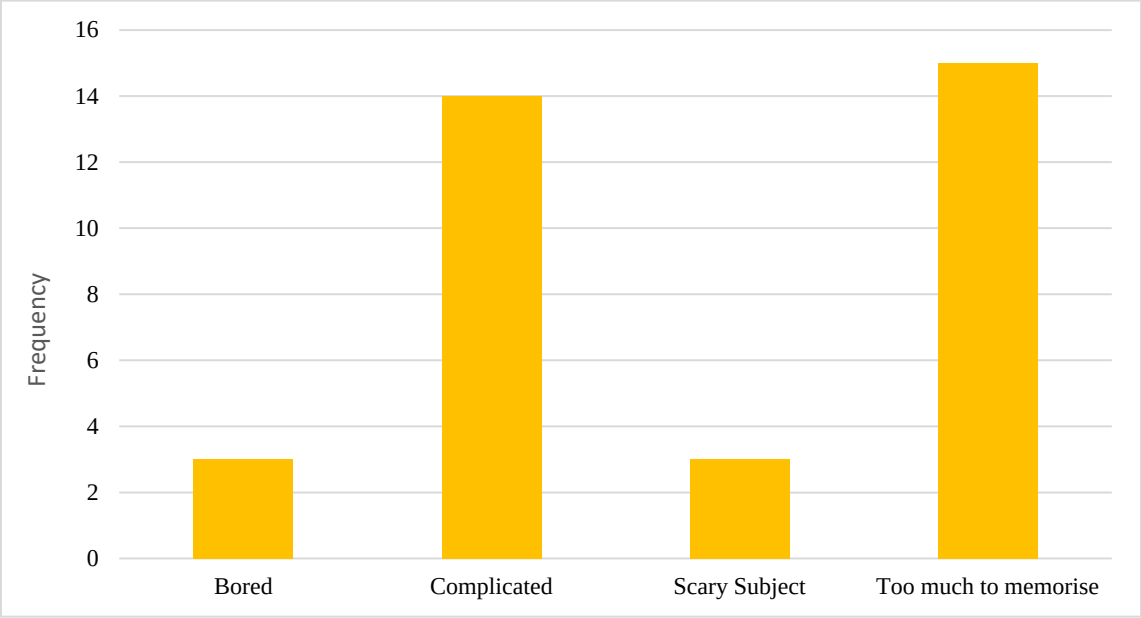
[4] During the period when data collection took place, measures introduced by the Indonesian government to restrict the spread of COVID were in place. Every neighbourhood was designated to be in a particular COVID zone, depending on the level of COVID infection in the neighbourhood. Activities that could and could not take place in each zone were prescribed by law. Of relevance to this study was that in some zones face-to-face teaching in school buildings was permitted whilst in other zones this was not permitted.

The factor that dominates students' negative perspective on mathematics is that mathematics is a subject that has too many formulas/concepts/steps that must be memorised. Students believe they will only be able to solve questions, for example, related to multiplication and division, if they memorise the multiplication tables. An example response is shown below:

"I don't like math because it's complicated, ma'am, mainly because there are too many formulas to memorise"

Figure 2

Students' perception of mathematics



A comfortable and enjoyable learning environment encourages student participation and maximizing learning objectives' achievement (Trinova, 2012). Understanding students' aspirations for learning mathematics is helpful in effectively implementing the 2013 Curriculum Based on the analysis of the data collected in response to the questions "What makes learning mathematics more interesting?" and "Do you have any unforgettable memories while studying mathematics?", some items that represent the aspirations of mathematics students were identified. Figure 3 summarizes the key findings of students' aspirations in learning mathematics.

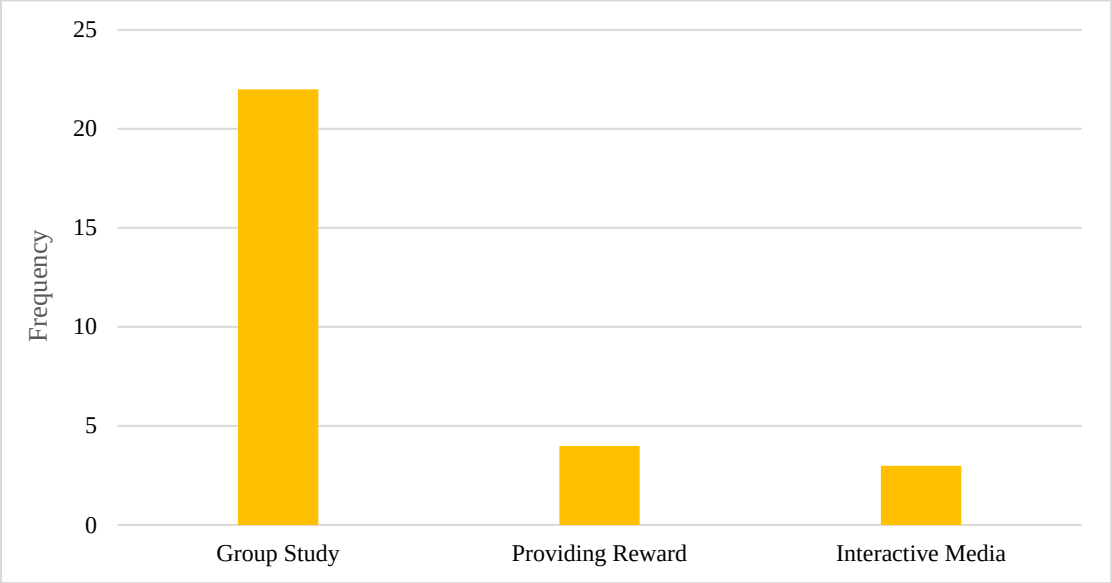
According to the results presented in Figure 3, almost all students believe that studying mathematics in groups will make learning the subject more enjoyable. An example response is shown below:

"When I can work in groups, learning math will be fun because I can study with my friends and reduce my fear when I face difficult questions"

The students believe studying in groups would add “fun” to the process of learning mathematics. Additionally, students feel that working in groups could help address affective issues such as fear of not being able to answer difficultquestions. It appears that they find asking peers to be more comfortable than approaching the teacher. Following bythe providing reward like points or scores and the use of interactive media.

