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Literacy and Numeracy Teaching and Learning in Pandemic Outbreak: A Case Study of Private Primary School in Rural Area

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Abstract: Literacy and Numeracy Teaching and Learning in Pandemic Outbreak: A Case Study of Private Primary School in Rural Area. **Objective:** This research aims to portray the teaching and learning of literacy and numeracy in a private school in rural area with few students in each class. **Methods:** The research method employed is descriptive qualitative. Data revealed that students doing *Kampus Mengajar Angkatan 1* (KMA-1) or student teacher taught literacy and numeracy lesson through playing games and singing. **Finding:** The teaching procedures are claimed in three phases – pre, while and post. The teaching and learning process during the pandemic was carried out in various ways such as using videos and using games and singing. **Conclusion:** Students' challenges are lack of vocabulary and its meaning. Teachers need to develop their teaching and learning based on student and school characteristics. This is done to develop student learning motivation, literacy, and student numeracy can improve

Keywords: literacy, numeracy, rural area, private primary school.

Abstrak: Pembelajaran Literasi dan Numerasi di Masa Wabah Pandemi: Studi Kasus SD Swasta di Pedesaan. ***Tujuan****: Penelitian ini bertujuan untuk menggambarkan pembelajaran literasi dan numerasi di sekolah swasta dengan jumlah siswa sangat terbatas di pedesaan.* ***Metode****: Metode penelitian menggunakan pendekatan deskriptif kualitatif. Data mengungkapkan bahwa mahasiswa yang melakukan Kampus Mengajar Angkatan 1 (KMA-1) atau mahasiswa magang mengajar melaksanakan pelajaran literasi dan numerasi (berhitung) dengan permainan dan bernyanyi.* ***Temuan:*** *Prosedur pengajaran diklaim dalam tiga fase - awal, inti dan penutup. Proses belajar mengajar di masa pandemi dilakukan dengan berbagai cara seperti menggunakan video dan menggunakan permainan* dan nyanyian. ***Kesimpulan:*** *Tantangan siswa adalah kurangnya kosakata dan makna kata. Sebagai kesimpulan, guru perlu mengembangkan pembelajaran berdasarkan karakteristik sekolah dan siswa. Hal ini dilakukan untuk mengembangkan motivasi belajar siswa, literasi, dan numerasi siswa dapat meningkat*

Kata kunci: *literasi, numerasi, pedesaan, SD swasta.*

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INTRODUCTION

The ability to read, write and count are skills that have been considered as literacy & numeracy learning (Napoli & Purpura, 2018; Soto-Calvo et al., 2020; Wrahatnolo, 2018). It is explained in Law Number 20 of 2003 concerning the National Education System that the culture of reading, writing, and arithmetic is implemented for all members of society to produce creative, productive, innovative, affective human beings through strengthening attitudes, knowledge, and skills (Irawati & Susetyo, 2017). To achieve this minimum standard of ability as well as to achieve the educational goals set forth in the regulation, the education curriculum in Indonesia places these abilities as basic abilities and is given to students since they are at the level of kindergarten (Khomsiyatun, 2019; Nisa et al., 2019; Setiawati & Novitasari, 2019).

The Covid-19 pandemic has caused learning and teaching is carried out face-to-face; it is recommended that online learning use platforms such as learning management systems, social media, zoom or similar conference platforms (Çubukçu & Aktürk, 2020; Irfan et al., 2020; Jacques et al., 2021). This aims to prevent and reduce the risk of the spread of COVID-19 (Abidah et al., 2020; Almarzooq et al., 2020), although currently the condition of the spread is starting to decline but in general we still have to watch out for an increase in the spread of COVID-19. In the face of drastic changes in the learning era, from face-to-face learning to online learning, as a result of the COVID-19 pandemic, Tejedor et al. (2020) conducted a comparison study of teachers in Spain, Italy and Ecuador which resulted that teachers need to improve key aspects such as teacher digital skills, adaptable learning resources, communication between universities and students, and teaching methodologies that must be appropriate with the current context as a result of the COVID-19 pandemic. In addition, the results of a survey conducted on 42 English teachers in Japan show that they are quite confident in using digital technology to support their teaching both inside and outside the classroom, they realize the importance of developing their digital literacy, and they are actively pursuing skills up to advanced (Cote & Milliner, 2018). In Indonesia, the use of information and communication technology during distance learning encourage teachers to develop technological literacy which results in new habits in the learning process in the future (Wardhana, 2020). In the previous research, it is found a higher level of digital literacy was positively related to the output of learning outcomes in the subjects studied skills, and higher levels of digital literacy positively affected the high output of learning outcomes to student academic performance (Yustika & Iswati, 2020).

Whether we realize it or not, the effects of online learning, digital literacy possessed by teachers and students have increased (Patmanthara & Hidayat, 2018). Digital literacy is the ability to use ICTs in finding, evaluating, utilising, sharing, and creating information found online (Maphosa & Bhebhe, 2019). The increase in teacher digital skills can be seen from the teacher's ability to use the LMS platform, google meet, zoom, and the teacher's ability to obtain new information from the virtual world (Mishra et al., 2020; Nur, 2021; Wong & Moorhouse, 2021). The positive effects of increasing digital literacy skills during the pandemic, such as a survey conducted on mathematics teachers in senior high and vocational schools in Bali and Nusa Tenggara showed that there was an influence of teachers' digital literacy skills on the ability of teachers to develop HOTS - based assessments (Widana, 2020).

Related to the cognitive skills possessed by students during online learning during the pandemic experiencing lack of clarity in students'

abilities, so that learning during the pandemic with online learning causes lost learning (Arsendy et al., 2020; Bahasoan et al., 2020; Pratiwi, 2021). Online learners feel anxious because they do not understand and are accustomed to online classes, especially for those who have limited computer skills (Yustika & Iswati, 2020). Even though all parties hope that even though learning is carried out online, students' abilities will still increase, or at least not experience a decrease in ability (Dhawan, 2020; Simamora, 2020). As the results of a survey conducted by PISA show that students' literacy skills in 2018 have decreased compared to 2015 (Aditomo & Faridz, 2018; Masfufah & Afriansyah, 2021; Tohir, 2019).

Addressing the problem that cognitive abilities such as literacy and numeracy have decreased, as well as to facilitate students during lectures to have additional competencies, not only have competence according to minimum standards based on the KKNI 6th level, The Indonesian Ministry of Education, Culture, Research, Technology and Higher Education (Kemendikbudristekdikti) held the *Merdeka Belajar–Kampus Merdeka* program (MBKM Program) with 8 excellent programs and one of them is Teaching Assistance (*Asistensi Mengajar*) (Amalia, 2021; Andari et al., 2021; Krishnapatria, 2021; Purwanti, 2021). This program aims to provide opportunities for students to learn and develop themselves through activities at the school closest to the students' residence (Tohir, 2020). In this activity, students are placed in elementary schools throughout Indonesia and help the teaching and learning process (Bali et al., 2022; Nehe, 2021). Three activities are focused on the teaching assistance, namely (1) literacy and numeracy learning assistance, (2) technology adaptation, and (3) school management systems (Fatonah et al., 2021; Maula, 2022). The targeted schools in this program are schools located in the frontier, outermost and farthest or rural areas (Bali et al., 2022), although there are several schools outside rural area that are used as teaching assistants (Fatonah et al., 2021). It is hoped, students throughout Indonesia can provide progress and change in education, there is no too big gap between rural areas and non rural areas.

Indonesia also currently needs teaching and learning assistance, especially for elementary school students to achieve optimal learning opportunities in limited and critical conditions during the pandemic, so that the biggest problems during the pandemic such as loss learning, low literacy and numeracy skills can be resolved. In addition, teaching assistance aims to (1) provide opportunities for students to learn and develop themselves through activities outside of lectures; (2) realizing students as part of strengthening literacy and numeracy learning; (3) provide opportunities for students to learn and develop themselves through activities outside the classroom; (4) helping schools to provide optimal educational services to all students at the elementary level in limited and critical conditions during the pandemic; and (5) provide optimal learning opportunities to all elementary school students in limited and critical conditions during the pandemic.

In connection with these problems, the purpose of this study is aimed at determining the literacy and numeracy skills of elementary school teachers/students in the 3T area (*tertinggal* (left-behind), *terdepan* (foremost) dan *terluar* (outermost)) of the MBKM program, the so-called teaching assistance (*asistensi mengajar*). Research related to literacy and numeracy has been done by many experts. As has been done by several researchers who conducted research on campus teaching activities to improve literacy and numeracy skills of elementary school students (Noerbella, 2022; Shabrina, 2022), research related to increasing literacy and numeracy in

junior high school students (Rachman et al., 2021), previous study religious-based elementary schools (Martina et al., 2022). Meanwhile, in this study, the research subjects used were the 5th and 7th semester students from various universities in Yogyakarta as well as teacher and students in a private elementary school in the 3T area.

METHODS

Desain of Research

In accordance with the purpose of this study, this research employs descriptive qualitative approach. The case studied was literacy and numeracy teaching and learning that was applied to private elementary school students in a program (KMA-1) carried out by the Ministry during pandemic outbreak. Qualitative research is exploratory research (Creswell, 2012a, 2012b), so this qualitative research serves to help researchers to find out more about the challenges faced by lecturers in implementing e-learning during a pandemic and what basic abilities lecturers have to support their learning. The case studies that are used as the focus of this research include research conducted in the 3T area in Gunungkidul Regency.

Participant

Respondents in this study amounted to 7 university students (teaching apprentices) who participated in KMA-1. This program is a program implemented by the government through the Ministry of Education, culture, research and technology. The seven students are from various departments across universities in Yogyakarta. They are assigned to assist a private school in rural area with limited number of students ranging from grade 1 to 6.

Data collection

The main instrument in this study is the researchers themselves. Literacy is closely related to reading and writing (Yulia & Amirudin, 2021) whereas numeracy deals with numbers (subtraction, addition, multiplication and division (Johnson & Layng, 1992; Ojose, 2011). In collecting data, researchers started from the planning and implementation based on observation. this is what is used as an indicator of literacy and numeracy in this study. researchers as instruments and main data collectors used semi-structured interview techniques and documentation (Creswell, 2012b). Interviews were conducted to clarify teacher qualification, experience, method, strategy, media and challenges in teaching literacy and numeracy in pandemic outbreaks. Observation was conducted to portray the teaching and learning process focusing on literacy and numeracy teaching and learning. The data of this study were obtained from subject participants asking about their experience in teaching and learning. The data obtained during the interview were recorded using a camcorder. In this case, the method used to collect data is Think Out Louds (TOL). TOL is a data collection method, where the subject is asked to voice his/her thoughts during the interview process. It allows the subject to say something or what s/he thinks (Someren et al., 1994).

Analysis of data

The analysis was conducted to find out the teaching of literacy and numeracy in a program the so-called, KMA-1. The procedures of data analysis are (1) preparing and organizing data for analysis, (2) exploring and coding data, (3) coding to develop descriptions, (4) representing and reporting findings, (5) interpreting findings, and (6) validating the accuracy findings (Creswell, 2012a; Fraenkel et al., 2012; Martin & McKneally, 1998; Miles et al., 2014). At the stage of preparing and organizing the data, it was carried out by preparing the results of reports on research subjects participating in KMA-1

activities organized by the Ministry. At the exploring and coding phase, the data was carried out by reducing information by analyzing all data collected from various sources, especially sources originating from reports of research subjects participating in KMA-1, in particular, in the teaching of literacy and numeracy activity. At the coding to build description stage, it is carried out by providing coding in reports of research subjects participating in KMA-1. At the presenting and reporting stage the findings are carried out by displaying the data that has been reviewed. At the stage of interpreting the findings is done by concluding the results of the error analysis carried out by the research subjects. In the step of validating the accuracy of the findings or the data validity stage, it is to make careful, thorough and continuous observations during the research, and to confirm the data obtained from one source with another by comparing the written test results (Fraenkel et al., 2012; Miles et al., 2014). For this reason, triangulation in this study was carried out using theoretical triangulation techniques and data source triangulation.

RESULTS AND DISCUSSION

Findings show participants (university students) learn how to teach and motivate primary school students by practicing (doing the activity) with planning and evaluating as well after the teaching learning process. They keep discussing among friends and teachers to run the teaching learning process. They discuss and learn together though most of time, the students seem to conduct teaching and learning process themselves without monitoring from class teachers. Example student-teacher interaction

Guru: Kita bermain sambil berhitung ya…siapa yang dapat menjawab… ibu membeli jeruk 3 dan 1 pepaya; berapa jenis buah buahan yang dibeli ibu?
S1 : 4 bu…
S2 : 2 bu…
Guru : Baiklah, jumlah ada…empat buah dan jenisnya ada berapa jenis?
S2 : 2 bu….

This result is in line with a report from one of the respondents noting that literacy and numeracy lessons need to be given to students at the beginning of learning (see figure 1). This is intended so that the literacy and numeracy skills possessed by students can increase.

Pada pelaksanaan program Kampus Mengajar ini ada beberapa hal yang sesuai dengan rencana yang telah dibahas dan juga terdapat beberapa hal yang kita sesuaikan dengan kebutuhan sekolah. Berikut penjelasanan mengenai pelaksanaan program yang kami lakukan:

1. **Kegiatan Mengajar**
   a) Mengadakan Bimbingan Belajar kelas 1

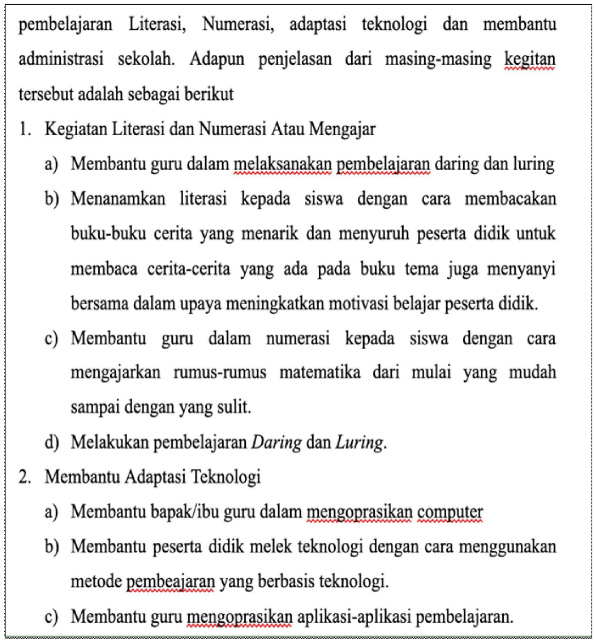
      Pada kegiatan mengajar kelas 1 ini kami lebih memfokuskan pada pendampingan dalam mengajarkan membaca, menulis, dan menghitung. Hal tersebut kita lakukan karena memang masih banyak siswa yang belum mampu membaca, menulis, dan berhitung dengan baik dan mereka juga sangat antusias dalam mengikuti pembelajaran. Selanjutnya kita juga sisipkan permainan yang seru dan bernyanyi bersama agar siswa tidak bosan ketika dikelas dan juga dengan meminta siswa untuk menggambar hal yang mereka sukai.

   b) Mengajar Kelas 2

      Pada kegiatan mengajar kita menggunakan buku tematik yang berisi mata pelajaran IPA, IPS, PPKN, Bahasa Indonesia, dan Seni Budaya. Selain itu kita juga selalu menekankan untuk pengembangan pelajaran literasi dan numerasi dalam setiap mengawali pembelajaran agar menumbuhkan semangat belajar literasi dan numerasi sejak dini pada anak – anak.

Figure 1. A sample of respondents' activity about literacy and numeracy teaching & learning

Teaching and learning process seems to be conducted in three phases – pre, while and post. By the time the teachers were asked, they mention that they lacked of professional development. Participants and primary students, eventually, always motivate students through interesting learning such as playing games and singing.


pembelajaran Literasi, Numerasi, adaptasi teknologi dan membantu administrasi sekolah. Adapun penjelasan dari masing-masing kegitan tersebut adalah sebagai berikut

1. Kegiatan Literasi dan Numerasi Atau Mengajar
   a) Membantu guru dalam melaksanakan pembelajaran daring dan luring
   b) Menanamkan literasi kepada siswa dengan cara membacakan buku-buku cerita yang menarik dan menyuruh peserta didik untuk membaca cerita-cerita yang ada pada buku tema juga menyanyi bersama dalam upaya meningkatkan motivasi belajar peserta didik.
   c) Membantu guru dalam numerasi kepada siswa dengan cara mengajarkan rumus-rumus matematika dari mulai yang mudah sampai dengan yang sulit.
   d) Melakukan pembelajaran *Daring* dan *Luring*.
2. Membantu Adaptasi Teknologi
   a) Membantu bapak/ibu guru dalam mengoprasikan computer
   b) Membantu peserta didik melek teknologi dengan cara menggunakan metode pembeajaran yang berbasis teknologi.
   c) Membantu guru mengoprasikan aplikasi-aplikasi pembelajaran.