Figure 3

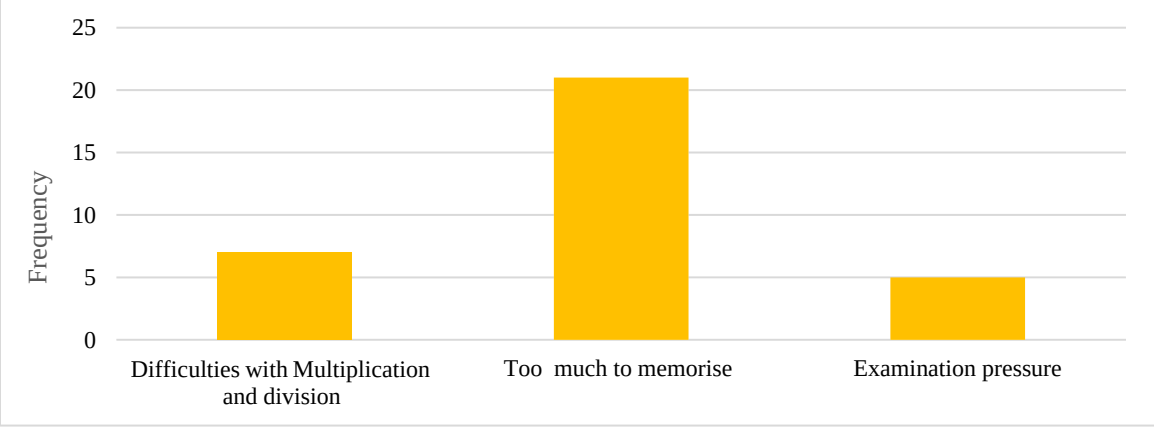
Students’ aspiration in relation to learning mathematics



Students' challenges in learning mathematics can be inhibiting factors in implementing the 2013 Curriculum. According to an analysis of the data gathered in response to the questions "What are your weaknesses in learning maths?" and "What don't you like about maths?", several factors influenced the challenges faced by students in studying mathematics, as shown in Figure 4.

Figure 4

Students’ challenges in learning mathematics



Twenty-one of the twenty-four students believe that mathematics contains numerous formulas that must be memorised, which means they must have a strong memory. This is consistent with their perceptions that learning mathematics is primarily a matter of rote learning formulae. It seems likely that this arises, in part at least, from the way that mathematics is taught. Students believe that if they cannot recall the formula of a shape (for example), they cannot calculate its area. Memory constraints make it difficult for students to answer the provided questions. Students tend to lack an in-depth understanding of mathematical concepts and rely mainly on memorisation.

Lesson Plan Review

The review of curriculum documents aimed to determine whether the teachers' lesson plans match the components outlined in the 2013 Curriculum with the criteria in the checklist document adopted by the Ministry of Education and Culture, it can be seen whether the lesson plan is implemented in the classroom (through classroom observation). Several findings were found from analysing the data through curriculum documents review in schools A, B and C.

The lesson plans made by all teachers did not entirely follow the standards contained in the 2013 Curriculum. These standards require that the lesson plan should consist of ten components, including standards competency /core competencies, basic competencies, indicators, learning objectives, subject matter, learning methods, learning activities, media/tools, learning material and resources, and assessment (Ministry of Education and Culture, 2013). However, in the lesson plans reviewed in this study some details are missing, such as appropriate sequence of learning steps and location of learning resources (such as internet links or other information details about the resources).
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In each school, the teacher included a selected learning method in their lesson plan. For example, the lesson plan from school B showed the teacher intended to use Problem Based Learning (PBL) in teaching triangles and quadrilaterals. According to Gorghiu et al. (2015), the PBL model is based on the elaboration of a scenario which includes seven steps, including 1) Clarifying Unfamiliar Terms; 2) Problem Definition; 3) Brainstorming; 4) Analysing the problem; 5) Formulation of Learning Goals; 6) Self-study; and 7) Reporting. However, in the analysed lesson plan, the teacher only wrote an outline of the method without giving proper detail of the learning stages in the model. At the other schools, there was evidence in the lesson plans of the intent to use other active learning strategies such as discovery learning.

Classroom Observation

Observations of classrooms were carried out to determine the level of implementation of the 2013 Curriculum, student participation and whether the lesson plans were followed. The classroom observation checklist used is provided in Appendix 3. Analysis of the class observation data revealed several findings, outlined below.

The use of learning resources

Teacher-centred learning methods were utilised throughout the learning process in every lesson observed. Teachers in schools A and B did not present anything at the beginning of the lesson that would encourage students' interest in learning about triangles and quadrilaterals. In all three schools, the only learning resource utilised by instructors was a single textbook. Other learning resources were not used.

Learning Environment

Throughout the learning process, teacher at school A observed each student individually. However, this was not observed at schools B and C. This indicates that the teacher at school A endeavours to address students as individuals. Learning objectives were communicated at the beginning of lessons in all schools. The teachers at schools B and C reviewed previous material, but the teacher at school A did not. Generally, all instructors appeared to have difficulty capturing the students' attention and creating an enjoyable learning environment.

Participation

The teachers tried to make students focus on the lesson during the class by explaining the learning objectives and showing the pages of the textbook that contain the material and asking relevant question about the material they will learn. However, there was no visible interaction, and students watched silently and only listened to the teacher's instruction in all schools. The teachers tried encouraging students to ask questions and participate in class, but students ignored this encouragement. Since no student took the initiative to pose questions, teachers continued to direct the lesson. Teachers were observed to move on quickly when no-one asked a question immediately, this may be because their experience showed them that students rarely asked questions. Furthermore, the learning strategy employed was teacher-centred and had no variation of activities in class; students were observed only listening to the teacher's explanation and completing the tasks, and there was no visible engagement between the teacher and students. Overall, the participation of students in the class in all schools was very low.

Mathematics Instruction

The teachers did not provide any applications of the concepts of perimeter and area of quadrilaterals and triangles. Furthermore, the material was taught simply, and only short, straightforward exercises were used. There were no open-ended or problem-solving questions used. In all the lessons observed, there was little evidence of implementationof the Scientific Approach of the 2013 Curriculum. There were some attempts to encourage students to pose questions,but these were not successful. Instead of modelling observation and asking by suggesting possible questions and allowing students to proceed to exploring and associating, in the absence of questions, all teachers reverted to teacher-

centred approaches. There was no evidence of active learning or of students developing communication skills. Despite the intentions expressed in their learning plans to use active learning approaches, in practice the teachers did not do so and adopted teacher-centred approaches very quickly when students did not respond to questions posed to them.

Teacher interviews

Thematic analysis of the transcripts of the teacher interviews revealed three themes: implementation factors, challenges, and instruction. These themes had several sub-themes, some of which can be further broken down into categories. The sub-themes and categories of the implementation factors theme are shown in Table 1.

Table 1

The Implementation themes

Sub-themes	Categories	F*
The use of interactive media	Using simple learning media	1
	Providing Learning video	1
Teaching Methods	Combination of teacher-centred and active learning	3
Learning Resources	Using Additional learning resource: creating a module	1
	Using handbook from Government	3
Assessment	The test is the only instrument used for assessment.	3
Lesson Plans	The lesson plan does not match its implementation	3
	Lesson plan made with colleagues/ local math teacher organization	2

* F stands for frequency and represents the number of teachers who raised a particular sub-theme.

The sub-themes that emerged from the teacher interviews were the use of interactive media, teaching methods, learning resources, assessment, and lesson plans. The teacher in school B tried to demonstrate the properties of triangles and quadrilaterals using simple learning tools, such as blackboards and other classroom objects. However, the teacher in school C offered instructional videos; usually, the teacher gave the video link via Google Classroom before the meeting. Mathematics consists of abstract concepts and presentation of these in a more concrete way, particularly one which can be visualized, assists the learning process (Wijaya et al., 2020).

The learning approach chosen by the three teachers was a combination of teacher-centred and active learning. Additionally, the teachers' stated that they did not employ the Scientific Approach in the classroom. The Indonesian government instructs teachers to implement active learning, specifically the Scientific Approach. However, all three participants stated that they prefer to use a teacher-centred strategy more often than an active learning strategy. An example response is shown below:

"... the most frequently used is teacher centred. In my opinion, the most important is the students understanding the material. Because if I try to use active learning method and the time allocation does not fit, it will make the material unable to convey fully in the meeting"

Furthermore, all three teachers said they used the textbooks provided by the government. The government-provided mathematics textbook is intended to support the active learning approach, particularly the Scientific Approach. However, in practice, teachers only look at the material without applying every detail or activity in the textbook. In addition, the teacher in school C went further by creating a learning module himself because he felt the material in the textbook needed to be clearer for students to understand, he took the initiative to summarize and provide additional explanations.

Assessment is another factor relating to the implementation of the 2013 Curriculum. The three teachers measured student learning outcomes solely through tests. In the 2013 Curriculum, the Government stressed three areas of learning outcomes: attitudes, knowledge, and skills. The Indonesian government emphasises that the assessment system should refer to all three of these areas. Tests can usefully measure skills and knowledge, but they do not effectively assess attitudes. This is one area of the 2013 Curriculum that these teachers are completely overlooking.

In creating lesson plans, the teachers in schools B and C stated that they collaborated with other teachers in the same school and MGMP [5] to create lesson plans that followed the 2013 Curriculum. They discussed the lesson plans' contents and components. During the interviews, all three teachers stated that their implementation did not match the written lesson plan. This was consistent with the classroom observations. They stated that time constraints prevented them from completing all the scenarios outlined in the lesson, with an example response below:

"... lesson plans should be used as a basis for every meeting. But in fact, it is challenging to implement lesson plans with learning media and teaching methods because the time allocation is not enough..."

The second theme to emerge from the analysis of the teacher interviews was challenges (or barriers) to implementing the 2013 Curriculum. Table shows the sub-themes and categories of this theme. In Addition, based on the analysis results from teacher interviews, which presented various findings linked to challenges in implementing the 2013 curriculum, the Table 2 below outlines issues connected to implementation challenges in schools.

Limited time was the primary factor that impeded the implementation of the 2013 Curriculum. Under normal conditions, the weekly time allocation for mathematics in junior high school is 200 minutes. According to the statements of the three teachers, the lesson durations pose a challenge because the target material for one semester does not match the allocated lesson hours. Teachers' felts that, particularly when employing an active learning technique, the amount of time required is considerable, resulting in an inability to cover all the topics in a semester.

[5] MGMP is a forum for professional activities at the district/city level for teachers of the same subject and grade level.

Table 2

The Challenges Theme

Sub-Themes	Categories	F*
Time Allocation	Limited time allocation	3
Facilities	School Facilities do not support	2
Students	Students lack motivation and participation	3
	Student Lack of Basic Knowledge	3
Teacher	Hard to find interactive learning resources	2
Working Conditions	Extra part time job	3

* F stands for frequency and represents the number of teachers who raised a particular sub-theme.

The teachers from School A and B reported that the facilities in their schools do not support the implementation of the Scientific Approach. They said that their schools' facilities are inadequate, particularly in relation to the limited number of projectors, learning media, laboratories, and Internet access.

All teachers reported that a major challenge they faced relates to their students: both their attitudes and their basic knowledge. In their opinion, students' motivation to learn mathematics is generally relatively low; students already believe mathematics to be a challenging topic, which negatively impacts their enthusiasm to learn mathematics (this is consistent with the findings of the student focus group discussions reported earlier). In addition, teachers felt that many students lack basic mathematical abilities in multiplication and division (again, the students had also raised this point). Furthermore, based on interview results, the teachers reported difficulty finding interactive learning resources that matched the topic. As a consequence of these factors, they continued using teacher-centred methods in the classroom.

The final sub-theme to emerge was their working conditions. All three teachers were clear that teaching is their desired career. However, they stated that the salary is not enough, particularly for teachers with temporary/honorary status. As a consequence of this, many teachers have additional jobs. Such teachers inevitably have less time for professional development and for preparing learning materials for the classroom, which will impact their performance as teachers.

It is striking that there was a high level of similarity in the responses of the teachers on matters relating to the theme of the challenges (or barriers) to the implementation of Curriculum 2013.