Figure 2. A sample of respondents' activity regarding literacy and numeracy teaching and learning (reading books and teaching mathematical formula)

Data show student participants focus their teaching and learning on numeracy aspects by playing games and singing regarding 'simple counting' on adding and subtracting. As shown in Figure 2, it can be seen that literacy and numeracy activities can be carried out by reading story books, singing, and teaching mathematical formulas

In preparing teaching and learning, participants of KMA-1 wrote in brief what the topic and followed by what techniques/ procedures that can motivate students to learn happily. After greeting and asking students' condition then the next activity is usually having songs, in Bahasa Indonesia as well as in English. Literacy and numeracy aspects are taught subsequently. Participants/university students create games to drive students' enthusiasm and participation. This is in line with previous research which states that learning with games can hone students' ability to make decisions (Chow et al., 2011; Kaczmarczyk et al., 2016; Rumeser & Emsley, 2019), and improve cognitive abilities such as critical, creative, literacy and other skills (Bork, 2012; Nachiappan et al., 2014; Sari, 2021; Supriyatno et al., 2020).

Regarding the aim of teaching primary, teachers said that the goal of teaching and learning in elementary school was to develop students' competence on literacy and numeracy. Teachers accordingly said that vocabulary mastery is the focus of their teaching and learning for literacy. This is in line with previous research that there is a reciprocal relationship between vocabulary mastery and reading comprehension. The better the students' vocabulary knowledge, the better their performance with reading comprehension tasks. Similarly, the more students read using appropriate skills and strategies, the more their vocabulary develops (Constantinescu, 2007). Although the results of other studies show that there is no correlation between vocabulary mastery and students' reading ability (Bishry, 2018). But in general, there is a correlation between students' vocabulary skills and students' literacy skills because, without having vocabulary skills, students will find it difficult to read (Susanto, 2017; Wasik & Hindman, 2018).

Furthermore, teachers also confirmed that they always try to create interesting learning environment to increase students' achievement; this is done by combining singing and playing games. To achieve better learning outcome, teachers motivate students by creating various activities as well as media to after singing or playing (games), learning is carried out using various techniques and media so that learning becomes interesting for students. Primary students continued learning by doing activities provided by participants, such as drawing and coloring as well as finishing the task outside or inside the class.

When using songs, participants consider some aspects such as context, vocabulary, pronunciation, and practice (Brewster et al., 2004; Burri & Baker, 2019). Using songs for learning English can also be used to develop students 'memory skills, making classes more enjoyable, making students happy during the learning process, training students' social sense, used to learn pronunciation, rhythm, and emphasis. Songs that can be used as learning media in elementary schools have many types, such as active songs, animal songs, sports songs, food songs, learning songs, lullabies, patriotic songs, parody, counting songs, traditional songs, and so on.

With time constraints due to the pandemic, media are needed to design; The media can be in the form of realia and or social media for students to learn such as using the WhatsApp application (see Figure 3). The purpose of using various media can be to increase student interest in learning because of the limited offline learning space facilitated by the school. Video is also a medium used by teachers in learning as well as students in doing assignments, such as the task of reading students' iftar prayers.

Figure 3. Students' learning activity

The data reveals that learning is carried out through two modes at once, offline, and online. The online media used is through WhatsApp group whereas offline class is conducted at school with limited school time and learning materials are from textbook. They claimed also that the teaching learning process in pandemic outbreak is to develop students' character as well as motivation. Learning materials are expressions in English that are used daily (literacy) and addition and simple subtraction (numeracy). In teaching and learning process, primary school students learn both literacy and numeracy through songs and games and vocabularies are learnt through daily expressions such as day, month, and parts of the body. It is claimed that this teaching and learning can develop students' character.

Kid songs in teaching and learning process such as parts of the body, primary school students were excited during teaching and learning process. Students are engaged and they can conclude about the meaning in the song, identify the vocabulary, write the lyrics of the song into the students' note, and pronounced the vocabulary.

Teachers said that the goal of teaching and learning in elementary school was to develop students' competence on literacy and numeracy (Yuniharto & Nisa, 2022). Teachers accordingly said that vocabulary mastery is the focus of their literacy teaching and learning. By the time the researchers ask about teachers' challenges in teaching and learning in pandemic outbreak, the language teacher concludes.

Students found difficult to learn vocabulary and its meaning when the teaching and learning is conducted online. Teachers need breakthrough what techniques and strategies should be developed in facilitating students to improve their vocabulary teaching.

Teachers claim that students found difficult to memorize vocabularies and impact upon their motivation in learning.

Overall, literacy and numeracy learning strategies require teacher creativity to increase student motivation. A research conducted in Malaysia, for example, concludes that selecting appropriate spoken, written or visual texts or materials are best suited for pupils' needs and interests, decide on the most suitable methods, approaches and techniques; plan the most appropriate activities to be carried out; and choose, design or adapt the teaching materials that are best suited for their pupils in different settings and from diverse numeracy or literacy proficiency levels (Md-Ali et al., 2016).

Teachers, accordingly, develop their pedagogical competence by engaging students in teaching and learning such as giving questions that triggering students' thinking to answer the questions (Hamzah & Asokan, 2016; Yulia & Budiharti, 2019). Added to this, the national education curriculum demands students to be actively engaged in class and they have critical thinking in the learning process. Study shows that most students become less active when teachers ask them questions (Yulia & Budiharti, 2019).

■ CONCLUSIONS

KMA-1 contributed much to teaching and learning process since pandemic outbreak. University students/participants always try to improve their teaching and learning through games and interesting activities including media, such as the use of videos in learning and combining literacy and numeracy together with playing games as well as singing. To summarize, teaching learning process is conducted through various and interesting ways to develop student motivation. Singing and playing games is one of strategies to teach primary school students both literacy and numeracy. Three pillars of education during pandemic outbreak needs to facilitate; so, parents, schools and communities are responsible for teaching and learning activity. are needed when primary students are assigned to watch and learn from video. Parents are also asked to engaged actively though they might have insufficient knowledge on technology. Ki Hadjar Dewantara pinpoints three pillars of education, family, school, and community. The success of teaching and learning depends on the participation of these pillars.

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Development of TPACK-Integrated Creative Problem Solving Model in Improving Higher Order Thinking Skills

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Abstract: Development of TPACK-integrated Creative Problem Solving Model in Improving Higher Order Thinking Skills. **Objective**: This study aims to develop creative problem solving model integrated TPACK to improve higher order thinking skills. **Methods**: This research is Borg & Gall development with sample was 35 students of class XI SMAN 2 Selong. Research instruments is validation guidelines, practicality questionnaires and higher integral material essay tests. Data analysis using descriptive analysis for validity, practicality and t test for effectiveness. **Findings**: Products in the category are valid according to experts materials, language and learning technology. The product is relatively practical with an average score of 82.63. The product is classified effective with $t_{count} = 98.54 > t_{table} = 2.03$ with $\alpha = 5\%$ and n-gain value of 0.77 with high category. **Conclusion**: CPS model integrated TPACK has effective potential to improve higher order thinking skills.

Keywords: TPACK, creative problem solving, high order thinking skills.

Abstrak: Pengembangan Model Creative Problem Solving Terintegrasi TPACK untuk Meningkatkan Keterampilan Berpikir Tingkat Tinggi. ***Tujuan:*** *Penelitian ini bertujuan untuk mengembangkan Pembelajaran Creative Problem Solving terintegrasi TPACK untuk meningkatkan kemapuan berpikir tingkat tinggi siswa.* ***Metode:*** *Penelitian ini adalah penelitian pengembangan Borg & Gall. Sampel penelitian adalah 35 siswa kelas XI SMAN 2 Selong. Instrumen penelitian meliputi pedoman validasi desain pembelajaran , kuesioner kepraktisan dan tes esay materi integral. Analisis data menggunakan analisis deskriptif untuk analisis kevalidan, kepraktisan produk dan uji t untuk keefektifan produk.* ***Temuan:*** *Produk dalam kategori valid menurut ahli materi, Bahasa dan teknologi pembelajaran. Produk juga tergolong praktis dengan skor rata-rata 82,63. Produk tergolong efektif dengan $t_{hitung} = 98,54 > t_{tabel} = 2,03$ dengan $\alpha = 5\%$ serta nilai n-gain sebesar 0,77 dengan kategori tinggi.* ***Kesimpulan:*** *Model pembelajaran CPS terintegrasi TPACK memiliki potensi efektif untuk meningkatkan keterampilan berpikir tingkat tinggi*

Kata kunci: *TPACK, penyelesaian masalah kreatif, keterampilan berpikir tingkat tinggi.*

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INTRODUCTION

Teachers as educators at the unit level of early childhood, primary, and secondary education have a very important role in determining the success of students so that they become determinants of improving the quality of education in schools. Formal education in Indonesia currently does not emphasize how to develop higher order thinking skills (Yanti, 2019). According to a TIMSS study in 2015, it states that Indonesian students' mathematics ability in the field of mathematics is still far from other countries, which is ranked 44 out of 49 countries (Mullis, 2016). Similarly, from the results of the PISA survey in 2015, the high order thinking skills of elementary and junior high school students in Indonesia is still low (OECD, 2016). Facing these problems, it is necessary to carry out learning that is able to actively involve students in learning so that students are able to explore ideas by utilizing technology so that concepts and strategies are obtained in solving mathematical problems (Khaulah, 2018; Yen, 2015).

Developing higher order thinking skills is an important part of learning (Waluyo, 2020). In mathematics learning, developing high order thinking skills is an activity that is difficult for students to do (Khatimah, 2019). High order thinking requires students to think so that they can find different ways to solve the real problems of mathematics at hand. Higher order thinking skills are skills in using the knowledge possessed by a person to find answers to the problems encountered (Conklin, 2012). Higher order thinking skills are activities in finding solutions to problems by involving knowledge, insight and experience (Richland, 2015). Higher order thinking skills as a skill in using knowledge possessed or previously known to solve problems (Septian 2019). Rahmani (2018) states that through higher order thinking skills, students can find various possible problem solving through the interrelationship of the different fields of knowledge they have learned.

Based on the foregoing, one of the learning strategies that teachers need to go through that are able to teach students actively and have the potential to improve students' higher-order thinking skills is the application of a creative problem solving model. Treffinger & Isaksen (2005) states that one of the learning models that can be used to support learning to think is creative problem solving. Creative problem solving (CPS) is learning that trains students to use their thinking skills in solving problems by considering various possible solutions that arise from students' ideas, as well as being able to improve students' positive attitudes during learning (Hu, 2017). This is also supported by Chant (2009) who states that the CPS model is used in learning that emphasizes critical thinking skills and metacognitive strategies. CPS is the thinking ability that students have and serves to improve the ability to think in a high order in solving problems (Puccio, 2005). The use of CPS facilitates the process of solving certain problems so as to provide space for increased creativity in solving problems (Adams, 2010). The CPS learning model is a learning model that focuses on learning and problem-solving skills, followed by strengthening skills (Nguyen, 2017). Based on previous experience, when students are faced with a new problem, students can select and develop previously acquired ideas, use problem-solving skills and develop higher-order thought processes (Pepkin, 2004).

The CPS model learning is different from traditional learning which is mostly teacher centered, but focuses on learning creativity so that it can be considered a learning model with integrated knowledge, and not only emphasizes active students learning but also emphasizes the togetherness of teachers and students in planning learning activities (Hu, 2017; Tseng, 2015). The same thing is also stated by Su (2016) that CPS learning will also encourage students to think critically by considering various solution options and coming up with new strategies in solving

problems. Furthermore, Isaksen and Aerts (2011) state that individuals who learn to use CPS have clear references regarding problem-solving tools and methods that involve creative thinking effectively.

The development of information and communication technology has had a major influence on the learning process of the 21st century and encouraged teachers to have knowledge related to information and communication technology. Facing the development of technology in today's 21st century learning, teachers are required to have technological, pedagogical, content knowledge (TPACK) knowledge that is able to integrate technology in learning, especially learning in schools today must follow the adaptation of new habits due to the Covid-19 pandemic. TPACK is a new type of knowledge that teachers must acquire to be able to integrate technology well in learning (Mishra & Koehler, 2006). TPACK is the transformation of knowledge, content and pedagogical knowledge into different types of knowledge used to develop and implement teaching strategies (Tuithof, 2021). In learning, teachers must have the necessary competencies in integrating technology appropriately and effectively (Akturk, 2019). Koehler, Mishra, & Cain (2013) stated that TPACK is a framework used to analyze the integration of technology in teacher learning.

The TPACK integrated CPS learning model is a CPS learning model where in every step learning is integrated with the use of technology. Some literature search results show the advantages of learning the creative problem solving model. The advantages of CPS learning include training students' thinking skills, training students to solve problems systematically (Kandemir & Gür, 2009), and focusing on learning creativity (Hu, 2017). Yurdakul (2012), revealed in his study that pre-service teachers need to provide opportunities to gain practical knowledge and skills to use the latest technology during the teaching and learning process. Almada (2014), explained in their study that the integration of technology in the classroom depends on the ability of teachers to educate the learning environment using effective technology based pedagogy. TPACK skills are needed by teacher educators because they facilitate effective teaching and learning along with helping prospective teachers to use them efficiently (Lee & Tsai, 2010). Yurdakul (2012), also states that teacher inefficiency in terms of knowledge of various teaching skills as well as inability in technology are the main obstacles to assimilating technologically integrated teaching and learning in the classroom. As stated by (Hew & Brush, 2007), the barriers to technological assimilation consist not only of the absence of certain technologies and teaching skills but also the absence of pedagogical knowledge and technology-supported content.

Based on the description above, it is necessary to develop an TPACK integrated CPS model in improving students' higher order thinking skills.

METHODS

Participants

The population of this study is class XI students of SMAN 2 Selong East Lombok which consists of 6 classes. Randomly 1 class was taken with a total of 35 students consisting of 15 male students and 20 female students as research subjects.

Research Design

The type of research used in this research is the development research Borg and Gall (2007), which is a systematic process carried out in developing an educational product and refers to the development of learning designs including

needs analysis, design product, development product, implementation and evaluation product. (Dick, Walter, Carey, & Lou, 2001).

The needs analysis was carried out by interviewing 3 mathematics teachers regarding the application of the learning strategies used and providing questionnaires to 35 class XI students of SMAN 2 Selong about students' feelings after participating in mathematics learning. Based on the results of the needs analysis, researchers compile a draft of creative problem solving model integrated TPACK. The draft is then consulted with material experts, linguists and learning technologists to measure the feasibility of the learning design being developed and revised based on input from experts. The next step, a trial was carried out in the classroom for 3 meetings to 35 class XI students of SMAN 2 Selong who were the subjects of the study. The implementation of learning is measured using a questionnaire about student responses to the implementation of learning. Meanwhile, to measure whether the learning design developed has the potential to improve students higher order thinking skill, the t-test is used using One Group Pretest Posttest Design and calculating the N-Gain scores of pretest and postest scores.

Instrument

The instruments used in this study include (1) guidelines for validation of learning products, (2) guidelines for the practicality of implementing learning and (3) essay tests of students' higher-order thinking skills. The learning product validation guidelines developed contain measurement indicators including: (a) goal formulation indicators, (b) content indicators, (c) language indicators, and (d) time indicators. While the product practicality guidelines developed contain indicators of (a) students' feelings of pleasure towards the learning process, (b) assessment of the novelty of products developed in learning, (c) students' interest in following learning using developed products. The high-order thinking test instrument used is an essay test with 5 questions with indicators: 1) determining the problem; 2) explore the problem; 3) plan solutions in solving problems according to the solution strategies that have been selected and drawn up, and 4) implement plans, 5) review solutions, 6) evaluate (Winarti, 2017).

Data Analysis

Products in the form of learning designs that have been developed are validated by 3 experts, namely material experts, learning technology experts, and linguists. The quality of the development product in the form of a CPS model integrated TPACK is measured based on product validity, product practicality and product effectiveness. Product validation indicators are presented in Table 1, Table 2 and Table 3.

Table 1. Product validation guidelines developed by material experts

Aspects	Indicators
Conformity	The order of conformity of the learning design with the model developed with the basic competencies and indicators of competency achievement in the curriculum
Ease	The language used in developing products with a order of understanding is difficult, moderate or easy by the teacher.
Completeness	Completeness of materials and selection of technology
Clarity	Clarity of description and systematic arrangement of the material in the learning model

Table 2. Product validation guidelines by learning technology experts

Aspects	Indicators
Conformity	The developed product integrates technology that matches the learning material taught by the teacher
Ease	Products developed using technology that is easy for teachers and students to use
Communicative	The language used is easy to understand and the selection of technology for learning that is easy for students to use

Table 3. Product validation guidelines by linguists

Aspects	Indicators
Readability	Products developed using good and correct language rules
Ease	Products developed using language that is easy for teachers and students to use
Communicative	The language used is easy for students to understand and understand

Products developed in the form of learning designs with a TPACK integrated creative problem solving model are said to be valid if the product developed is in accordance with each aspect with indicators set for each aspect. The validity criteria of the learning model developed, namely the creative problem solving model integrated TPACK are used criteria Table

Table 4. Learning model validity criteria

Interval Score	Validity Criteria
$x \geq 85$	Very valid
$70 \leq x < 85$	Valid
$45 \leq x < 70$	Quite Valid
$x < 45$	Invalid

The practicality of the product developed in the form of a creative problem solving model integrated TPACK is tested based on (1) an assessment of the practicality of the product by an expert, (2) the magnitude of the teacher's response after carrying out TPACK integrated Creative Problem Solving with criteria such as Table 5.