Finally, the third theme identified was mathematics instruction in the classroom. Only one teacher, who is teacher in school C mentioned using open-ended questions in learning, and two teachers (teachers in schools B and C) stated that they tried to use examples that connected the topics given to real-world problems, as shown in the Table 3.

Table 3

The Instruction Theme

Theme	Sub Themes	F*
Mathematics Instruction	Providing Open-ended Questions	1
	Connecting to the real word problem	2

* F stands for frequency and represents the number of teachers who raised a particular sub-theme.

Not all teachers use open-ended questions because they believe students will often complain if given challenging questions. As a result, they provide routine and easy questions to the student, an example response is given below:

"My students have difficulty solving questions like open-ended questions, especially the types of questions that are applied and analysed, then I decide to use simple routine questions for my students"

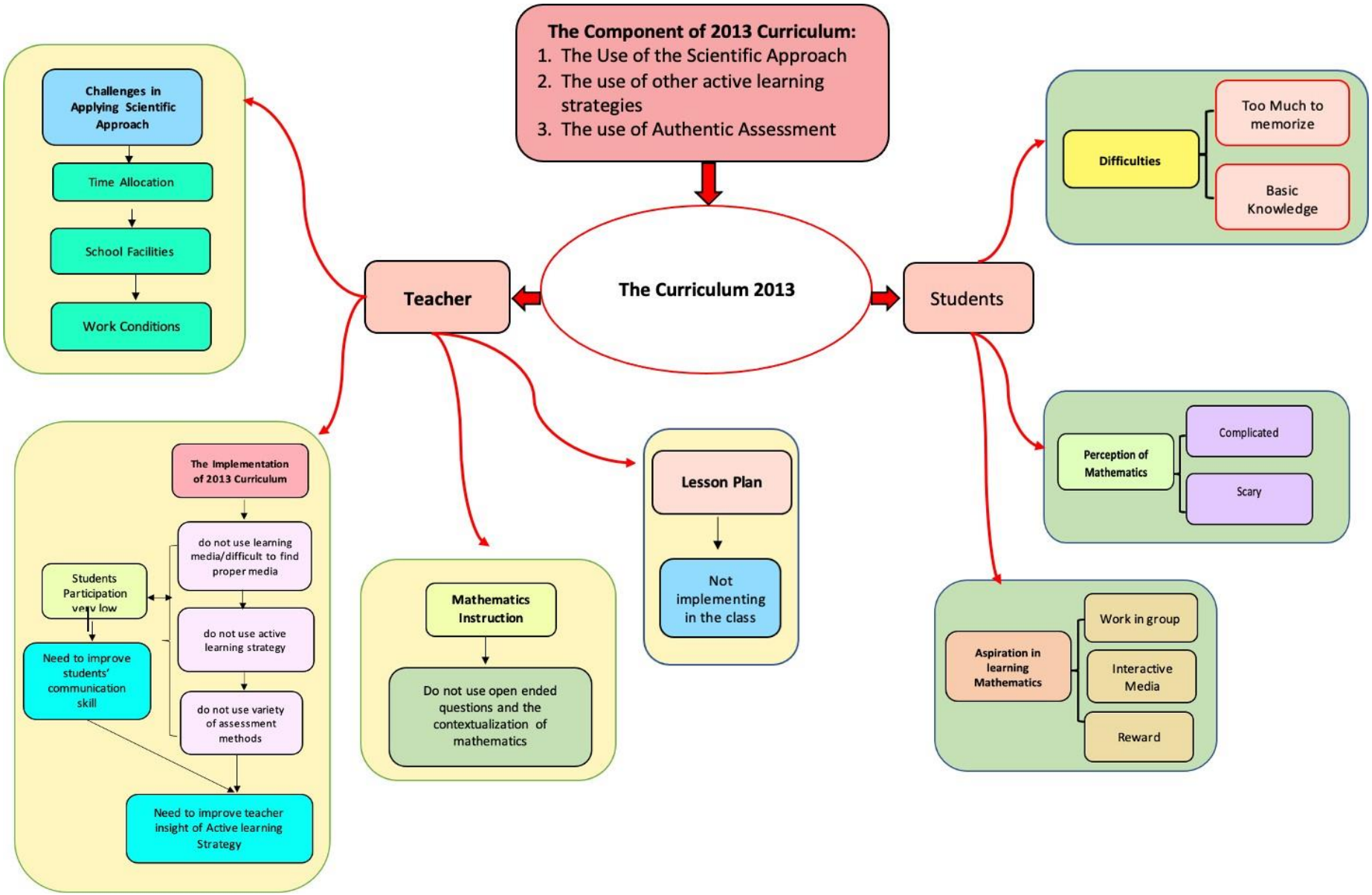
Concerning connecting mathematics with real-world contexts, teachers said that they attempted to link the presented material with real-world problems; however, this depends on the presented material and the teacher's ability to discover connections to real-world applications. As the classroom observations showed, they do not always succeed in finding relevant applications.

Discussion

This case study has investigated the implementation of the 2013 Indonesian Curriculum in three schools in Lampung province. In implementing the 2013 curriculum, several factors are linked to its application, including the teacher and students. Figure 5 summarizes the analysis, showing a range of factors that impact on the implementation of the 2013 Curriculum, from both the teacher and student points of view.

Figure 5

The Challenges factor in implementing 2013 Curriculum



Findings from classroom observations and teacher interviews show that none of the teacher participants fully use the Scientific Approach during the teaching and learning process. This finding is in line with earlier studies conducted by (Hasanah et al., 2020; Retnawati, 2015). The teachers stated that they sometimes attempt to use active learning, although they used this only occasionally and most of the time relied on the teacher-centred approaches. They assume that students have low motivation because the students regard mathematics as a difficult subject. This latter point is confirmed by the students. The teachers believe that if they employ an active learning strategy, students lack motivation to learn mathematics will lead to them not focusing on learning. Consequently, the teachers turned to teacher-centred learning as the predominant model resulting in no variation in learning activities other than listening and taking notes. Furthermore, the teachers stated that utilizing a Scientific Approach to teaching and learning requires considerable time and effort. Consequently, they tend to use teacher-centred methods as the easiest method for the teaching and learning, rather than active learning strategies, enabling them to cover all of the curriculum content.

The findings from classroom observations show that the teaching and learning process in class appears monotonous. There is no variety of meaningful learning activities, which affects the low interaction between students and teachers in class. According to Hidayati (2017) mathematics education is an active, dynamic, and creative process (doing mathematics). These activities significantly contribute to the student's growth in logical reasoning, systematic reasoning, thorough and critical thinking, and objectivity and openness in dealing with various problems (Simamora & Saragih, 2019). Furthermore, according to the student group discussions, almost all students say they wish to work together in study groups. They believe studying together in groups can reduce anxiety and make them more enthusiastic. In addition, students also hope that teachers can use more exciting learning methods and create a conducive learning environment. This indicates that pupils expect meaningful mathematics instruction through active learning. In teaching mathematics, active learning necessitates the teacher providing innovative ways to successfully enrich mathematical knowledge for students to participate effectively in the class (Katsap, 2009).

Utilizing appropriate and engaging media in teaching mathematics is crucial because it can improve student learning outcomes (Krishnasamy et al., 2014). However, based on the findings from the classroom observations, the teachers did not utilize interactive media or a variety of learning resources in teaching mathematics. This was confirmed by the student group discussions findings. Students acknowledged that remembering the formulas was one of the aspects of learning mathematics that they found challenging. This occurs because they get used to formulas without understanding how to discover and derive them, which causes them to forget easily. With mathematics learning tools or media, students can more easily understand abstract mathematical content because it is presented in a more realistic context and can be visualized (Wijaya et al., 2020). The use of engaging media increases learning effectiveness while reducing pupils' chance of memorizing information without understanding it (Kustandi & Darmawan, 2020).

Yen & Halili (2015) highlighted the importance of High Order Thinking Skill (HOTS) as the skills required by every individual in the academic environment. Consequently, it is important to familiarize students with problem-solving mathematics questions instead of only routine questions to improve their performance, particularly their understanding

in mathematics. However, according to the teacher interviews and classroom observations, the use of open-ended questions that lead to an increase in students' high order thinking skills in mathematics is almost completely absent. The teachers decide to utilise simple and routine questions because they assume that the pupils will quickly give up and stop working when faced with challenging ones. Moreover, the teachers only used tests as the method to assess learning outcomes. However, the assessment in the 2013 Curriculum requires teachers to measure all three aspects, namely knowledge, attitudes, and skills (Ministry of education and Culture, 2013). Since tests cannot cover all these three aspects, teachers are expected to use a variety of assessment techniques.

on the review of the lesson plans revealed that the teachers' lesson plans contained various active learning strategies, various learning resources and learning media. However, they did not implement this in the class (based on the observations and interviews). According to the results of interviews, the available time is a barrier to implementing this curriculum. In their opinions, the application of active learning, particularly the Scientific Approach, requires extensive time, and the time normally allocated for teaching and learning mathematics, reduced even further during the Covid pandemic, makes it highly challenging to implement.

A lack of school infrastructure hinders the application of the 2013 Curriculum during the teaching and learning process. In the Scientific Approach, students are expected to acquire information from various learning resources that might motivate them to learn and accelerate their comprehension and mastery of the material to optimize the learning outcomes (Hasanah et al., 2020). In applying the scientific approach, five stages of learning must be carried out, starting with observation. Students are expected to observe and identify problems provided through various learning sources, including the internet, at this stage. Nevertheless, schools do not have adequate facilities for learning using this approach. The insufficiency of supporting facilities hinders the implementation of the 2013 Curriculum by instructors. A further factor hindering the implementation of the 2013 Curriculum is teacher salary. According to the results of interviews with the teacher participants, they were forced to take on additional jobs because they were honorary teachers, and the salary is not enough for their needs. This is in line with the findings of Fauzi & Syafar (2017).

It appears that there is a primary “vicious circle” acting here. The students’ prior experiences with learning mathematics have given them a poor grasp of basic mathematical knowledge, negative perceptions of the subject and low motivation to study it further. The teachers, sensing these negative perceptions and low motivation believe that students will not engage with active learning approaches. Consequently, they adopt teacher-centred approaches which are passive and give the students a poor grasp of the new mathematical knowledge and reinforce their existing negative perceptions of mathematics and further drive down their motivation.

Adoption of more stimulating, active learning approaches could break into this primary “vicious circle” by providing interest and increasing motivation. However, there are secondary “vicious circles” which prevent this from happening. There is a shortage of good quality learning materials and teachers have to spend time to find them and/or develop

their own. But their working conditions do not give them the time to identify such resources. Even if they were able to find appropriate websites or videos or other interactive media, the facilities within their schools are such that students cannot utilise such resources and cannot independently pursuing the initial observing phase of the Scientific Approach.

The government's support and involvement are required to break into these vicious circles. Without substantial support from the government as a policymaker, the 2013 Curriculum cannot be implemented effectively. The government should emphasise continuing professional development, using established better practices to improve teaching quality, and urgently helping meet higher teacher competency standards through intensive assistance and teacher training to prevent teachers from experiencing confusion and difficulties implementing the 2013 Curriculum. In addition, providing support for the infrastructure is also highly influential in implementing the 2013 Curriculum, as not every school has appropriate facilities. Although the government provides a textbook, it could go further and provide a wider range of learning resources to support a range of topics across the mathematics curriculum. This would remove some of the out of class time pressures on teachers to locate hard to find resources. Furthermore, if the government can improve teachers' financial security, including honorary educators, they would be able to devote more out of class time to lesson preparation and professional development enabling them to better implement the 2013 Curriculum. Overall, the curriculum implementation needs national, provincial, and district support to help schools provide students with a quality education.

Summary

This case study is a qualitative study with four data-gathering activities: focus group discussions, classroom observations, curriculum documents review and teacher interviews. Throughout the implementation of the 2013 Curriculum, which has existed for ten years, mathematics teachers in three schools in Lampung Province have encountered difficulties incorporating the recommended Scientific Approach to teaching and learning. This influences students' motivation to learn mathematics and their mathematical performance (as measured, for example, by PISA result). This study suggests further government support in providing learning facilities, teacher support, and supervision is required in order to implement the curriculum effectively.