Table 5. Practicality criteria of learning models

Interval Score	Practicality Criteria
$x \geq 85$	Very Practical
$70 \leq x < 85$	Practical
$45 \leq x < 70$	Quite Practical
$x < 45$	Impractical

Meanwhile, to test the effectiveness of the product developed in the form of a CPS model integrated TPACK was tested using a t test with a significance level of 5% for each indicator of high order thinking skills. Meanwhile, to test the potential effects of products that have been

developed in improving students' higher-order thinking skills, it is carried out by calculating the N-Gain score, which is calculating the difference between the postes score and the pretests obtained by students.

■ RESULTS AND DISCUSSION

Needs analysis

Before conducting research as a basis for product development, researchers conduct a needs analysis by conducting interviews with mathematics teachers regarding the application of learning strategies used and providing questionnaires to students about students' feelings after participating in mathematics learning. The results of interviews with 3 mathematics teachers can be concluded that (1) most of the learning process carried out is still conventional and not student-centered, the teacher's dominance in learning is very high, students' thinking ability has not developed adequately and the teacher provides more examples and practice questions; (2) In learning, teachers have not integrated technology in teaching certain concepts such as utilizing laptops, google classrooms, google drive applications and other applications in accordance with current learning demands; (3) In learning, schools need to prepare supporting facilities related to the use of technology such as laptops, google classrooms and internet networks that are adequate in integrating technology in learning; (4) Teachers expect support from schools to improve their knowledge in the field of technology and information as part of the competencies needed in carrying out current learning.

Meanwhile, based on the questionnaire given to 35 students of class XI of SMAN 2 Selong on the learning carried out by mathematics teachers, it shows that (1) the learning obtained in general has not been fun, boring, and seems that mathematics is still considered one of the difficult and scary lessons with a percentage of 75%; (2) In learning, teachers' efforts to develop students' higher order thinking skills have not been optimal so that students are confused when facing non-routine questions, which require high-order thinking skills in solving the problems faced; (3) In learning, teachers and students have not utilized adequate technology due to the availability of technology needed in learning in schools with a percentage of 80%, this is due to the lack of facilities prepared by the school and the economic ability of parents of students to prepare facilities such as android; (4) In learning, teachers have not used innovative and varied learning strategies so that learning is a momoton with a percentage of 75%. Referring to the needs analysis above, it is necessary to develop a learning model that is able to develop students' higher-order thinking skills by actively involving students in learning so that two-way interaction in learning can be carried out.

Product Design

The product developed is in the form of a learning design for the TPACK integrated Creative Problem Solving model, namely how in teaching certain materials teachers are able to integrate technology with their pedagogical knowledge. TPACK integrated CPS model syntax developed with steps such as Table 6.

Table 6. Syntax of tpack integrated creative problem solving model

No	Fase	Teacher Activities	Student Activities
1	Orientation to the problem	The teacher divides a group of 3-5 students, explains to the	Pay attention to the teacher's explanation of the problem to be solved.

		students about a given problem	
2	Disclosure of opinion	Teachers facilitate students in exploring ideas	Students are freed to express their opinions on a wide variety of problem-solving strategies by digging through their information through the internet and android
3	Evaluation	Teachers guide students in problem solving	Each group discusses which opinions or strategies are suitable for solving the problem
4	Implementation	Teachers facilitate individually and in groups in finding solutions to problems	Students determine strategies that can be suitable for solving problems and finding solutions to problems by accessing the information needed with their android.
5	Presentation	Teachers guide and direct students in presenting and providing reinforcement	Representatives of each group presented the results of the problem solving carried out, while the other group gave responses
6	Reflection	The teacher evaluates all problem-solving activities carried out by students. Together with students draw conclusions to get concepts related to the problem that students solve	Students draw conclusions based on problems solved under the guidance of the teacher

Product Development and Evaluation

The product in the form of a learning design of the TPACK integrated creative problem solving model is validated by three experts, namely learning material experts, learning technology experts, and linguists using validation sheets that have been prepared with the specified validity criteria. The validation results are used to revise the product developed based on expert input and advice. Based on the results of the validity analysis, a product validity score is obtained as presented in Table 7.

Table 7. Validation results of developed products

Component	Validation Results		
	Material Expert	Technologist	Linguist
Identity	92	90	85
Formulation Indicators	81	79	85
Goal Formulation	85	80	82
Material suitability	80	82	80
Preliminary Activities	80	85	85
Core Activities	82	85	84
Learning Activities	85	87	86
Technology Selection	87	86	85
Technology Integration	85	85	82
Concluding Activities	84	87	85
Language Use	82	85	82
Average Score	83,91	84,64	83,73
Conclusion	Valid	Valid	Valid

Based on the validation results by the experts in Table 7 above, the average product validation scores of the three experts are consecutively 83.91; 84,64; and 83.73 so that the product developed is valid and suitable for use.

Product Revisions

Product revision is carried out based on the input of experts. Some of the components that need to be revised include: 1) Aspects of indicator formulation, namely the need to use operational verbs C4, C5, and C6 that measure higher order thinking skills, 2) Aspects of technology selection, it is recommended to use applications that are easy for students to use, 3) Language aspects, it is recommended to use language that is easy for students to understand.

Product Practicality

The learning design of the creative problem solving model integrated TPACK that was developed was tested based on practicality scores by experts and the implementation learning carried out by teachers in teaching integral material using predetermined practicality criteria. Based on the data obtained from the observation sheets that have been collected both observation sheets by experts and teacher responses, presented as Table 8 and Table 9.

Table 8. Results of the practicality assessment of the developed model

Validators	Score	Category
Material Expert	82.25	Practical
Technologist	84.14	Practical
Linguist	80.54	Practical
Average	82.31	Practical

Table 9. Product practicality assessment results during learning

Aspects of Observation	Meeting		
	First	Second	Third
Delivery of learning objectives	84	84	85
Motivating Students	85	85	85

Giving real problems	82	84	82
Material Mastery	83	80	82
Mastery of Technology	80	82	82
Technology Integration	79	80	80
Classroom Management	82	80	85
Conducting Evaluations	80	84	85
Making a Conclusion	82	84	85
Average Score	81.89	82.56	83.44
Average		82.63	
Category	Practical	Practical	Practical

Referring to the scores shown in Table 9 above, it shows that, the application of learning using the TPACK integrated Creative Problem Solving model for 3 meetings shows that the learning model used in learning is included in the practical category both at meetings 1, 2, and 3. However, based on the results of observations at each meeting, there are several things that must be improved in the implementation of learning. At the first meeting, the results of the observations showed that teachers need to make improvements in aspects 1) mastery of the technology used needs to be adjusted to the material taught and it is recommended that teachers socialize first before being used in learning,2) re-examining the order of learning syntax so that the implementation of learning is more systematic and follows the syntax that has been formulated in the learning design, 3) in drawing conclusions, it is recommended that the teacher first ask the students to draw conclusions and the teacher directs not the teacher who directly draws conclusions. In the second meeting, the results of the observations showed that mastery of learning syntax is still not fully mastered by the teacher, this is because the application of TPACK integrated creative problem solving learning tends to be new to teachers and it is recommended that the learning syntax be better understood. In addition, the integration of the technology chosen in exploring concepts also still needs to be improved. At the third meeting, the real problems that the teacher chooses in the initial activity need to be adapted to the material being taught and more challenging which requires various strategies in solving. In addition, teachers need mastery of essential and advanced materials because this will affect the management of the class carried out by the teacher. In drawing conclusions, the teacher also needs to ask the students to draw conclusions and the teacher provides reinforcement.

Product Effectiveness

Pretest and postes score of students higher order thinking skills on integral material were obtained by providing essay tests to 35 students of class XI of SMAN 2 Selong before and after getting creative problem solving model integrated TPACK. The scores of the pretest results and postest of the students higher order thinking skills are shown as in Figure 1.

The effectiveness of the developed product is measured using a t-test against each indicator of students' higher order thinking skills. The t-test with subjects of 35 students for each indicator of higher-order thinking skills with a significance level of 5% is presented as Table 10

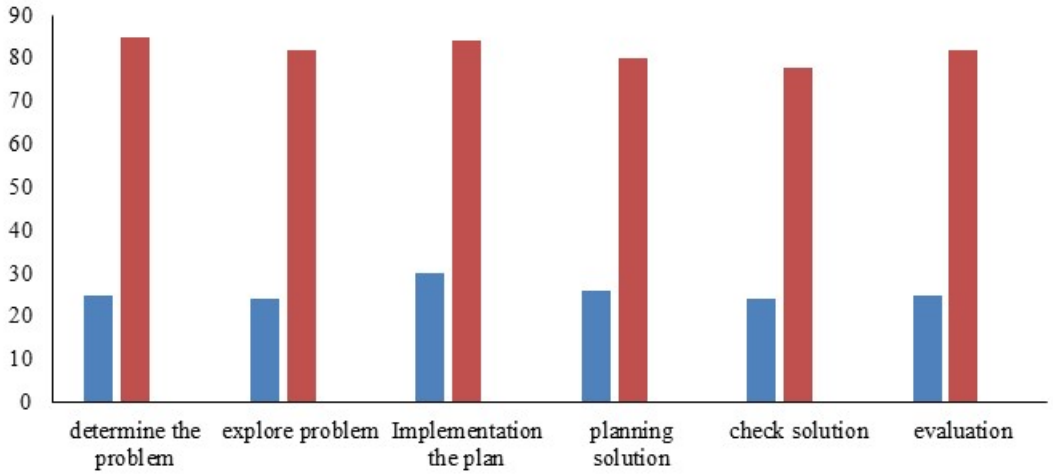

Figure 1. Pretest and postest score showed in blue and red color, respectively

The effectiveness of the developed product is measured using a t-test against each indicator of students' higher order thinking skills. The t-test with subjects of 35 students for each indicator of higher-order thinking skills with a significance level of 5% is presented as Table 10

Tabel 10. Test t indicators of higher order thinking skills

Indicators	Average score of high order thinking skills		t value		Conclusion
	Pretest	Postest	t_{count}	t_{table}	
Determine the problem	25	82	77.97	2.03	effective
Explore problem	24	82	89.12	2.03	effective
Planning solutions	30	84	34.94	2.03	effective
Implementation the plan	26	80	59.79	2.03	effective
Checking solutions	24	78	70.41	2.03	effective
Evaluation	25	82	68.81	2.03	effective
Average score	25.67	91.83	98.54	2.03	effective

Based on Table 10, the t-test for each higher-order thinking skills indicator as well as the test for the indicator as a whole shows that the learning model developed is effective in improving students' higher-order thinking skills.

While the n-gain value for determine problem indicator of 0.80 belongs to the high category, the explore problem indicator of 0.76 belongs to the high category, the planning solution indicator of 0.86 belongs to the high category, implementation the plan indicator of 0.73 in the high category, the checking solution indicator of 0.71 in the high category and the evaluation indicator of 0.76 in the high category. Similarly, if you look at the average score of 6 indicators of high-level thinking skills, the N-Gain value of 0.77 belongs to the high category. Based on the foregoing, it can be said that the application of the creative problem solving learning model integrated TPACK has a high potential in improving the higher-order thinking skills of high school students.

Learning with the creative problem solving model integrated TPACK begins with the provision of real problems by the teacher that students must solve. Furthermore, students are

directed to explore information related to problems provided by teachers by utilizing technology such as using androids to get new ideas and ideas used to solve these problems through active discussions both in groups and between groups. Discussions in groups are intended so that students can express ideas and ideas and experiment in solving problems, and then students present the results of solving their problems. A series of activities ranging from giving problems to presenting the results of discovery or problem solving, both teachers and students utilize information technology that is in accordance with each stage of the series of learning activities, for example presenting real problems through videos, the google drive application to send real problems that students must solve and androids that students use to explore various information used to solve these problems. Discussions in groups are intended so that students can express ideas and ideas and experiment in solving problems, and then students present the results of solving their problems. A series of activities ranging from giving problems to presenting the results of discovery or problem solving, both teachers and students utilize information technology that is in accordance with each stage of the series of learning activities, for example presenting real problems through videos, the google drive application to send real problems that students must solve and androids that students use to explore various information used to solve these problems. The series of learning activities carried out like this are believed to be able to foster higher order thinking skills and student curiosity. The learning process that actively involves students in learning by utilizing various appropriate and adequate learning resources is expected to be able to create student curiosity (Kwon, 2014). The application of creative problem solving model integrated TPACK allows students to discuss in groups to develop mathematical problem solving skills. Learning with the creative problem Solving model integrated TPACK provides opportunities for students to explore information, find ideas and find concepts that can be used by students in problem solving (Schmidt, 2009).

The use of appropriate and appropriate technology in learning is very necessary in teaching a certain material. In this case, teachers are required to have the competence to ensure that the selection and use of technology in learning is effective. In addition, teachers are also required to understand when the chosen technology is used and how to use it, anticipate the impact caused by the use of technology in learning and the effectiveness of the technology used in teaching certain teaching materials by using certain learning strategies (Guerrero, 2010). Integration of technology, pedagogy and content in the form of TPACK based learning tools as creative solutions developed in learning (Beri, 2021). TPACK based learning tools optimize student learning activities and are able to improve students' higher-order thinking skills (Archambault, 2010)

The integration of TPACK in teaching certain materials in learning refers to the ability of a teacher to integrate the content of the material to be taught into the form of learning with the teacher's pedagogical abilities that are adequate for various abilities and characteristics of students (Khine, 2017). By integrating TPACK when a teacher applies creative problem solving learning in learning certain teaching materials has high potential in developing and improving students' abilities in solving mathematical problems provided by the teacher. Besides having an impact on improving students problem-solving abilities, the development of an integrated TPACK model using the creative problem solving model is also believed to have an impact on improving students' high order thinking skills, namely critical thinking ability, creative thinking ability and students' mathematical communication skills.

CONCLUSIONS

The product developed in the form of creative problem solving model integrated TPACK design has been developed based on needs analysis and developed systematically and refers to the stages of developing the Borg & Gall learning model. The learning design using the creative problem solving model integrated TPACK developed, based on validity, practicality, and effectiveness tests has met the criteria that have been set. The validation results by 3 experts, each linguist, material expert, and expert in learning technology showed that the product developed was included in the category of valid and worthy of continuing at the field trial stage. Based on the practicality assessment carried out by ahi, products in the form of learning designs using the creative problem solving model integrated TPACK also meet the practicality category. Similarly, after conducting trials in class for 3 meetings, the results of observations showed that the score of the implementation of learning application at meetings 1, 2, and 4 was included in the paktis category. Meanwhile, the product in the form of a learning design using the creative problem solving model integrated TPACK developed is an effective category indicated by the percentage of students who obtained a high-order thinking skills score on integral material and its use e" 75 by 88.57%, higher than the set effectiveness indicator of 85%. The learning model used, namely the creative problem solving model integrated TPACK, also has a high potential effect in improving students high order thinking skills as indicated by an N-Gain score of 0.77

The implications of this research, in today's 21st century learning, teachers are not only spectators of technological developments but teachers are also expected to be actors who are able to use technology in learning. In addition, teachers are also expected to be able to use innovative student-centered learning strategies. Teachers are also expected to be able to develop students' high order thinking skills by applying student-centered learning models, especially the creative problem solving learning model integrated TPACK. I would like to express my deepest gratitude to the Ministry of Education, Research and Technology and LPDP for providing funding so that this research can be completed properly. I would also like to thank the dean of the Faculty of Mathematics and Natural Sciences, Hamzanwadi University for providing facilities and support in completing this research.

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The Effect of Self-Regulated Learning, Self-Efficacy and Learning Motivation on Economic Learning Achievement with Gender as Moderating Variable

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Abstract: The Effect of Self Regulated Learning, Self Efficacy and Learning Motivation on Economic Learning Achievement with Gender as Moderating Variable. **Objective**: This study analyzes whether gender moderates the effect of self-regulated learning, self-efficacy, and learning motivation on economic achievement. **Methods**: This research is a quantitative research with a correlational. The population in this study was students of Social Studies XI in Boyolali, as many as 1,284 students. This research uses cluster random sampling. The number of samples is 308 students. Data collection techniques using a questionnaire. Data analysis technique uses moderated regression analysis (MRA). **Findings**: The self-regulated learning variable obtained a t-count: 1.385 <1.656 with a sig. 0.167 > 0.05, self-efficacy variable, t-count: 1.929 > 1.656 with a sig. 0.055 > 0.05. The learning motivation variable obtained a t-count: 2.122 > 1.656 with a sig. 0.035 <0.05. **Conclusion**: There is no difference in self-regulated learning between male and female students. Gender has a positive but not significant effect on self-efficacy. Gender has a positive and significant influence on learning motivation.

Keywords: self regulated learning, self efficacy, motivation, learning achievement, gender

Abstrak: Pengaruh Self Regulated Learning, Self Efficacy dan Motivasi Belajar terhadap Prestasi Belajar Ekonomi dengan Jenis Kelamin sebagai Variabel Moderasi. ***Tujuan:*** *penelitian ini untuk menganalisis apakah jenis kelamin memoderasi pengaruh self-regulated learning, self-efficacy, dan motivasi belajar terhadap prestasi belajar ekonomi.* ***Metode****: Penelitian ini merupakan penelitian kuantitatif dengan jenis korelasional. Populasi dalam penelitian ini adalah seluruh siswa kelas XI IPS jenjang SMA di Kabupaten Boyolali sebanyak 1.284 siswa. Penelitian ini menggunakan cluster random sampling. Jumlah sampel 308 siswa. Teknik pengumpulan data menggunakan angket. Teknik analisis data menggunakan Moderated Regression Analysis (MRA).* ***Temuan:*** *Berdasarkan uji MRA diperoleh variabel self-regulated learning memperoleh t-hitung 1,385 < 1,656 dengan tingkat sig. 0,167 > 0,05. Variabel self-efficacy, t-hitung: 1,929 > 1,656 dengan nilai sig. 0,055 > 0,05. Variabel motivasi belajar memperoleh t-hitung 2,122 > 1,656 dengan nilai sig. 0,035 < 0,05.* ***Kesimpulan:*** *Tidak ada perbedaan self -regulated learning antara siswa laki-laki dan perempuan. Jenis kelamin memiliki pengaruh positif namun tidak signifikan pada self-efficacy. Jenis kelamin memiliki pengaruh positif dan signifikan motivasi belajar terhadap.*

Kata kunci: *self regulated learning, self efficacy, motivasi, prestasi belajar, jenis kelamin*

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INTRODUCTION

The covid-19 has a great impact on education around the worlds, specifically on the teaching and learning from elementary to high school (Toquero, 2020). Starting from March 2020 to June 2022, many schools in Indonesia have embraced the online learning. The sudden changes to digital learning methods undoubtly faced many obstacles and barriers (Crawford et al., 2020). Students were also falling behind on their academic achivements because this sudden shifts (Meji & Dennison, 2020). Many of the subject courses never completed the intended subject materials ((Patricia, A., 2020). Most of these students were not able to passed the minimum criteria of the learning processes (Argaheni, 2020).

One of the possible reason that student not be able to achive maximum score in their study was may be due to the lack of stable internet connections, which may lead to the absence (Limbong, 2020). Beside that, the students achievements are also influenced by internal and external factors (Altun & Erden, 2013). Self regulated learning and self efficacy are the examples of internal factors influences the students academic achievements (Agustiani et al., 2016). Self regulated learning defined as the students ability to understand and control the methos they use to learn and to make changes in the learning processnthat affected emotions and academic achievement (Harris et al., 2011). Zimmerman (1989) defined self regulated learning as the ability to actively participate in learning to achive a goal at metacognitive, motivational, and behavioral level. There are three self-regulated learning strategies, namely: 1) cognitive learning strategies; 2) metacognitive and self-regulated learning strategies; and 3) resource management and regulatory learning strategies.

Students use the cognitive learning strategy in order to comprehend material in their study. Cognitive learning strategies are classified into three types: organization, elaboration, and training. The student attempted to memorize and comprehend what was taught by reciting phrases and recalling keywords. Students understand theory with a method for summarizing problems, drawing equations, connecting past knowledge with new information, and collecting information. While in metacognitive learning strategies, students regulate, monitor and control various study activities to reach learning objectives. Students filter information before reading or learning, ask questions, monitor comprehension of readings that have been explained by the teacher, monitor speed in answering quiz questions, effectively change study methods, and adjust study style with type lesson. The third strategy, resource management strategies, requires students to control and manage the environment using technique. Make time to learn and create a positive learning environment; collaborate with other students; seek guidance if a problem arises; and manage effort to overcome inability to study.

Students with higher levels of self-regulation are better in coping with the environment learning and performs better academically (Barnard-Brak et al., 2010; Wang et al., 2013). Several empirical research on the effect of self regulation on academic performance on various education level (elementary, middle school, high school and colleges) has been reported (Fredericks et al., 2004). It has been reported, student with stronger self regulated learning can exceeded the learning standard (Xiao et al., 2019; Guo et al., 2019). According to Saraswati (2017), there is no correlation between self regulated learning anda student achievement outcomes. Similarly, Tarumasely (2021) reported that self-regulated learning had no effect with results-oriented students.

Self-efficacy is another factor that migtht influences performance study students (Martin et al., 2019; Ayllon et al., 2019; Mohebi et al., 2018 Self-efficacy influence the learning environment to support one's attitude to develop and to act to achieve their learning goals (Surjanti et al., 2020). Bandura (1994) defines self-efficacy as the confidence in one's ability to reach success. Confidence is defined as the ability to put someone in control and achieve desired results (Santrock, 2011). However, self-efficacy is not the same as self-esteem; for it is related to value and respect for someone. While self-efficacy is more of a measure of student's trust in themselves to perform certain activities (Akraam & Ghazanfar, 2014).

There are three dimensions to measure self-efficacy according to Bandura (1977), namely magnitude, generality, and strength. The magnitude describes the perceived difficulty of the tasks that can be resolved. Generality describes the various contexts where self-efficacy could be used. While the third dimensions, the strength is related to a person's assessment of his beliefs. A strong belief will drive someone to persevere in the face of adversity. This strength dimension is associated with someone's determination to continue a particular behavior.

Students with high self-efficacy will be able to set their own goals, set their own plans to achieve those targets, so they will be more motivated to achieve those targets and thus can achieve higher learning (Roick & Ringeisen, 2017). Students with high self-efficacy showed to have better results where learning is also high (Honicke & Broadbent, 2016). However, results from the study of Alafgani & Purwandari (2019) shows contradiction that self-efficacy has a negative relationship toward academic performance.

Aside from the aforementioned factors, motivation in learning also influences student achievement in achieving learning objectives (Uno, 2019). Motivation is defined as the mental impulse to self-study in order to push activity and achieve goals (Winkel, 2015). Motivation to study, as an impetus that comes from within the student as an internal factor rather than from external, has the potential to arouse interest and the passion of the student in order to achieve the desired results. Because its existence create wants and needs, therefore a motivation is a driver for behavior change (Sulfemi, 2018). However, research by Cahyani et al. (2020) shows that student basically has a low motivation. During online learning in COVID-19 pandemic, according to Wijaya and Bukhari (2017), there is a positive relationship between motivation and student achievement. Motivated students have better results, but students with lower motivation get lower results.

According to Harso and Merdja (2019), female students are more motivated than their counterparts. Taasoobshirazi et al. (2019) propose that motivation in male and female students have no effect on achievement, but female students have higher self-efficacy than male students. Furthermore female students are more self-assured, more diligent, and have better timing (Pajares et al., 1999). In contrasts to male students, who were engage in slightly more non-productive and annoying activities (Kenney-Benson et al., 2006). An investigations using various hypotheses proposed by Naderi et al. (2008) and Atonum (2018) show that there is no effect of gender type on students academic performance.

METHODS

Participants

The population in this study were the high school students in class XI IPS in all public high schools in Boyolali on the 2021–2022 school year. The total population counted as

many as 1,284 students. But for this research, in determination of sample is using the cluster random sampling, that divided Boyolali into two areas for the school sampling, which are the South and North Boyolali. In choosing the sample school is at random from each section. So for this purpose, the school that became the sample are SMA-1 Klego, SMA-1 Simo, SMA-1 Banyudono, and SMA-1 Boyolali. We handed out the questioners to students majoring in social studies, aged 15 to 16, who participate in online learning through the Zoom and WhatsApp applications in those highschools. For research purposes the amount of sample were 308 students.

Research Design and Procedures

This research is a quantitative research with a correlational. Quantitative or statistical research is used to collect data. The established hypotheses were tested using quantitative research techniques. The independent variables in this study are self-regulated learning, self-efficacy, and motivational learning. The dependent variable is student achievement in economics subjects. The moderator variable in this study is gender. Data collection used questionnaire were given to 308 students. Data analysis was then carried out, namely data coding, filtering the appropriate data and analysing, data analyzing data. Research prosedure of this research following: questionnaire distributions, questionnare analysis, results and conclusion.

Instrument

To collect data, a questionnaire is administered to prospective respondents. The questionnaire is in forms of close ended statements to collect the respondent's perception on those variables. The number of statement items as many as 30 valid statements using a likert scale. The sccale concist of 5 points. Instruments for measuring self-regulated learning use indicators: training strategies, development, organizing, metacognitive settings, time and learning environment, business settings, and seeking help. The number of statement items is 10. Indicators for measuring self-efficacy use magnitude dimensions with 4 statements, generality with 3 statement items, and strength with 3 statement items, while indicators for measuring learning motivation use indicators: intrinsic goal orientation, extrinsic goal orientation, value task, control of learning beliefs, and test anxiety. Questionnaire using a Likert scale.

The ability to set and develop learning strategies (3 items), to organize learning (2 items), to set metacognitive goals (2 items), study time allocation and study environment (1 item), ability to provide study effort (1 item), and seek assistance (1 item) are the indicators of self-regulated learning (Zimmerman, 1989). There are three indicators used to measure self-efficacy, according to Bandura (1977), which are magnitude (4 items), generality (3 items), and strength (3 items). The study on **motivation** according to Duncan and McKeachie (2005) consists of five components: orientation destination intrinsic (2 items), orientation destination extrinsic (2 items), value task(2 items), control confidence learning (2 items), and anxiety (2 items). While for the **student achievement**, the research used the students' cognitive, affective, and psychomotor related to economies are studied.

The performance data study is collected at the end of the 2021-2022 school year's second semester. Three variables are declared valid with test results > 0.5. While the reliability test showed that the three variables were declared reliable with test results > 0.70. The all the items in the instrument had gone through valid and reliable and classical asumption test.

Data analysis

The data analysis technique was moderated regression analysis (MRA) to test the connections and causal relationships between the independent variables with dependent variables which might strengthen by the presence of a variable moderator. In this study, the variable moderator is type gender. In this study, the moderated regression analysis model serves as the analytical framework. The MRA test uses an analytical strategy to maintain the research sample while trying to control the influence of the moderating variable (Ghozali, 2018). Moderating variables, especially gender, are involved in the relationship between self-regulated learning, self-efficacy, and motivation.

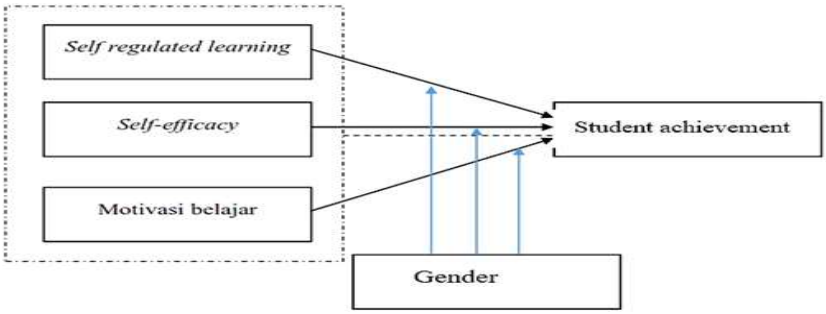

Figure 1. Conceptual Model

RESULTS AND DISCUSSION

Before testing the hypothesis, a classic assumption test was carried out, which included the multicollinearity test, heteroscedasticity test, and normality test. Based on the results of the multicollinearity test, it shows that the tolerance value is greater than 0.10 from the VIF value of 10, so there is no multicollinearity in this research. The heteroscedasticity test results show that the self-regulated learning variable has a sig value of 0.619 > 0.05.The self-efficacy variable has a sig value greater than 0.05.The learning motivation variable gets a sign value. 0.678 > 0.05. Thus, it can be concluded that the data of this study did not exhibit heteroscedasticity or homoscedasticity. The normality test shows that the asymptote Sig. The two-tailed analysis shows that 0.275 > 0.05.Based on these results, it can be concluded that the variables of self-regulated learning, self-efficacy, and learning motivation, as well as learning achiev variables, are normally distributed.

Self-regulated learning for high school students majoring in social sciences in Boyolali Regency can be presented as follows:

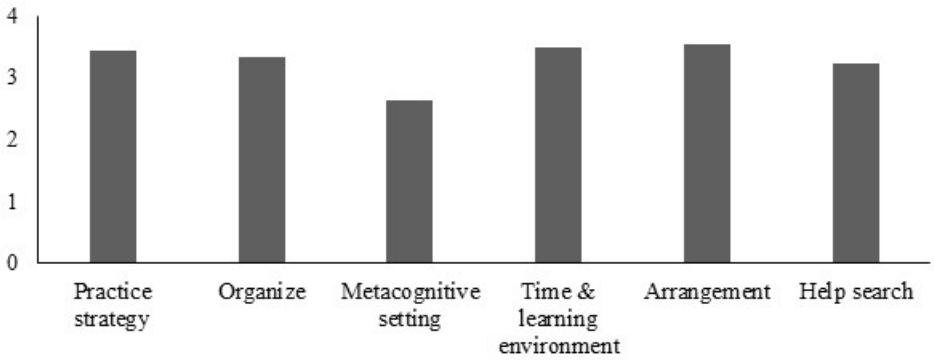

Figure 2. Data description of self-regulated learning

Based on Figure 2. high school students in Boyolali have high abilities in:managing academic assignments, class environment and dynamics, managing effort and time spent on assignments, arranging and building a fun learning environment, recognizing and applying cognitive strategies that can aid in the transformation of information, organizing, elaboration, and recovery, and being able to organize, direct, and plan thought processes. While the ability to control the desire to maintain focus and motivation when carrying out academic activities is included in the moderate category, Likewise, the ability to control emotions when carrying out academic activities is also included in the moderate category.

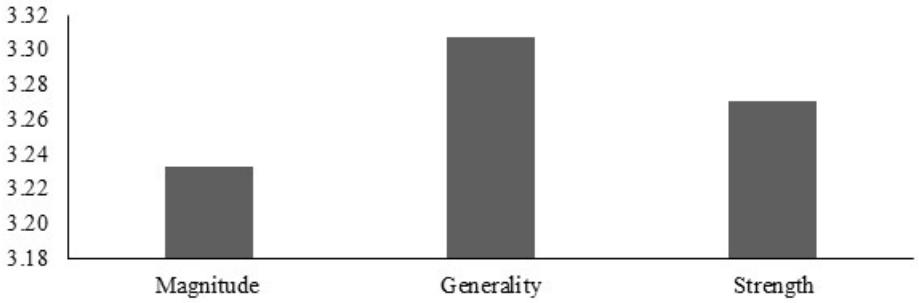

Figure 3. Data description of self-efficacy

Based on Figure 3, it shows that students have high confidence in achieving success. This can be seen from the three indicators of self-efficacy on the magnitude dimension: 1) Students have high confidence in their ability to take action; 2) students have confidence in their ability to take the necessary actions to achieve results, even when facing difficulties; and 3) students have a clear positive view of the task at hand. On the generality dimension, students have a positive attitude when responding to various situations and show confidence in the economics learning process. On the strength dimension, 1) students have a strong belief in their own potential in completing economic tasks, 2) they have enthusiasm for completing economic tasks, and 3) they have a high level of commitment to completing economic tasks well.

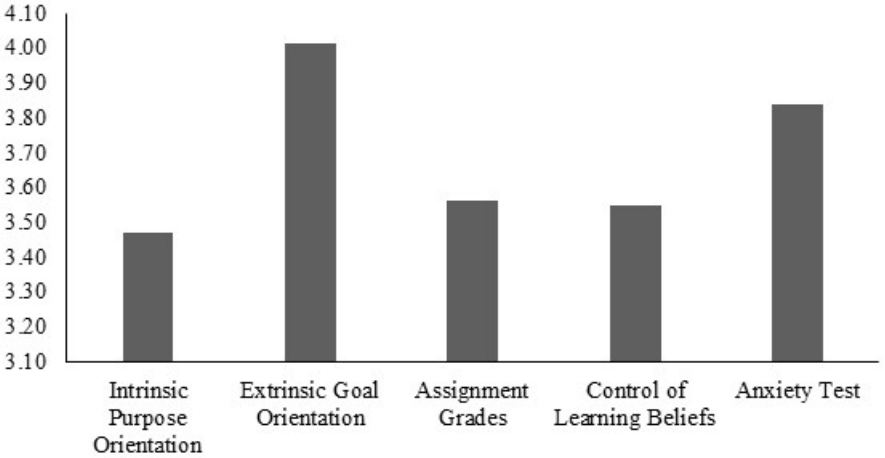

Figure 4. Data description of motivation

Based on Figure 4, this shows that students have high learning motivation. Students have a high intrinsic goal orientation, namely, an interest and enthusiasm for learning the material and a strong desire to achieve goals through learning. Students have a strong extrinsic orientation; they regard economics as a difficult subject that necessitates not only memorization but also a higher level of thinking ability.Students have the ambition to get the best grades in economics lessons. Students are able to control their individual beliefs and have high confidence when economics lessons take place. In addition, students feel able to control their feelings in order to get better grades in economics subjects.