Limitation

Since this study employed a limited number of participants in a small number of schools in a single province, the researchers realise that care should be taken in extrapolating these results. It would be beneficial to carry out further studies with participants from multiple provinces throughout Indonesia. This would give a better insight into the national picture concerning the implementation of the 2013 Curriculum.

Acknowledgements

Muhammad, R. would like to acknowledge the financial support received from the Indonesian government through the Ministry of Religious affairs Scholarship for performing her PhD program at Centre for Global Learning Educationand Attainment in Coventry University, UK.

References

Akhyak, M. A. (2013). Implementation of teachers pedagogy competence to optimizing learners development in public primary school in Indonesia. *Journal Education and Research*, *1*(9), 113–122.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). *Content knowledge for teaching: What makes it special?*. Journal of teacher education, 59(5), 389-407. https://doi.org/10.1177/00224871083245

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Daud, A. S., Adnan, N. S. M., Abd Aziz, M. K. N., & Embong, Z. (2020). Students' perception towardsmathematics using APOS theory: A case study. *Journal of Physics: Conference Series*, *1529*(3), 32020. DOI 10.1088/1742-6596/1529/3/032020

Edmund, N. W. (1994). *The general pattern of the scientific method (SM-14)*. ERIC.

Fauzi, H., & Syafar, D. (2017). Studi Tentang Kebijakan Guru Honorer Sekolah Dasar di Yogyakarta.

Tadbir: Jurnal Manajemen Pendidikan Islam, *5*(2), 162–172. Retrieved from https://www.journal.iaingorontalo.ac.id/index.php/tjmpi/article/view/402

Gorghiu, G., Drăghicescu, L. M., Cristea, S., Petrescu, A.-M., & Gorghiu, L. M. (2015). Problem-based learning-an efficient learning strategy in the science lessons context. *Procedia-Social and Behavioral Sciences*, *191*, 1865–1870.

Haq, M. N., & Murdiono, M. (2019). Problematika guru dalam penerapan pendekatan saintifik pada pembelajaran PPKn. *Jurnal Civics: Media Kajian Kewarganegaraan*, *16*(2), 165–176. DOI. 10.21831/jc.v16i2.24603

Hasanah, H., Nugraheni, P., & Purwoko, R. Y. (2020). Analisis Kendala Penerapan Pendekatan Saintifikdalam Pembelajaran Barisan dan Deret Geometri. Kreano, *Jurnal Matematika Kreatif-*

Inovatif, 11(1),16–26. DOI: https://doi.org/10.15294/kreano.v11i1.20663

Henderson, S., & Rodrigues, S. (2008). Scottish student primary teachers' levels of mathematics competence and confidence for teaching mathematics: Some implications for national qualifications and initial teacher education. *Journal of Education for Teaching*, *34*(2), 93–107. https://doi.org/10.1080/02607470801979533

Hidayati, A. U. (2017). Melatih keterampilan berpikir tingkat tinggi dalam pembelajaran matematika pada siswa sekolah dasar. Terampil: *Jurnal Pendidikan Dan Pembelajaran Dasar*, 4(2), 143–156. https://doi.org/10.24042/terampil.v4i2.2222

Undang-undang Republik Indonesia Nomor 14 Tahun 2005 tentang Guru dan Dosen, (2005). Retrieved from: https://jdih.kemdikbud.go.id/detail_peraturan?main=1680

Katsap, A. (2009). Empowerment of teachers as learners, Active Learning in the College Mathematics Classroom. *Colección Digital Eudoxus*, *1*(5).

Krishnasamy, H. N., Veloo, A., & Hooi, N. S. (2014). Perception of teachers towards media usage in teaching Mathematics in secondary schools. *Procedia-Social and Behavioral Sciences*, 112, 1093– 1098. https://doi.org/10.1016/j.sbspro.2014.01.1274

Kustandi, C., & Darmawan, D. (2020). *Pengembangan Media Pembelajaran: Konsep & Aplikasi Pengembangan Media Pembelajaran bagi Pendidik di Sekolah dan Masyrakat*. Prenada media.

Ministry of Education and Culture: Kemendikbud. (2013). *Dokumen Kurikulum 2013.* Jakarta: Kemendikbud.. Retrieved from: https://drive.google.com/file/d/1Ch_-4gU2zY0VVXQglx5co7m-viBS29sW/view

Ministry of Education and Culture: Permendikbud. (2016). *Permendikbud RI Nomor 22 tahun 2016 tentang Standar Proses Kurikulum Dasar dan Menengah*. JDIH Kemendikbud. Retrieved from: https://repositori.kemdikbud.go.id/4790/1/Permendikbud_Tahun2016_Nomor022.pdf

Ministry of Education and Culture: Kemendikbud. (2018). *Modul Manajemen Implementasi kurikulum2013*. Jakarta: Kemendikbud. Retrived from: https://repositori.kemdikbud.go.id/11351/1/K13_KS_1_5_BK_SMP_180305.pdf

Ministry of Education and Culture: Kementrian Pendidikan dan Kebudayaan, 2013. *Pedoman Akreditasi Sekolah/Madrasah*. Jakarta. Retrived from:

https://bansm.kemdikbud.go.id/unduh/kategori/pedoman-akreditasi.

Ministry of Education and Culture: Kementrian Pendidikan dan Kebudayaan, 2014. *Panduan Monev*

program Lesson Study LPTK dan Direktorat Ketenagaan Ditjen DIKTI. Jakarta

Mutia, M. (2019). Analisis Kesulitan Belajar Matematika Siswa SMP Kelas IX dalam Memahami Konsep Tabung dan Alternatif Pemecahannya dengan Pendekatan Pemecahan Masalah. *Jurnal Equation: Teori Dan Penelitian Pendidikan Matematika*, *2*(1), 1. https://doi.org/10.29300/equation.v2i1.2305

OECD. 2018. The 2018 PISA Result .[online] available from <https://www.oecd.org/pisa/PISA-results_ENGLISH.png> [24 April 2023].

OECD. 2018. The Indonesia PISA Result .[online] available from <http://www.oecd.org/pisa/publications/PISA2018_CN_IDN.pdf > [24 April 2023].