Gender was tested using MRA to see if it could strengthen or weaken the variables of self-regulated learning, self-efficacy, and learning motivation on economic learning achievement. The results of the MRA test are presented in Table 1 below:

Table 2. MRA test results

	t	Sig.
Constant	297.33	.000
Gender	-4.529	.000
SRL x Gender	1.385	.167
Efficacy x Gender	1.929	.055
Motivation x Gender	2.122	.035

Based on Table 1 above, it shows that the gender variable obtained a result of 4,529, meaning that in this study, the number of female students was greater than the number of male students. The male category uses dummy one (1), and the female category uses dummy zero (0). This number is only a classification or grouping. Variable X_1.Z (Self-regulated learning * gender) displays the results of a t-count< t-table, 1.385< 1.656 with a significance value of 0.167 > 0.05, indicating that gender has no effect on economic learning achievement and does not moderate self-regulated learning. Based on the results of the study, it was found that there was no significant difference in self-regulated learning between male and female students. Both male and female students have and show the same characteristics of independent learning on the seven indicators of self-regulated learning, namely training strategy, development, organizing, metacognitive regulation, learning time and environment, business management, and seeking help. These findings support the research by Ruminta et al. (2018), which states that there is no significant difference in self-regulated learning between male and female students. Nurdian et al.'s (2020) research, which confirms that there is no difference in the impact of self-regulated learning on learning achievement between male and female students, supports the findings of this study.

The results of this study contradict the results of research by Bidjerano and Dai (2007), where the gender differences found may be a function of the stereotypical belief that women are expected to be conscientious, organized, and skilled in managing their learning environment. These stereotypes can be dispelled if those who believe in them can be controlled. Psychologically, there is no theory that men are smarter than women. The results of intelligence tests show that women also get the same scores as men (Pajares & Valiante, 1999).

According to Yukselturk and Bulut (2009), there is no statistically significant difference in learning achievement between

male and female students' learning independence.Individuals who have self-regulation and are good at learning will be able to employ various self-regulated learning strategies, especially cognitive and metacognition strategies, which will result in higher levels of academic achievement than individuals who cannot. The absence of a significant difference indicates that the level of self-regulated learning of male and female students is almost the same. Male and female students have the same responsibility, namely to themselves and their parents.

Male and female students have the same independent learning strategies. There is no significant difference between male and female students in the self-regulated learning of high school students in Boyolali because students have equal opportunities. Students who score low on the midterm assessment will receive additional lessons to improve their understanding of the material. Students have the ability to control themselves so that they continue to study on their own, even though they are not trained by the teacher. This habit will encourage students to always be ready to face the various lessons given by the teacher. For both boys and girls to succeed academically, self-learning is an important factor, which serves as the basis for understanding and realizing each student's level of self-learning. Self-regulated learning has a significant effect on academic achievement and inspires children to achieve the highest level of academic success for each student (Dent & Koenka, 2016).

This study found that X_2.Z (self-efficacy*gender) showed t-count > t-table results with a value of 1.929 > 1.656 and a significance value of 0.055 > 0.05. This explains that gender has an effect on self-efficacy but not on economic learning achievement. Thus, it can be concluded that gender is able to strengthen self-efficacy but is not significant for students' economic learning achievements. Female students have higher persistence than male students. Female students are slightly better at managing their learning strategies than male students. Female students are better able to take the time to study economics compared to male students. Students who believe in their own abilities are more likely to be motivated to study and work harder on challenging schoolwork. Female students show a higher level of self-efficacy than male students. Female students are better able to use various techniques and time management to study economics.

The results of this study are in line with the research of Suryono (2018), which states that there are differences in the self-efficacy of male and female students towards learning achievement. Adilla and Muzakki (2019) state that there is an influence between self-efficacy and gender on student learning outcomes. Hartono et al., (2019) explained that female students are better at doing assignments, paying attention to educators during learning, preparing for learning activities, and also having better relationships with educators. According to Alishah and Dolmaci (2013), female students are more active during the learning process. Research from Kenney-Benson et al. (2006) found that female students rarely engage in behaviors that disturb other students in class.

The findings of Research show that the variable X_3.Z (learning motivation*gender) showed t-count > t-table results with a value of 2.122 >1.656 and a significance value of 0.035 < 0.05. The gender moderation variable has a positive effect. It can be concluded that gender has a positive and significant influence on learning motivation and economic achievement. The learning motivation of female students is higher than that of male students. The existence of differences in behavior is one of the factors that supports female students' having higher learning motivation than male students. The

findings of this study are in line with the research of Saragi and Suryani (2018), which found that the learning motivation of male and female students was significantly different and had an impact on academic success. Ayu et al., (2018) stated the same thing: there are differences in learning outcomes between men and women that are influenced by learning motivation. Harso and Merdja (2019) state that one of the factors suspected of causing women's learning motivation to be higher than men's is an authentic assessment system that is comprehensive and objective. This assessment system helps students who were previously unable to understand the material be motivated to take part in learning. Willingness, need, desire, and a strong drive to participate and succeed in learning are the fuel for learning motivation. Students who are less enthusiastic about learning will not complete their learning assignments, therefore motivation is needed during the learning process. Female students always complete the homework given by the teacher before the deadline. More time is spent by male students outside the classroom than on the activities given to them.

■ CONCLUSIONS

Based on the findings of the preceding analysis, it is possible to conclude that type sex has no effect on self-regulated learning in study economy participants educated at a state high school in Boyolali. When compared to performance, economy, or participant education, type sex has a positive influence but has no significant effect on self-efficacy. For participants educated at a state high school in Boyolali, type sex has influenced positive and significant motivation studies for economic performance. The invention of Zimmerman and Martinez-Pons results in no difference in self-regulated learning between male and female students, according to research findings. Based on the findings of the study, this could be used as a reference in future research.

This study reveals that self-regulated learning, self-efficacy, and learning motivation have a positive and significant influence on achievement in studying economics online. In this study, gender has a negative effect on or weakens the effect of self-regulated learning on learning achievement. The results of this study can be used as input for teachers and prospective teachers in improving self-regulated learning, self-efficacy, and learning motivation. Efforts to improve self-regulated learning, self-efficacy, and learning motivation can be done by applying interesting learning methods so that students are enthusiastic and active during learning and can also take advantage of various facilities provided by schools to support learning activities.

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Classroom Language: Preparing the Pre-Service Teachers for Successful Classroom Interactions

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Abstract: Classroom Language: Preparing the Pre-Service Teachers for Successful Classroom Interactions. **Objective:** This study aims to investigate how pre-service teachers (PSTs) employ classroom language for Opening, Running, and Closing the Lesson in the classroom. **Methods:** A qualitative method was applied where the data were gathered through questionnaire sheets and an observation checklist. Thirty students in the second year of the English Education Study Program in Surabaya, Indonesia, participated in this study. **Findings:** The findings reveal that PSTs have applied classroom languages appropriately and successfully for eight components of basic teaching skills. Nevertheless, three components that do not vary are the language expressions attributed to opening the lesson for checking attendance, varying stimuli for setting and cleaning up teaching media, and organizing the small group discussion. **Conclusion:** The findings can be valuable input for the teacher of an education program to be more concerned with the teacher candidates' language variations to prepare them for successful classroom interactions.

Keywords: classroom language, pre-service teachers, classroom interactions.

Abstrak: Bahasa Kelas: Mempersiapkan Calon Guru untuk Keberhasilan Interaksi Kelas. ***Tujuan:*** *Penelitian ini bertujuan untuk menginvestigasi bagaimana mahasiswa calon guru menerapkan bahasa kelas (classroom language) untuk membuka, melaksanakan, dan menutup pembelajaran dalam kelas.* ***Metode:*** *Metode kualitatif diterapkan dimana data dikumpulkan melalui lembar kuesioner dan observasi kelas. Tiga puluh siswa di tahun kedua dari program studi pendidikan bahasa Inggris di Surabaya, Indonesia, berpartisipasi dalam penelitian ini.* ***Temuan:*** *Hasil penelitian menunjukkan bahwa partisipan telah menerapkan bahasa kelas dengan tepat dan sukses untuk enam komponen dari ketrampilan dasar mengajar. Namun, tiga komponen yang terkait ungkapan bahasa yang tidak partisipan variasikan meliputi membuka pelajaran untuk memeriksa kehadiran, mengatur dan membersihkan media pengajaran, dan mengorganisasikan diskusi kelompok kecil.* ***Kesimpulan:*** *Temuan ini dapat menjadi masukan yang berharga bagi program pendidikan guru untuk lebih memperhatikan variasi bahasa yang calon guru gunakan dalam menyiapkan mereka untuk kesuksesan berinteraksi dengan peserta didik di kelas.*

Kata kunci: *bahasa kelas, calon guru, interaksi kelas.*

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INTRODUCTION

Interaction is very pivotal for everyone. Through interaction, one can exchange ideas, thoughts, and opinions; share experiences; help and understand each other, and maintain good social relationships with others as well. Regarding its importance, a language medium is needed to interact with others. The use of language is varied based on the context. For instance, informal language is employed when someone interacts with peers or colleagues in an informal situation. On the contrary, formal language is applied when someone is interacting with other (older) people in formal situations, for example, during the teaching and learning process, in a formal meeting, and so on.

In dealing with the language used in the class, several essential things should be taken into account. One of them is that the use of classroom language and expressions should fit into the classroom activities done by both the teacher and students during the teaching and learning process.

Classroom language can be understood as the everyday language that teachers and students regularly use in the classroom. It consists of requests, questions, imperatives or statements of encouragement, praise, and others. For example, "Could someone clean the whiteboard?" "Who can tell the content of the first paragraph?" and others. Employing the appropriate classroom language during the teaching and learning process will make the students understand the teacher's meaning or message easily and clearly. In addition, effective two-way communication between the teacher and students will run successfully. Unfortunately, many teachers still need help applying classroom language appropriately and optimally. This fact is due to the influence of the use of the mother tongue during the lesson. Related to the use of the mother tongue in the learning process, Ellis (2008), Krashen (1982), and Yphantides (2009) consider the mother tongue as a hindrance in acquiring or learning the target language. Besides, the teacher's lack of classroom language variations also creates unsuccessful classroom interactions.

A number of studies on Classroom Language have been conducted (Bella & Zainil, 2020; Van Canh & Renandya, 2017; Hapsari Oka & Artini, 2022). Bella and Zainil (2020), for example, for example, analyzed three English teachers at SMPN 4 Muara Bungo in terms of their classroom language regarding the language input and their reflection on their classroom language. The findings revealed that teachers spoke six types of classroom language from the beginning until the end of the lesson. They were simple instruction, dealing with the language of spontaneous situations, the language of social interaction, pair-group work, question types, and dealing with errors. Among those six types of classroom language, question types are the dominant classroom language found in the teaching and learning process. While from the teachers' reflection on their classroom language, it was found that the average of the teachers' English classroom language use showed a low percentage, which is only 45,4%. It proves that teachers in this study needed to provide comprehensible input to the students. It is due to the students' and teachers' proficiency. Therefore, the teachers in this study need to improve their English proficiency so that they can use more English in the classroom.

Meanwhile, Van Canh and Renandya (2017) examined the correlation between teachers' English proficiency and classroom language use and showed that teachers' general proficiency significantly affects the way they use language in the classroom to promote learning. Another previous study conducted by Hapsari Oka and Artini (2022) analyzed how classroom language is used by one of the EFL teachers who teach English to eighth-graders of SMPN 2 Amlapura, Karangasem and why it is used. From the finding, it was found that the purposes of using

classroom language are to motivate the students to be more active during the teaching and learning process, instruct or organize the classroom, and guide the students in using English naturally.

From the previous studies, it is obvious that classroom language is essential to be learned and mastered, exclusively by the candidate teachers, since classroom language and its variations are needed to create successful classroom interactions between teacher and students. It deals with the variations of classroom language employed in the stages of learning activities, such as opening the lesson, running the lesson, and closing the lesson. Therefore, the researchers are interested in conducting this study in order to assist pre-service teachers in interacting or communicating with their students during the teaching and learning process. This research focus is then elaborated into three following research objectives: (1) How do pre-service teachers employ classroom language in the opening of the lesson stage; (2) How do pre-service teachers employ classroom language in the running of the lesson stage; and (3) How do pre-service teachers employ classroom language in closing the lesson stage.

Literature Review

Classroom language, in general, is defined as expressions used in interaction in the classroom between teachers and students (Leona et al., 2021), like giving requests, asking questions, praising, checking the understanding (Ellis, 2008), and instructing (Bilash, 2011). More specifically, Martriwati et al. (2018) define *classroom language* as the segments of discourse—sequences of a unit of language arranged to produce interaction for particular functions. It focuses on the function of units of language *language* as the segments of discourse—sequences of a unit of language arranged to produce interaction for particular functions. It focuses on the function of units of language larger than the sentence. From those definitions, it can be concluded that classroom language is the everyday language teachers and students regularly use. It consists of requests, questions, imperatives or statements of encouragement, praise, and others. For example, "Could someone clean the whiteboard?" "Who can tell the content of the first paragraph?", "Well done," "Excellent," and others.

As previously stated, classroom language is essential for both teachers and students. By employing the appropriate classroom language, students can fully catch the meaning of the language and relate it to real communication (Bella & Zainil, 2020; Hadiatmi et al., 2020). For instance, students will be familiar with phrases uttered by the teacher and later use those phrases in real communication. Besides, using suitable classroom language can motivate students to be more active during English lessons (Whitehead, 2021). In addition, classroom language can also enrich the students' new vocabulary (Habibi, 2017; Zarei & Afshar, 2014). Also, employing the appropriate classroom language enables the teacher to organize the classroom and to guide the students in using English naturally (Sujarwo, 2020; Wichadee, 2011; Widyahening, 2018).

For the implementation of classroom language, language variations are applied during the teaching and learning process, particularly during the implementation of the learning stages, such as in Opening the Lesson, Running the Lesson, and Closing the Lesson. Those learning stages have different activities. Opening the Lesson stage, for instance, consists of such activities as a greeting, praying, checking attendance, checking the physical conditions in the classroom, getting organized: blackboard, seating, and books, stimulating the students' motivation to learn something (brainstorming), apperception, and telling the students the learning objectives. Meanwhile, five teaching skills in running the lesson stage: the teacher explains

the learning materials, displays or sets visual or/and audio teaching media, clears up the teaching media, asks the students questions related to the learning materials, and varies the stimuli (e.g., singing a song, doing role play or playing language games), and organizes small group or class discussions. In closing the lesson stage, the teacher can do several activities like reviewing the learning materials or drawing conclusions on the material students have learned, doing reflection, setting or giving homework or announcement for the next meeting, praying, and leave-taking. Giving appraisal and reinforcement and checking and controlling the students' discipline can also be conducted during the learning process (Willis, 1981).

1. Opening the Lesson

The beginning of the lesson is a natural and motivating opportunity for the teacher to help her students to get used to listening to English. They can also learn to give simple replies in English. The first few minutes of most lessons follow the same pattern, meaning she can build up useful language routines and exchanges. Gradually she can introduce a new language to these same routines. If students can take part from the very beginning, it adds to their confidence and shows them that the language they are learning works. Moreover, it is a good idea to remind students that the phrases they hear and use at the beginning of the lesson are also helpful outside the classroom.

Some expressions of classroom language used in opening the lesson are: greeting (i.e., "Good morning," "how are you all today?"), checking the attendance (i.e., "Right! I am going to call the roll", "who is absent today?"), and stimulating the students' motivation to learn something, as in the example below:

Teacher : "Do you remember these pictures?"
Students : "Yes, Mam."
Teacher : "Look! We did this last lesson, didn't we?"
Students : "Yes, Mam,"

2. Organizing the Class

The classroom environment itself plays an important role in students' language learning. A positive classroom environment offers opportunities for students to use English and encourages them in their learning. Creating a positive environment includes two aspects: the material (for example, how the furniture is arranged, what is displayed on the wall) and the immaterial (the relationship between the students and the teacher and the atmosphere created by the teacher). Different environments can support different types of interaction and create different types of learning opportunities – from practicing set phrases to using language spontaneously.

Some expressions of classroom language used in organizing the class for checking the physical conditions in the classroom can be seen in the dialogue below;

Teacher : "It's rather hot in this room, isn't it?"
Students : "Yes, Sir."
Teacher : "Would you mind turning the fan on, please?"
Students : "No, not at all."
Teacher : "Thank you."

In getting organized: blackboard, seating, and books, the expressions used in the classroom are presented in the dialogue below;

Teacher : "Now. Please could someone clean the whiteboard?"
Students : "Me, Sir."
Teacher : "Thank you. Well, now turn your chair around; after that put all your

other books and papers away except your English book."
Students : "Alright, Sir."

Moreover, the classroom language used to control and discipline the class can be "quiet, please", "no more talking", and "quiet now".

3. Explaining the Lesson or Learning Materials

Lessons usually consist of a number of clearly marked stages. The short phrases that begin and end these stages are important because they structure the lesson and help students follow what is going on. Students get used to these phrases quickly because they occur in every lesson. Because there are several alternatives, they will also hear a variety of forms. In this way, their receptive vocabulary grows, and they are encouraged to guess the meaning of unknown words from the context. It is often a good idea to accompany a particular instruction with a distinct gesture, at least at the beginning. This way, the teacher helps her students remember the instruction and allows her to introduce alternative forms.

The following dialogue is an example of classroom language used in explaining the lesson or learning materials,

Teacher : "First, we're going to practice this. Then, I want you to learn a dialogue about ….. Next, I want you to practice asking questions about …. At the end of the lesson, if there's time, we'll do some games. Can you get the point?"
Students: "Yes, Mam".

4. Asking Questions

As one of the basic teaching skills, the teacher's questions can be delivered during or after explaining the learning materials. The goal of asking questions is to check the students' understanding of the materials being studied on that day. In asking questions, the teacher can use some of these expressions: Who can answer question number 1?; Who can tell the content of the first paragraph?; Whose turn is it?; What does the text talk about?; What is the main idea of this text?; and others.

5. Giving Reinforcement

The same as asking questions, giving reinforcement can be done during the learning process. It can be given in the beginning, whilst, or post activity. Reinforcement is given as a teacher's response (feedback) to students' answers. The goal of giving reinforcement is to give students support, praise, and encouragement. The teacher can reinforce students by saying these expressions: Well done!, Good, Very good, Excellent!, and others.

6. Varying Stimuli

Varying stimuli can be given before starting the lesson, in the middle of the lesson (as an ice breaker), or before closing/ending the lesson. This teaching skill aims to make the class fun and more enjoyable so that students will not get bored with the lesson. These stimuli can be conducted by applying language games, role play, or singing a song.

7. Organizing Small Group or Class Discussions

Small group discussion is usually conducted after the teacher has explained the learning material. It is only sometimes conducted in every meeting. The implementation of this small group or class discussion depends on the characteristic of the exercises done by the students. One thing that the teacher should remember is that when she applies this small group or class

discussion, she must be able to be a good facilitator. Here, she must be able to treat each group fairly and manage the process of discussion well..

The following dialogue is an example of classroom language used in organizing small groups or class discussions:

Teacher : "Now. I'll divide you into several groups. In groups of four. In your groups, you're going to write a short paragraph about ….."
Students : "Understood, Mam".

8. Closing/Ending the Lesson

Most lessons probably end in the same way: the teacher tries to draw things to a close, set any homework, possibly review the lesson, and perhaps make a few announcements. It is another situation where students can become familiar with a limited but recurring range of everyday phrases. Much of what is said at the end of the lesson is connected with what has happened in the previous forty minutes, so it has great personal relevance to the students, especially if the teacher can exchange a few words with individual students as they are leaving the classroom. This regular interaction helps them to develop their listening skills and also to build up their confidence. The teacher can use the end of the lesson to boost students' motivation and give them a positive sense that they have been active participants in the lesson and are making progress.

The following dialogue is an example of classroom language used in closing / ending the lesson:

Teacher : "Well, everyone. Finish the sentence you are writing, then put your pens down. It's time to clear up ….. Come on! Finish now. OK?"
Students : "Yes, Mam".

Moreover, the expressions used in setting homework in the classroom are presented in the dialogue below;

Teacher : "Well, students … at home do the exercise on page 9. Write it out neatly on paper and give it in tomorrow morning".
Students : "Yes, Mam".

■ METHODS

This paper applies a descriptive, interpretive qualitative method that describes how pre-service teachers employ the classroom language in the Opening the Lesson, Running the Lesson, and Closing the Lesson stages, including identifying the various languages PSTs use for classroom interactions.

The participants of the study are thirty pre-service teachers (PSTs) in the fourth semester. The data of the study are the result of a questionnaire and field observation. The instruments used are the questionnaire sheets that are used to describe what classroom languages the participants have got or learned from campus. Besides, classroom observation was conducted to identify how the participants employed the classroom language in the Opening the Lesson, Running the Lesson, and Closing the Lesson stages. In other words, the study investigations were attributed to how they varied the classroom language for classroom interactions and whether the language used was appropriate or not. Regarding teaching simulation, the participants worked in groups. There were six groups of five students each. Their job description is as follows:

To obtain the data, the researchers conducted some procedures: (1) distributing the questionnaire at the half of the semester before

Table 1. Job description for each students

Student	Basic Teaching Skills
1	Opening the lesson and organizing the class
2	Explaining the materials,
3	asking questions, and giving reinforcement
4	Varying stimuli
5	Organizing the small group discussion and closing

the participants conducted teaching practices; and (2) doing classroom observation by completing the observation checklist and recording the activities. After the data were obtained, the researchers then conducted the steps of analyzing and describing the data: (1) reading the results of the questionnaire and classroom observation; (2) analyzing the data by using the provided instruments; (3) discussing the result of analyzing the data; (4) drawing a conclusion; and (5) presenting the findings.

■ RESULTS AND DISCUSSION

Before conducting classroom observation, a questionnaire was distributed to get data about pre-service teachers (PSTs) learning classroom language before teaching practices. Henceforth, the classroom observation was conducted to get data on how PSTs employed the classroom language in opening the lesson, running the lesson, and closing the lesson stages.

The Classroom Language Employed in Opening the Lesson Stage

Even though the opening of the lesson stage activities run in a short time, it is completely significant. Allday and Pakurar (2007) assert that the first several minutes of a class period is crucial for completing a variety of administrative tasks, like taking attendance or collecting assignments. Moreover, Emmer, E., Evertson, C., and Worsham (2006) argue that it can be very challenging for teachers to achieve and maintain student on-task behavior. In other words, teachers will prepare students' conditions before learning the materials so they can learn well and achieve successful study sessions.

Considering classroom language employed in opening the lesson stage, the data obtained from the questionnaire presented that six participants in all groups have employed appropriate language expressions as proposed by Willis (1981), covering greetings, checking attendance, stimulating the students' motivation to learn something, and checking the physical conditions in the classroom. Moreover, they also informed that all kinds of language expressions regarding classroom instructions had been learned, including classroom language used for brainstorming and ice-breaking.

Considering the questionnaire data, they are consistent with classroom observation data that six participants in all groups employed the classroom language appropriately in the opening of the lesson stage. In greetings, for example, participants in groups 2 and 3 opened the class by saying, "*Hello, students, good morning*." Other participants in groups 1 and 5 greeted students by saying, "*Good morning, students*," and participants in groups 4 and 6 only said, "*Good afternoon*." Even most of them (participants in groups 1, 2, 4, and 6) greeted students and followed by asking students to pray exclusively when the class was in the first period. They used the same language, "*let's pray together*," and asked one of the students to lead. Then, almost all participants (participants in groups 1, 2, 3, 5, and 6) also asked about students' conditions. Participants in groups 1,2,

and 6 said, "*How are you?* While a participant in group 5 used the language of *How, do you feel today? Do you feel happy today?"* Moreover, the Participant in group 3 also made a short conversation with the students to know their condition as the following dialogue:

Teacher : "Do you feel good today?"
Students : "Yes, Mam."
Teacher : "Danny, you look handsome with your new hairstyle."
Danny : "Thank you, Mam."

The language expressions used in this stage can bring a positive atmosphere in the classroom because what the teacher says can be a stimulus indicating their attention to the students. Besides, the language used can reinforce students' appropriate behavior, as Allday and Pakurar (2007) explained that a simple pleasantry, merely greeting a student with his or her name, will increase student on-task behavior.

In checking the students' attendance, all participants in 6 groups have conducted the activity well. Nevertheless, three participants in groups 2,3, and 5 used the same language expressions: "*Let me check your attendance*,"; and Participants in groups 1 and 4 said, "*Who is absent today?*" Even a Participant in group 6 used inappropriate language by saying, "*I will absent you now* ."No one used the language variation like "*I am going to call the roll*" or "*I will take the register*" for this activity. Although it did not significantly impact the learning objectives, they still have to enrich their language attributed not only to taking attendance but also other language variations since teachers' classroom language is one of the primary sources for the students to get English input (Bella & Zainil, 2020).

All participants in six groups have used classroom language appropriately for telling the learning objectives before entering the main activities or whilst activities and organizing the class. For telling the learning objectives, two participants in groups 1 and 4 applied the language expressions, such as; *"We will discuss about....."* while Participant 3 said, "*Well, student, what you will learn today is about....."* Participants in groups 2 and 5 used the language "Today, our material is ….." another Participant in group 6 said, "*The text that we will discuss is ....*"

Furthermore, the participants also practiced the classroom language appropriately for organizing the class, like the language expression used by Participant in group 1: "*Now, if you found any rubbish below your desk, pick it up and put it in the bin*." Similarly, a Participant in group 5 said, *"It is quite messy. Tidy up and put the rubbish into the bin*." Other Participants in groups 2 and 6 applied the language "*It is hot. Turn the fan on, please!*" (group 2) and "*The class is hot. Could you open all windows, please?*" (group 6). Furthermore, participants in groups 3 and 4 emphasized the room lighting by saying, "*The room is dark, and we need to switch on the lamp. Please help me to switch on the lamp*" (group 3), while a participant in group 4 said, "*Could you please open the window so that the sunlight can enter our class*."

Likewise, in getting organized: the blackboard, seating, and books, all participants in six groups applied various languages to give instructions. A participant in group 1 said, "*Would you please clean the whiteboard?*" Two Participants in groups 2 and 5 only said, "*Clean the board, please!*" Meanwhile, a Participant in group 3 applied the language: "*Now, prepare your English book, book note, and pen*"; and Participants in groups 4 and 6 said, "*Please, tidy up your seat and open your book page ...."*

Before the lesson began, three participants from groups 1, 2, and 5 established

rules to control and discipline the students' behavior in learning. In other words, students need to know the expected behavior from them during the lesson for their misbehavior can be avoided and an effective learning environment can be achieved (Paramita et al., 2020; Woodcock & Reupert, 2013; de Jong et al., 2013; Clunies-Ross et al., 2008). Paramita et al. (2020), for example, emphasized that classroom rules can anticipate or avoid students' misbehavior in the teaching and learning process in the classroom. The language expressions used by a participant in goup 1 in establishing classroom rules were "*Before we start the lesson today, I have some rules in this class."* Other Participants expressed, *"These are rules for our today's class"* (group 2) and *"Still remember our agreement about rules during the classroom activities?"* (group 5)

Moreover, what language the participants used to stimulate the students' motivation to learn something is crucial. The language like "*Do you still remember what we have learned at the last meeting?*" used by three participants in groups 2,4 and 5 will be able to activate students' prior knowledge. Then, the students can be better prepared for the materials that they will learn. Sharafi-Nejad et al. (2016) assert that when students' prior knowledge is activated, they become conscious of what they know about the topic before learning it. Meanwhile, a participant in group 1 involved students in a game stimulating their motivation. She said, "*To move up your mood, I have a game for you. It is called a flash card game*." Similarly, two Participants in groups 3 and 6 engaged students to move their bodies for a while to do ice-breaking by saying, "*To make us fresh, let's move our body. Follow my instructions"* and *"Students, stand up, please! Follow my instructions*!"

The Classroom Language Employed in Running the Lesson Stage

Based on the results of a questionnaire, six participants from all groups informed that they had learned the classroom language used in running the lesson stage. They used classroom language to explain the lesson or learning materials, asking questions, giving reinforcement, varying stimuli, and organizing small group or class discussions. In addition, they also admitted that they have sufficient knowledge or skills in employing the classroom language in running the lesson stage.

The data obtained from classroom observation revealed that six participants from all groups have applied the classroom language appropriately to explain the lesson or learning materials and give appraisal and reinforcement for the students' efforts. The classroom language they applied was what Participant 1 expressed; "*Today we are about to learn…. What is …? Please get familiar with …. I will ask you some questions regarding*…." Three other participants in groups 2, 5, and 6 emphasized the students' understanding of the materials by saying, "*Is that clear? What part is not clear yet?"* (group 2), "*I have explained the lesson. Is there a question?*" (group 5), and "*First, you are going to learn about …Do you get the point?*" (group 6). The other two participants in groups 3 and 4 used language like "*I will explain the material. Listen to me carefully. If you have a question, you can raise your hand*."

Similarly, in asking questions, six participants for all groups have used a number of language expressions, like "*Here comes my first question, what is...?"* (group 1) and "*I will give you three minutes to answer the questions. Who wants to answer number 1?* (group 2) *"Please tell us the answer to number 1! What about number 2, 3, ...?*" (group 5), "*Do you agree with the answer? Any other opinions?*"

(groups 3, 4, and 6).

Then, they say, "*Well done, good, great (participants in groups 1, 3, and 4),* "*good, very good, excellent, perfect*" (participants in groups 2, 5, and 6) to give appraisal and reinforcement. All the language variations used by the participants are easily understood by students in the learning process. Henceforth, these language expressions can guide students to learn the materials and use the language naturally (Hapsari Oka & Artini, 2022).

In varying stimuli for applying language games, role play, or singing a song, six participants in all groups have successfully applied the languages for these activities. The classroom language participants in groups 1, 4, and 6 used was: "*We will play a game, but before that, please listen to my instructions carefully. Is it clear? Let's start!"* Likewise, Participants in groups 2, 3, and 5 said, "*You are going to play a game. Count one to..., then the one who gets the same number will be one group*."

Meanwhile, only two participants from two groups (groups 3 and 6) used the language in the activities of displaying or setting visual or/and audio teaching media and clearing up the teaching media. They only used the language for distributing/setting the visual media, like "*Can you pass….*(cards, pictures, papers, and others)?" No language for displaying/setting visual media, like "*Can you see the picture? Is it clear enough?*" or/and audio teaching media is applied. Likewise, no participants in all groups employed the classroom language to clear up the teaching media, although almost all used media in the practices. For this, even when technology is integrated into pedagogy, it is a challenge for PSTs to have competencies in using a variety of classroom languages, not only dealing with displaying or setting and clearing up the teaching tools but also operating them.

Then, in organizing the small group or class discussion, six participants in all groups have applied the classroom language appropriately, like what the Participant in group 1 said, "*You are going to work in pairs, with a friend next to you. Can be on the left or right hand*." Similarly, two participants said, "*Work in pairs. Look for a partner. If you do not have a partner, you can join with friends behind or in front of you.*" (groups 2 and 6). Furthermore, other participants applied a language, like "*I will divide you into…..groups. One group consists of five to six students*" (Participant in group 3) and "*We are going to work in groups. Make a group consists of …. In your groups, you are going to write….*" (participants in group 4 and 5). Unfortunately, no participants employed the language for choosing a leader for groups. They need to vary the language for pointing the leader of group work since a group leader can encourage greater participation and more responses from the group members (Greig, 2000). Then, the classroom languages, like "*Choose a leader for your group!" "Who is the leader of your group?*" is necessary to employ.

The Classroom Language Employed in Closing the Lesson Stage

Concerning the questionnaire results, all participants explained that they had learned the classroom language for giving homework, drawing a conclusion on the material students learned, reflecting, and leaving-taking. Further, they said their skill or knowledge of the classroom language in closing the lesson stage is sufficient.

Based on the classroom observation, six participants in all groups have applied various languages to give homework and leave-taking. Participant in group 1 expressed, "*Thank you, students. You are great today. For homework, please do … See you*". Likewise, two Participants said, "*This is the end of our class. Your homework is exercise…..Do it in*

pairs! (group 2) "*Do it in a group of ....*" (group 4) *See you, class*". The other three participants used the language: "*Thank you, students. You have done well today. For homework, I want you to do .... See you* (groups 3, 5, 6) *Wassalamu'alaikum*" (group 6).

In drawing a conclusion on the materials and reflection, the classroom language applied by six participants in all groups is varied enough. For example, participants in groups 1, 5, and 6 applied a language like "*Ok/Well, students, what have you learned today?*" Other language expressions used by participants 2 and 4 were "*Before we end it, let us review it once again. So, what have we learned today?*" Moreover, a Participant in group 3 said, *"What can we conclude for our materials today? Do you get difficulties in learning the materials?"* All the language expressions applied by the participants are significant because students will be more aware of their learning. In other words, students will know what they have learned and understood through the teacher's reflection questions (Richards & Lockhart, 2007).

■ CONCLUSIONS

As a future teacher, the pre-service teacher needs to be concerned and learn classroom language since the language used in the classroom can achieve successful interactions between teachers and students. Henceforth, positive classroom interaction can establish a good learning environment.

In teaching practicum for EFL context, PSTs basically have been able to select and employ a variety of classroom languages dealing with opening, running, and closing the lesson stage. Nevertheless, the PSTs still need to improve their competence in employing the language variations attributed to opening the lesson for checking attendance, varying stimuli for displaying or setting visual or/and audio teaching media and clearing up the teaching media, and organizing the small group discussion. Thus, it must be badly considered by the teacher of the education program to prepare the candidate teachers better to achieve successful classroom interactions.

From all interpretations in this study, three limitations should be considered: first, the classroom observations might be limited since the participants conducted teaching practicum in groups, and each group was observed only once, lasting 20-25 minutes. Besides, the number of participants might also limit the results.

Hence, repeated observations and more participants could provide more reliable information for the study. Eventually, the specific research site where PSTs conducted teaching practicum in class or on-campus might be a factor interfering with the research findings. Therefore, conducting a similar study in various setting contexts may yield more fruitful information about PSTs' competencies in using a variety of classroom languages. Then, the teacher education program will also get more information to prepare PSTs for real teaching practicum in schools.

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Promoting the Pancasila Students' Profiles through Mathematics Education in Schools: Ethnomathematics Roles

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Abstract: Promoting the Pancasila Students' Profiles through Mathematics Education in Schools: Ethnomathematics Roles. The present mathematics curriculum in Indonesia (IND) places a strong emphasis on the creation of a Pancasila student profile in order to ensure that pupils are learning mathematics in a meaningful way. **Objective:** This paper suggests an integration of ethnomathematics into the formal mathematics curriculum as one approach to dealing with these learning issues. It is based on a literature assessment of studies on ethnomathematics, mathematics education, and Pancasila student profile. **Methods:** The literature review method used with a narrative review design. A total of 28 articles were selected for publication at the final stage of the review process. **Findings:** In light of the preceding explanation, it is clear that ethnomathematics plays a part in the formal school mathematics curriculum since the context-relevant and constraint-filled problem-solving techniques give many abstract mathematical notions the required contextual meaning.