Pratiwi, I. (2019). Efek Program Pisa Terhadap Kurikulum Di Indonesia. *Jurnal Pendidikan Dan Kebudayaan*, *4*(1), 51. https://doi.org/10.24832/jpnk.v4i1.1157

Purwoko, R. Y. (2015). Problematika Pembelajaran Matematika Berbasis Pendekatan Scientific Pada Kurikulum 2013 di SMP. *Prosiding Seminar Nasional Matematika Dan Pendidikan Matematika* FMIPA UNY.

Retnawati, H. (2015). Hambatan guru matematika sekolah menengah pertama dalam menerapkan kurikulum baru. *Jurnal Cakrawala Pendidikan*, 34(3). DOI. 10.21831/cp.v3i3.7694

Shadiq, F. (2009). Model-model pembelajaran matematika SMP. *Yogyakarta: P4TK Matematika Depdiknas*.

Simamora, R. E., & Saragih, S. (2019). Improving Students' Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context. *International ElectronicJournal of Mathematics Education*, *14*(1), 61–72.

Suryadi, B., Rahmawati, Y., Hayat, B., & Suprananto, S. (2019). Indonesia national curriculum reform in the context of standard-based education: policy and implementation. *TARBIYA: Journal of Education in Muslim Society*, 6(1), 76–87. https://doi.org/10.15408/tjems.v6i1.12883

Syamarro, N. (2015). Pengaruh Motivasi Dan Persepsi Siswa Pada Matematika Terhadap Prestasi Belajar Matematika Siswa Kelas VIII Di Mts Al-hidayah Dukupuntang Kabupaten Cirebon (Pokok Bahasan Kubus Dan Balok). *IAIN Syekh Nurjati Cirebon*. DOI: 10.24235/eduma.v4i2.32

Tang, X., Coffey, J. E., Elby, A., & Levin, D. M. (2010). The scientific method and scientific inquiry:

Tensions in teaching and learning. Science Education, 94(1), 29-47. https://doi.org/10.1002/sce.20366

Trinova, Z. (2012). Hakikat belajar dan bermain menyenangkan bagi peserta didik. *Al-Ta Lim Journal*, 19(3), 209–215. DOI 10.15548/jt.v19i3.55

Tsafe, A. K. (2013). Teacher pedagogical knowledge in mathematics: A tool for addressing learning problems. *Scientific Journal of Pure and Applied Sciences*, *2*(1), 1–7.

Wijaya, T. T., Tang, J., & Purnama, A. (2020). Developing an interactive mathematical learning media based on the tpack framework using the hawgent dynamic mathematics software. *International Conference for Emerging Technologies in Computing*, 318–328.

Wulandari, N. F., & Jailani. (2015). Indonesian students' mathematics problem solving skill in PISA and TIMSS. *In Proceeding of International Conference On Research, Implementation And Education Of Mathematics and Sciences 2015 (ICRIEMS 2015*).

Yen, T. S., & Halili, S. H. (2015). Effective teaching of higher order thinking (HOT) in education. The Online *Journal of Distance Education and E-Learning*, 3(2), 41–47. https://tojdel.net/journals/tojdel/articles/v03i02/v03i02-04.pdf

Zaragoza, M. C., Díaz-Gibson, J., Caparrós, A. F., & Solé, S. L. (2021). The teacher of the 21st century: professional competencies in Catalonia today. *Educational Studies*, *47*(2), 217–237. https://doi.org/10.1080/03055698.2019.1686697

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Please Cite: Muhammad, R. R., Lawson, D., Aslam, F. & Crawford, M. (2023). Indonesian Curriculum 2013 Ten Years On: Its Impact on Mathematics Teaching. *Journal of Research in Science, Mathematics and Technology Education*, *6*(SI), 109-136. DOI: https://doi.org/10.31756/jrsmte.615SI

Conflict of Interest: I declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics Statement: This study was approved by the Ethics Committee of Coventry University

Author Contributions: All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Received: February 23, 2023 ▪ Accepted: May 26, 2023

Appendix 1

The Scientific approach in 2013 Curriculum

Activity	Description
Observing	"The students are required to carry out observation in identifying or finding the problems through researching by reading books, interviewing people, or using the internet. The competencies that will develop through the Observing activity are curiosity, carefulness, ability to communicate and ability to seek information".
Asking	"The students formulate the problems about the information that they lack from what they observe or questions to get additional information about what they were observing, then the students construct a hypothesis. Through this activity, the competencies that will develop are creativity, curiosity, the ability to formulate questions, critical thinking skills, and developing the character of a lifelong learner"
Exploring	"The students test the hypothesis by doing an experiment, reading various sources, observing objects, observing events, and interviewing people. The competencies that will develop from this activity are carefulness, honesty, politeness, respect for other people's opinions, ability to communicate and the ability to gather information in various ways and become a lifelong learner".
Associating	"The students analyse data and construct meaning in various ways, through this learning experience, it is intended that students will develop discipline, carefulness, hard work and the ability to apply a procedure in thinking deductively and inductively to a conclusion".
Communicating	"The students make a conclusion based on the results of the analysis and communicate the result by an oral presentation or in written form. From
	this activity, students have the opportunity to develop their competencies in terms of thinking systematically, honesty, tolerance in expressing an opinion and having the ability to speak correctly and properly".