Keywords: ethnomathematics, mathematics education, pancasila student profiles.

Abstrak: Mendorong Profil Siswa Pancasila melalui Pendidikan Pendidikan Matematika di Sekolah: Peran-Peran Etnomatematika. *Kurikulum matematika di Indonesia saat ini memberikan penekanan yang kuat pada penciptaan Profil Pelajar Pancasila untuk memastikan bahwa siswa belajar matematika dengan cara yang bermakna.* ***Tujuan:*** *Artikel ini menawarkan integrasi ethnomathematics ke dalam kurikulum matematika formal sebagai salah satu pendekatan untuk menangani masalah pembelajaran. Hal ini didasarkan pada kajian literatur studi tentang ethnomathematics dalam pendidikan matematika, dan Profil Pelajar Pancasila.* ***Metode:*** *Metode kajian literatur digunakan dengan desain kajian naratif. Sebanyak 28 artikel dipilih untuk diterbitkan pada tahap akhir proses peninjauan.* ***Temuan:*** *Berdasarkan temuan dan penjelasan, maka jelas bahwa ethnomathematics dapat berperan dalam kurikulum matematika sekolah formal karena teknik pemecahan masalah yang relevan dengan konteks dan permasalahan memberikan banyak gagasan matematika abstrak berdasarkan makna kontekstual.*

Kata kunci: *ethnomathematics, pendidikan matematika, profil pelajar pancasila.*

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INTRODUCTION

The globalization-era process of modernizing the country's lifestyle has significantly contributed to the decline of Indonesian culture's high ideals (Hidayat & Pandin, 2021). It occurs due to a lack of understanding and implementing cultural values in the community. Every person needs to be imbued with the fundamental values of the country (Emilia, Andini, & Asbari, 2022). So that each person can better understand, interpret, enjoy, and grasp the value of carrying out every life activity, it needs to be imparted from an early age. Cultural values can be fostered through the family unit, the educational system, and the community (Agus, Cahyanti, Widodo, Yulia, & Rochmiyati, 2020).

The ease of access to a variety of knowledge that has no time or space limits, but is misused, is one of the reasons why cultural values are eroding among today's kids (Supiarza, Rachmawanti, & Gunawan, 2020). Technology use expertise is frequently abused, making complexity into a sharp, two-edged tool that, in addition to being functional, is frequently utilized to produce losses through losses-causing harm. Technology indirectly affects schooling, as untested media and information may be perceived as role models to be adopted and used (Skare & Soriano, 2021). Despite the reality that technology cannot replace the teacher's position as a learning resource for pupils (Jain, Lall, & Singh, 2021), it appears that technology has taken its place. No matter how advanced technology becomes, it will never have a soul. The teacher is a role model who supports students' cognitive and moral maturity growth (Ahn, Hu, & Vega, 2020). While it can aid instructors in the teaching process, technology in education can never fully replace them. Despite the fact that this phenomenon has been investigated, it is still worthwhile to conduct additional research regarding it, which ties to how culture changes as technology advances, mainly the function of information and communication technology as a platform for a wide range of activities and knowledge sources.

People appear to be pampered by the ease of information and communication technology has made all of their demands accessible. The majority of today's user society has started to leave interpersonal communication patterns and become less and less willing to use manual tools for effectiveness and efficiency reasons (Pouri & Hilty, 2021). It gets harder and harder to stay sophisticated in society. People will become increasingly dependent due to this for a very long period. Long-lasting things bring about cultural changes in society (Peregrine, 2022). For instance, using social networking or friendship on the internet is frequently regarded as a barometer for one's existence.

Both the constructive and destructive sides of change are inherent. It is impossible to avoid changes in systems and standards. When technology is employed ethically, professionally, and with integrity, constructive change occurs. Because of this disturbance, the government has responded with various regulations, including ones for education. According to the Indonesian Ministry of Education and Culture's strategic plan for 2020–2024, Pancasila Students (PP) will help the president realize his goal of becoming independent, sovereign, and unique education and country (Zakso, Agung, Sofyatiningrum, & Capnary, 2022). Students are expected to think critically, creatively, and independently, have confidence in God Almighty, fear Him, have a noble character, cooperate, and be culturally diverse.

Additionally, it takes on the persona of a lifelong learner who embodies Pancasila's values and is globally competent. Faith, the awe of God Almighty and noble character, cooperation, independence, critical thinking, and creativity make up the six main traits (Nurhayati, Jamaris,

& Sufyarma Marsidin, 2022). The development of Profile of PP must function at its best for students to be involved in all aspects of learning, including studying math.

A formal procedure with normative and dogmatic rules that are disconnected from the socio-cultural realities of society is frequently used to study mathematics (Zhang et al., 2020). In the meantime, the display and debate processes in mathematics learning did not appear or grow. Only the teacher-to-student transmission of knowledge constitutes mathematics learning. Without critically assessing what they have learned, students merely take mathematical knowledge as given. As a result of pupils' inability to comprehend mathematics, learning it feels pointless (Prahmana & Ambrosio, 2020). As a result, they cannot apply their knowledge of mathematics to real-world issues.

A significant challenge in understanding mathematics is the transformation of cognitive abilities from concrete to abstract items or the opposite (Venenciano, Yagi, & Zenigami, 2021). Therefore, it is essential to increase the significance of mathematics in daily life. The pressing necessity to advance mathematics' position demonstrates that it is a crucial piece of the knowledge base required for educational growth. The growth of mathematics is a component of the scientific foundation of knowledge and is inextricably linked to cultural shifts (Liu, He, & Dai, 2021). According to another viewpoint, the knowledge of a culture that expands and develops to link human needs makes mathematics what it is.

The review of human development, especially in the fields of science, shows that mathematics is related to many human efforts to acquire knowledge (Krumrei-Mancuso, Haggard, LaBouff, & Rowatt, 2020). Meanwhile, the value of mathematics related to the nature of mathematics is derived from how mathematicians from different cultures develop mathematics. These two views lead to the conclusion that mathematics and culture are inseparable parts. The coherence between cultural anthropology, mathematics, and mathematical modeling is referred to as ethnomathematics.

A nation will be great if cultural values are ingrained in the bones of human existence (Banks & O'Connor, 2021). Hence culture has a fundamental and necessary role as the foundation of the life of the nation and state. Since the reformation up till the present, Indonesian culture has faced numerous significant difficulties, particularly for the younger generation, who have struggled to understand the local culture. The majority of them are not very interested in regional culture. Therefore, it is important to keep expressing cultural discourse, particularly about high ideals. One way to do this is to uphold, advance, and expand the archipelago's cultural values while internalizing them through academic study.

This study seeks to draw attention to the fact that everyone working in the education services industry needs to deal with this issue head-on since doing otherwise could result in several adverse outcomes. This study makes the point that math teachers' classroom techniques significantly impact students' capacity to learn mathematics and student character development, despite the fact that many other elements could have led to math learning becoming meaningless.

The success of the educational reform in Indonesia depends on changing the culture of mathematics instruction, which this article suggests should happen in light of the ongoing educational reform in Indonesia. Masingila (1993) identifies three areas of mathematics education that need attention in light of the study on carpet layers and other studies that look at how math is used in real-world contexts. These

include the following: (1) the mathematics education research, (2) the methods used to teach mathematics in schools, and (3) the curriculum for math classes. This essay seeks to offer some ideas for thought under the following sub-headings while covering the last two themes.

1. Defining the role of ethnomathematics in mathematics education.
2. A Promising Direction related to the Ethnomathematics: Trivium Curriculum
3. The Role of Mathematics Education in the Development of Profiles of PP

METHODS

This study uses the literature review method with a narrative review design. The narrative review summarizes studies on a subject of concern previously published, concentrating on concepts and hypotheses, methods of study, or findings of the research (Paré, Trudel, Jaana, & Kitsiou, 2015). The most significant elements of the research are the compilation and synthesis of existing literature and a full report on recent expertise in the field under study. The narrative examination also serves as a suitable starting point for potential research and development and allows researchers to define and refine questions or theories in research. The source of this research data is in the form of secondary documents obtained from relevant scientific journals.

Conducting the Review

Two categories of keywords were used separately to search for relevant literature sources using keywords: (1) ("Pancasila Student Profile" AND "Mathematics Education") in Google Scholar; and (2) ("Ethnomathematics" AND "Mathematics Education" OR "Mathematics Learning" OR "Mathematics Teaching") in Scopus and ERIC databases.

The first keyword resulted in 155 titles appearing. The manual screening was carried throughout titles and abstracts relevant to the study and excluded data sourced from proceedings and non-accredited journals Sinta 1 – Sinta 4. For the second keyword, the search referred to the Preferred Reporting Items for Systematic Review standard and Meta-Analyses (PRISMA) to offer a comprehensive picture of the justification of the ethnomathematics approach in learning mathematics. The elements of the PRISMA standard include identification, screening, eligibility, and inclusion.

The first step is identification, that is, searching for articles with the keywords "Ethnomathematics" AND "Mathematics Education" OR "Mathematics Learning" OR "Mathematics Teaching" in the Scopus and Eric database. It was recorded that 208 articles appeared in the Scopus (n=145) and Eric (n=63) databases.

The second step was screening, which consisted of (1) manual screening (title and abstract); 203 papers were identified as meeting the research criteria, while five articles were identified as duplicates; (2) applying the inclusion criteria and leaving 35 articles. We established exclusion criteria for various document categories: conference proceedings, books, book reviews, magazines, short surveys, short communications, correspondences, newsletters, discussions, product reviews, editorials, publisher's notes, and erratum.

In the third step, eligibility, 11 articles were rejected at this step because they needed to fully explain ethnomathematics in mathematics education or clearly explain and review the finding data in the research findings section.

In the Inclusion step, only articles that match the following inclusion requirements were selected: (1) Discussing ethnomathematics in learning mathematics; (2) Registered in Scopus or ERIC databases (for indexing and citation quality); (3) Written in English. As a result, 24

articles were selected for publication at the final stage of the review process.

■ RESULTS AND DISCUSSION

Defining The Role of Ethnomathematics in Mathematics Education

Some research (e.g. Harding, 2021; Nur et al., 2020; Pathuddin & Nawawi, 2021; Prahmana & Istiandaru, 2021; Supiyati et al., 2019) has demonstrated substantial differences between the kinds of mathematical practices people in various cultures engage in daily and those taught in schools. Particularly Masingila (1993) emphasizes how knowledge of mathematics "gained in our out-of-school situations often develops out of activities which: (1) occur in a familiar setting, (2) are dilemma driven, (3) are goal-directed, (4) use the learner's natural language, and (5) often occur in an apprenticeship situation allowing for observation of the skill and thinking involved in expert performance." This is not how mathematics is taught in schools.

The term "ethnomathematics" refers to the study of mathematical concepts, strategies, and procedures used and generated by members of various cultural groups or sociocultural individuals (D'Ambrosio, 2016). Lexically, the *ethno* prefix, *tics* suffix, and *mathema* as the main subject are employed to create the meaning of ethnomathematics (Umbara, Wahyudin, & Prabawanto, 2021). The *ethno* prefix is a very general term that refers to the sociocultural context (including language, jargon, code, behavior, myths, and symbols), identification of cultural groups, and specific ways of reasoning and certain inferences. It is made up of elements from nature, society, culture, and imagined environments. The core concept of ethnomathematics is mathematical objects. Lexemes frequently have definitions like "explaining," "knowing," "understanding," and "doing tasks" (such as coding, classification, measurement, planning, inference and modeling). In the same way art, fashion, style, and technique have technical roots, so do suffix *tics* (D'Ambrosio, 2018).

Suppose the definition of ethnomathematics includes both the cultural or everyday practices of mathematics of a particular cultural group and a program that examines the generation, transmission, institutionalization, and diffusion of knowledge with a focus on the sociocultural environment. In that case, ethnomathematics has a place in the context of the teaching and learning process in the formal classroom (Machaba & Dhlamini, 2021). This is so that the teaching of the related but abstract concepts found in school mathematics can be connected to the everyday cultural practices of mathematics (Supiyati et al., 2019). Ethnomathematics is both context-relevant and problem-specific, and as a result, it provides the required connectivity between these two. Additionally, it can help students understand the significance of the links between ethnomathematics and school mathematics and give many of the abstract mathematical concepts they are taught in class a meaningful context, thereby validating the importance of school mathematics (Sunzuma & Maharaj, 2020).

Researchers are interested in exploring mathematical concepts that are used by numerous social groups, which has piqued their interest in the research genre of ethnomathematics in mathematics and mathematics education (Arisetyawan, Suryadi, Herman, & Rahmat, 2014; Hendriyanto, Kusmayadi, & Fitriana, 2021; Orey & Rosa, 2021; Prahmana & Ambrosio, 2020; Prahmana, Yunianto, Rosa, & Orey, 2021; Suharta, Sudiarta, & Astawa, 2017; Supriadi, 2019). As the founder of ethnomathematics, D'Ambrosio (2016) demonstrated that one important justification for teaching mathematics on an

ethnomathematics basis is the idea that mathematics is a manifestation of the evolution of culture and human thought. Building on the ethnomathematical knowledge that students bring to class from their everyday experiences, making appropriate connections between this and school mathematics, and elucidating the conceptual meanings associated with abstract school mathematical ideas are all tasks that the classroom teacher must complete. The ethnomathematical information that students have acquired from real-world experiences—knowledge they have also come to feel ownership over—will be formalized through such a teaching strategy.

For instance, Figure 1 depicts an illustration of an ethnomathematics activity at IND that can be utilized to clarify the geometric idea of "Riemann's triangle theorem" (Kholid, Fitriana, Adnan, Hendriyanto, & Sahara, 2022).

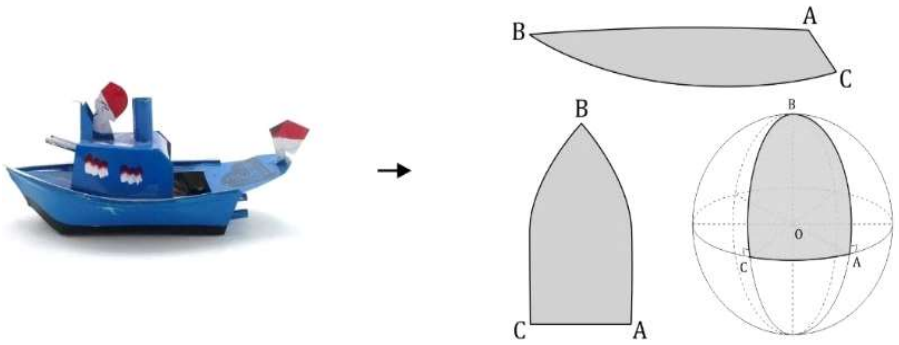

Figure 1. *Perahu othok-othok* and its illustration in the Riemann triangle

The illustration of *perahu othok-othok* in Figure 1 above can explain the Riemann triangle theorem "the sum of the angles of a triangle is higher than 180^o". Figure 1 above shows $\angle A = 90^o$ if the segment BC = polar distance. Identified information: $\angle A = 90^o$, $\angle C = 90^o$, $\angle B$ positive. Hence, $\angle A + \angle B + \angle C = 90^o + \angle B + 90^o > 180^o$. It is one of the many well-known examples that may be used to teach various formal geometrical principles in school mathematics and further explored for its deeper mathematical insights frequently sought in academic mathematics. In the context of mathematics training in schools, however, it makes the study of mathematics more interesting and pertinent by giving the students even more reasons to learn mathematics. Thus, it becomes imperative to incorporate ethnomathematics into the teaching of mathematics.

A Promising Direction related to the Ethnomathematics: Trivium Curriculum

The trivium curriculum for mathematics proposed by D'Ambrosio (1999) is an important innovative ethnomathematics approach that needs more investigation in order to address pedagogical purposes. Since ethnomathematics proposes that educators contextualize their mathematics teaching and learning by linking mathematics content to students' sociocultural experiences, integrating culturally relevant pedagogy and diverse ethnomathematics perspectives into existing teacher education programs became necessary.

The four goals of mathematics education, the goal relevant to ethnomathematics is the cultural goal. The purpose of culture in education is a form and product of culture. Mathematics education needs to place mathematics as a result of human culture and

simultaneously as a process to develop a culture (Planas, 2018). In connection with the cultural goals of mathematics education, mathematics education can be used as a tool for forming in and for life (Presmeg, 1998). We can use mathematics to understand and solve problems that are found and faced in everyday life.

One of the first requirements for the current mathematics curriculum is that it be flexible enough (Tirosh & Tsamir, 2020; Trouche, 2020) to accommodate the ethnomathematical knowledge gained from everyday practices of mathematics that students bring into the mathematics classroom to accommodate the potential role of ethnomathematics in the teaching of school mathematics. D'Ambrosio (1999) once developed a trivium curriculum, which consists of literacy, *matheracy*, and technocracy, allowing it to be developed in school activities.

Literacy is the ability of students to process, write, represent, calculate, and use various media and the internet. From a mathematical perspective, literacy is defined as the integration between the cultural context in the school and the cultural context in society through cultural dynamics that allows students to exchange academic knowledge and local knowledge. From the modeling perspective, educators must guide students to choose topics through dialogue and discussion that allow students to engage in mathematical exploration and creativity.