Note: The Scientific Approach as set out in the Curriculum 2013 document (Ministry of Education and Culture,2013)

Appendix 2

Students Focus Group Discussion Design

Duration : 1 Hours
Aims : - seeking information about students' motivation in learning mathematics
- seeking information about the student's self-confidence and challenges inlearning mathematics

Time	Activity

5 Minutes	**Welcome and Introduction** ➢ Welcome participants and explaining the general purpose of the discussion ➢ Explain that is not a test and that we want an honest an open discussion. Explain that the group will: - Start with general discussion of school life - Move on to explore student motivation to learn mathematics and how to gain the motivation to learn mathematics - Consider Students' self-confidence during learning mathematics - It will include some creative exercises which should be fun ➢ Explain the presence and purpose of recording equipment (to help facilitator write up notes later rather than during the focus group) and ask for permission. ➢ Explain that discussion notes will be analysed, and no personal data will be shared ➢ Set out ground rules (speaking up, one at a time, respect for others' opinions, etc.)
5 Minutes	**Icebreaker** ➢ Moderator to introduce themselves ➢ Ask each person to state their name briefly ➢ Ask the students to draw pictures about their favourite subject in school - Have each student come up and show their pictures and see if the students can guess what each student drew that tells a little bit about themselves.
25 Minutes (5 minute for writing and 20 minutes for talking/ discuss)	**Creative Exercise** Tools: Paper and pencil Ask respondents to write their initials and time of group on the top right of the paper. I will focus on the student motivation in learning mathematics ➢ Asking respondents to write down experience of learning mathematics in the classroom. Ask respondents to include: - Likes and dislikes, asking the students to put down three words or phrases to describe what they like about maths and three words or phrases to describe what they dislike - The strengths and weaknesses in learning mathematics
	➢ Asking about student satisfying with teaching experience: - I will make some list of things that might be happen in a math lesson and ask students to vote on whether each one is good, bad or neutral? - What do you think makes a 'good' or 'bad' learning in mathematics? - An example of great learning in mathematics experience in the classroom? If they have not had one, then describe what they think would produce great learning in mathematics ➢ Ask respondents to briefly talk around what they have put and explore

25 Minutes (5 minute for writing and 20 minutes for talking/ discuss)	**Creative Exercise** Tools: pencil and sticky note Students participate in this activity by writing information on sticky notes and then posting the notes on a chart or the whiteboard. I will focus on the student self-confidence and basic knowledge in learning mathematics. Ask respondents to write a word or phrase in sticky note about their feeling related to the interaction in mathematics class. Ask respondents to include: ➢ Relationship with their classmates - Explore what makes this relationship good, in terms of academic and non-academic ➢ The difficulty/ obstacle to interact with other during mathematics lesson - Explore experience and reasons why they were negative. - Explore their feeling during mathematics class, what makes student feeling confidence/shy. ➢ Ask respondents to briefly talk around what they have put and explore

Appendix 3

The Curriculum Documents Checklist

No	Items	YES			NO		
		A	B	C	A	B	C
1	Adequacy and clarity of lesson plan identity (school, subject, class / semester, subject matter, time allocation)	√	√	√			
2.	The suitability of the formulation of learning objectives with the Competency Achievement Indicators	√	√	√			
3.	The suitability of the learning steps with the selected/defined learning strategy/approach/model				√	√	√
4	The use of an appropriate sequence of learning steps				√	√	√
5.	Using proper time allocation for each stage of learning				√	√	√
6.	Using learning resources or reference				√	√	√
7.	The accuracy of choosing the type of media and / or learning resources	√	√	√			

8	The suitability of the selected learning media with strategies/approaches/learning models or types of student learning activities according to the basic competencies	√	√	√			
9	The appropriateness of selecting the assessment technique	√	√	√			
10	The competencies achievement related to the three domains of students' abilities (attitudes, skills, and knowledge)	√	√	√			
11	Learning steps include the development of higher order thinking skills (HOTS)	√	√	√			

Note:
A: School A
B: School B
C: School C

Appendix 4

Classroom Observation Checklist

Factor	**Categories**	**School A**		**School B**		**School C**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Learning Resource	The instruction materials used capture the interest of the students		√		√	√	
	Teacher uses relevant and appropriate resources during presentation to clarify meaning to students		√		√		√
	Teacher encourages students to use variation of learning resources		√		√		√
	Interactive or activity using worksheet related to hands-on activity		√		√		√

Factor	**Categories**	**School A**		**School B**		**School C**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Learning Environment	All students treated fairly	√			√		√
	Materials are prepared and ready to use		√		√	√	
	Objectives are communicated clearly at the start of the lesson	√		√		√	
	Review material from previous meeting		√	√		√	
	Quickly focuses students' attention on the topic		√	√	√		√

Factor	**Categories**	**School A**		**School B**		**School C**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
The Participation	The teacher involves all the students, listens to them, and responds appropriately		√		√		√
	Ask questions to gain and hold students' attention		√	√		√	
	Uses sufficient "wait-time" when asking questions of students		√		√		√
	A variety of activity and questioning techniques are used		√		√		√
	Reflect and summarize by involving students		√		√		√

		School A	**School B**	**School C**

Factor	Categories	Yes	No	Yes	No	Yes	No
Mathematics Instruction	Demonstrates relationship between different concepts		√		√		√
	Distinguishes between factual and non-factual information		√		√		√
	Using open-ended strategies				√		√
	Associating material with other knowledge or with real life situation		√	√		√	

Appendix 5

Mathematics Teacher interviews

From this activity, the researcher will focus on collecting information related to:

a. Implementing the scientific approach in the class, including preparing learning media, determine learning method, learning resource, time allocation and assessments.
b. The engagement between mathematics teachers and the students, and student participation during the lesson.
c. Mathematics instruction during the mathematics class

Interview Guidelines

Duration: 1 Hour (Before Introductory Workshop)

1) Training and introduction of 2013 curriculum
   a. Have you attended the introduction of 2013 curriculum? if yes when? And could you tell me about your experience during the introduction?
   b. What obstacles did you face when you participated in the introduction?
   c. Do you face problems in implementing the 2013 curriculum, including preparing learning media, and mastery of information technology?
   d. Do you apply the scientific approach in your class? Why and why not?
   e. Could you tell me about the process of preparing the class, including learning method, learning resource, time allocation and the assessments?

2) Relationship with the students
   a. Could you tell me about your relationship with your students? Do you support them not only academically? Why and why not,
   b. Do you often provide motivation to students at the beginning of a lesson? What kind of motivation do you use?
   c. Do you often use active learning strategies and divide students into groups for discussion? Why and why not?
   d. What difficulties do you find in encouraging students to be active in your class?

3) Mathematics Instruction
   a. Do you often associate mathematics material with the real-word contexts during teaching mathematics? Why and why not?
   b. Do you often give the open-ended questions for students? why and why not?
   c. Do you often give feedback and diagnostic tests to find the students learning difficulties in mathematics?