Matheracy is the ability of students to interpret and analyze signs and codes to propose a model to find solutions to everyday problems. This can help students develop creativity and analytical skills to understand and solve new problems and situations. From ethnomathematics perspective, *matheracy* is defined as a field of skills, strategies and competencies that trigger students to be aware of their way of explaining traditional beliefs, myths, symbols, scientific knowledge and mathematical knowledge. From a modeling perspective, *matheracy* is defined as the ability to interpret, manipulate, and recognize signs, symbols, and codes and use mathematical models in everyday life.

Technocracy is the ability of students to use and combine various technological instruments that help students in daily activities to assess the reasonableness of their results and contextualization. Technocracy is an important feature of scientific knowledge to translate matters related to the natural, social, cultural, political, and economic environment. The natural and social environment consists of various modes of explanation, belief, tradition, myth, and symbol in the development of mathematical knowledge. So, the perspective of modeling, technocracy is the combination and use of various tools, including calculators, computers, computational software programs and simulators.

The trivium curriculum critically provides education with the communicative, analytical, and technological instruments needed to develop education in the 21st century. Incorporating the three trivia in the classroom will imply a conceptualization in which ethnomathematics and mathematical modeling are tools for pedagogical action. In its development, this curriculum was adopted by several countries that developed ethnomathematics and studied further. Furthermore, it will facilitate the incorporation of diverse modes of explanation, belief, tradition, myth, and symbols in the development of mathematical knowledge. In the modeling process, technocracy is the incorporation and use of diverse tools that

include calculators, computers, software, computational programs, and simulators.

The Role of Mathematics Education in the Development of Profiles of PP

In improving the quality of education in Indonesia, the formal school curriculum has changed more than ten times since it was first created (Setiawan, 2020). The discourse of the latest curriculum, the "Merdeka Curriculum," which will be implemented nationally by all schools in Indonesia in 2024, has launched the profile of Pancasila students (PP). PP embodies Indonesian students as lifelong students who have global competence and act by the values of Pancasila (Hidayah, Suyitno, & Ali, 2021). Strengthening the profile of PP is a cross-disciplinary project from various subjects in the education unit. This project is carried out by adjusting the community's needs or problems in the school environment. Profile of PP has six key values: noble morals, global diversity, cooperation, independence, critical reasoning, creative (Fadillah, Wiwit, & Aisyah, 2022) and there are seven general themes in PP strengthening projects (Armania, Alfitri, & Dahlan, 2022). Ethnomathematics can facilitate five of the seven project themes: sustainable lifestyle, local wisdom, diversity in diversity, engineering and technology to build the Unitary State of the Republic of Indonesia (NKRI), and entrepreneurship.

The first is the sustainable lifestyle. This theme is intended to understand the impact of human activities, short and long-term, on the continuity of life in the world and the surrounding environment. The emphasis here is on building awareness to act and behave environmentally friendly and finding solutions to environmental problems. One of the forms of the culture studied in ethnomathematics is the activities of various cultural backgrounds, including the activities of "farmers." A study by Umbara et al., (2021) revealed that the Cigugur indigenous people in Kuningan Regency could predict what days were considered suitable for starting farming activities. This activity can be used to teach mathematics, such as the concept of numbers, sets, relations, congruence, modulo, and mathematical modeling.

The second is local wisdom. Indonesia is hit by the crisis of self-identity caused by the fading culture and local wisdom of the community. This theme was chosen to build curiosity and inquiry abilities by exploring the culture and local wisdom of the local community or area and its development. It is relevant to use ethnomathematics as a learning approach in mathematics lessons. In addition to teaching mathematical concepts, ethnomathematics also plays a role in introducing culture to students. Applying ethnomathematics as a pedagogical action in learning mathematics restores a sense of fun or involvement and can increase creativity in doing mathematics (D'Ambrósio, 2005; Prahmana & D'Ambrosio, 2020; Risdiyanti & Prahmana, 2021). Teaching mathematics, considering that mathematics is an expression of cultural development and human thought, is a relevant reason for teaching mathematics on an ethnomathematics basis (D'Ambrósio, 2005; D'Ambrosio & D'Ambrosio, 2013). Thus, learning mathematics needs to begin by using the real context of the sociocultural realities around students. Students' needs are not just learning external values and rigid academic mathematical knowledge (Prahmana, 2022).

The next is Unity in Diversity or Bhinneka Tunggal Ika in Indonesian terminology. Intolerance and radicalism have

become issues in the spotlight lately. Students must be invited to learn to build a respectful dialogue about the diversity of religious groups and beliefs held by local communities in Indonesia and the values of the teachings they adhere to. Studies focusing on the relationship between mathematics and culture allow one to reflect on different cultures and find ways to explore classroom challenges in classroom settings (Nkopodi & Mosimege, 2009). Through ethno-modelling, ethnomathematics ideas from different cultural groups can be a tool for teaching and learning school mathematics. It is assumed that the context students are familiar with is a powerful resource for teaching and learning mathematics.

We continue to the engineering and technology, which can indicate the advancement of the quality of a nation's human resources. Therefore, the implementation of engineering and technology continues to be encouraged so that students can collaborate in training critical, creative, and innovative thinking, as well as the ability to empathize with engineering to build technological products that facilitate their activities and those around them. Technocracy in the trivium curriculum developed by D'Ambrosio (1999) makes it possible to facilitate this topic. Technocracy is the ability of students to use and combine various technological instruments that help students in daily activities to assess the reasonableness of their results and contextualization.

The last theme is entrepreneurship. This theme is carried out in order to foster entrepreneurial souls in students. Students will later identify economic and business opportunities at the local level, problems in developing these potentials and business development, and their relation to environmental, social and community welfare aspects. Buying and selling activities carried out by the community can be used as learning content to raise this theme in ethnomathematics studies (Nurjanah, Mardia, & Turmudi, 2021).

Within decades, the dogma of the teacher as the authority and the only source of knowledge and information in the formal classroom (Hanif, Wijaya, & Winarno, 2019) developed massively in Indonesia. Many people believe this assumption because teachers consciously or unconsciously encourage this view. Evidence that teachers reinforce this view is shown by the absence of opportunities given to students to reflect and criticize what is being learned (Beene & Greer, 2021; Prahmana & Ambrosio, 2020; Zhang et al., 2020). The process of redefining the role of mathematics education requires teachers to see themselves as facilitators of the teaching and learning process, not as authorities and communicators of knowledge. In practice, this approach requires teachers to recognize students as equal partners in the teaching and learning process and encourage them to make meaningful contributions to educational activities. In other words, students become active participants in exchanging information and not passive recipients of information presentation.

If teachers can ensure that mathematics learning and mathematics education go well in schools, then ethnomathematics will become a bridge for students to understand the values imbued in learning mathematics. The six characteristics of PP will be realized through the development of Indonesian cultural values and Pancasila. With Indonesian cultural identity and Pancasila values that are deeply rooted, Indonesian society will become an open society with global citizenship - able to accept and utilize various sources, experiences and values

from various cultures. Thus, with optimal curriculum and implementation, ethnomathematics will assist in developing PP profiles via mathematics education.

n CONCLUSIONS

In light of the preceding explanation, it is clear that ethnomathematics plays a part in the formal school mathematics curriculum since the context-relevant and constraint-filled problem-solving techniques give many abstract mathematical notions the required contextual meaning. Mathematics teachers need to view themselves as facilitators of the teaching-learning process rather than as authorities and transmitters of knowledge to accommodate ethnomathematics' function in mathematics instruction. To achieve this, teachers must recognize students as active participants in the information-sharing process rather than passive recipients of information presentation and as equal partners in the teaching and learning process.

Utilizing students' extensive ethnomathematical knowledge in the classroom fosters the growth of conceptual understanding among pupils. Mathematics becomes a meaningful and reflective topic when pupils can create broad-ranging problem-solving procedures that necessitate both teachers and students to further test their validity in a variety of familiar and novel scenarios.

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Teachers' Experiences in Flipped Classroom in South-East Asian Countries: A Meta-Synthesis

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Abstract: Teachers' Experiences in Flipped Classroom in South-East Asian Countries: A Meta-Synthesis. Objective: This study aimed to meta-synthesize the teachers' experiences utilizing flipped classrooms across South-East Asian countries. **Methods:** Fifteen (15) out of 1,118 studies were included from various accessible academic databases in Publish or Perish software which was scrutinized using a set of inclusion and exclusion criteria. The included studies were organized using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 flow diagram, and were analyzed using Braun & Clarke's six-step thematic analysis, which generated five themes and one meta-theme. **Findings:** This meta-synthesis revealed that teachers utilizing flipped classrooms experienced varied experiences from shifting roles, making them more efficient, and improved teacher-student interaction. Teachers also experienced anxieties and faced challenges, yet no studies from the fifteen studies have shown how to address the said challenges. **Conclusion:** Teacher Education Institutions were reccommended to provide comprehensive training on appropriate technology and emotional and psychological support for the teachers utilizing flipped classrooms.

Keywords: flipped classroom, teachers' experiences, meta-synthesis, systematic review

Abstrak: Pengalaman-Pengalaman Guru dalam Flipped Classroom di Negara-Negara Asia Tenggara: Suatu Meta-Sintesis. Tujuan: *Studi ini bertujuan untuk mensintesiskan pengalaman guru dalam memanfaatkan flipped classroom di negara-negara Asia Tenggara.* ***Metode:*** *Lima belas (15) dari 1.118 penelitian dimasukkan dari berbagai database akademik yang dapat diakses dalam perangkat lunak Publish or Perish yang diteliti menggunakan seperangkat kriteria inklusi dan eksklusi. Studi yang disertakan disusun menggunakan diagram alir Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, dan dianalisis menggunakan analisis tematik enam langkah Braun & Clarke, yang menghasilkan lima tema dan satu meta-tema.* ***Temuan:*** *Meta-sintesis ini mengungkapkan bahwa guru yang menggunakan flipped classroom mengalami berbagai pengalaman mulai dari perubahan peran, menjadikannya lebih efisien, dan interaksi guru-siswa yang lebih baik. Guru juga mengalami kecemasan dan menghadapi tantangan, namun tidak ada dari lima belas studi tersebut yang menunjukkan bagaimana mengatasi tantangan tersebut.* ***Kesimpulan:*** *Lembaga Pendidikan Guru direkomendasikan untuk memberikan pelatihan komprehensif tentang teknologi tepat guna dan dukungan emosional dan psikologis bagi para guru yang memanfaatkan flipped classroom.*

Kata kunci: *flipped classroom, pengalaman guru, meta-sintesis, reviu sistematis.*

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INTRODUCTION

The flipped classroom is a trending instructional model in which traditional classroom activities become home activities (Akçayýr & Akçayýr, 2018). Published papers reported that educators have positive experiences with the flipped classroom (Mehring, 2016) and have produced good practices in preparing materials (Cagande & Jugar, 2018). However, several published papers also noted that flipped classroom has limitations (Milman, 2012), such as teachers finding flipped classroom challenging (Caicco, 2016), and teachers are challenged to re-design face-to-face class time in ways that are beneficial to students (Mehring, 2015). Several published researches tackled flipped classrooms only focusing on students' experiences and not on the teacher, and none has conducted a meta-synthesis on the teachers' experiences in the flipped classroom in South-East Asia. Hence, this study aims to meta-synthesize published researches on teachers' experiences in flipped classrooms in South-East Asia.

With the advancement of technology, learning activities now include a variety of techniques. We may discuss the flipped classroom idea and virtual learning utilizing learning management systems as two strategies (Louhab et al., 2020). The flipped classroom technique has been shown in several studies to be superior to traditional instruction (Baris, 2017; Moreta, 2018). A quantitative systematic review or meta-analysis of 118 research revealed that students' subjective impressions of the flipped classroom were favorable (Chen et al., 2017). Students in the flipped classroom performed much better, according to this research. Higher education has seen an increase in the use of the flipped classroom model, and it is expected that more conventional courses will use it to augment outside-of-class work with video lectures (Shi-Chun et al., 2014).

Students may be more actively involved and motivated to learn by using an alternate technique and teaching style, such as the flipped classroom (Bhagat, Chang, & Chang, 2016). This method moved the focus from the instructor to the students (Kong, 2014). These dramatic shifts in their pedagogical practices have sparked original thinking and inspired new perspectives. Teachers' improved sense of work satisfaction is a direct result of the chances afforded by flipped classes; these educators are the ones who have put forth the most effort to transform the way mathematics is taught in today's schools (Cevikbas & Kraiser, 2020). Because teachers leading flipped classrooms can keep a close eye on their student's learning activities, they can more easily see any gaps in their students' knowledge, leading to more opportunities for discussion and collaboration.

The internet and computers needed for the flipped classroom may only be accessible to select pupils in underserved areas. Without their networks or computers, students would have to use those in public locations like libraries or internet cafés (Shi-Chun et al., 2014). Additionally, while the flipped classroom trend has sparked much excitement in the teaching community, not all educators have embraced this novel approach (Wang et al., 2015). According to Chen et al. (2014), many students found adjusting to the flipped classroom challenging due to the new methodology and the fact that they had less time to view the video lesson outside of class. Additionally, flipping the classroom presented challenges for teachers since it required additional time to create engaging materials that would encourage students to view the lecture before class (Zainuddin & Halili, 2016). Enfield (2013) also emphasized that students would find viewing a video lecture outside class boring if the content and design were boring. The flipped paradigm requires instructors to spend more time

planning lessons (Caligaris, Rodriguez, & Laugero, 2016). Teachers who intend to use the flipped classroom approach must understand how to utilize technology in the classroom. The labor required to complete these flipped classroom sessions may be significantly increased by the need to supply supplemental materials (McCarthy, 2016). Teachers not knowledgeable about technological advancements risk failing to provide their students with constructive criticism.

Technologies in education provide countless international potential, thus making teachers look for methods to integrate technology into their classrooms so that their pupils have greater learning chances (Koehler et al., 2004). Despite the difficulties the teacher has experienced, they have also encountered some possibilities (Al-Samarraie et al., 2020). Teachers provided a range of visual inputs, which promotes deeper learning in a condensed amount of time, allowing students to watch the movie more than once, and fostering independence and autonomy in the learners. The flipped classroom presents instructors with the challenge of introducing fresh ways to engage pupils using cutting-edge technology (Strayer, 2012). Students in flipped classes across all courses downloaded and used more learning scaffolds developed by academics at various times, places, and speeds to suit their needs, optimizing their time for independent study. Students were motivated and inspired by the different teaching strategies to look for more advanced learning opportunities via technology that also matched their learning preferences (Dayagbil et al., 2018).

There have been several studies on the efficacy of the flipped classroom technique that have been published in publications. However, only a small number of studies concentrate on the experiences of instructors who use flipped classrooms and only a limited number of studies have examined the teaching experience in flipped classrooms (Fredriksen, 2020, as cited in Cevikbas & Kaiser, 2020). Additionally, no qualitative systematic reviews nor meta-synthesis have been conducted on teachers' experiences using flipped classrooms in South East Asian nations. Hence, this study aims to meta-synthesize published researches on teachers' experiences in flipped classrooms in South-East Asia. Specifically, this study seeks to answer the following questions: (1) What are the teachers' roles in a flipped classroom? (2) What are the changes in teacher-student interaction? (3) What are the depressing and challenging ideas and experiences experienced by the teachers? (4) What are the teachers' development in flipped classes? (5) What recommendations can be proposed?

METHODS

Participants

Meta-synthesis research design is conducted through data mining which gathers published or unpublished researches to make a systematic review (Jifa, 2013). This study synthesizes the experiences of teachers who are the participants in the published studies utilizing flipped classroom in South East Asian Nations.

Research Design

This study used a meta-synthesis research approach to interpretatively synthesize findings from many related studies on teachers' experiences in flipped classrooms (Walsh & Downe, 2005). It involves systematically reviewing and integrating the results of qualitative research (Lachal et al., 2017).

Study Search Procedure

The academic databases Google Scholar, Crossref, Scopus, and Semantic Scholar, were utilized to choose publications that dealt with instructors' experiences with the Flipped

Classroom. These datasets were selected in light of their accessibility via Publish or Perish Software (Harzing, 2007). The period from January 2020 to September 2022 was chosen on purpose. In the Publish or Perish program, the following keywords or descriptors were entered: (a) Flipped Classroom; (b) Teachers' Experiences; (c) Success in Flipped Classroom; and (d) Challenges in Flipped Classroom. The keywords mentioned earlier were used to locate relevant articles. The screened data was organized using a flow diagram utilizing PRISMA.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria provide the researcher with a foundation to make sound judgments (Meline, 2006). The studies that were chosen for inclusion met the following criteria: (a) papers published between January 2020 and September 2022; (b) they had to be from a South-East Asian country; (c) they had to be written in English, and (d) they had to contain studies about teachers' experiences in the flipped classroom. The predetermined inclusion criteria were used to filter the chosen articles.

Instrument

The researchers are the main instrument in conducting qualitative research (Pecson & Pogoy, 2021). In this meta-synthesis, the experiences of the teachers in utilizing flipped classroom were synthesized which were published in selected research articles. Harzing's Publish or Perish Software was used to select and gather publish articles. Open access academic databases such as Google Scholar, Open Alex, Scopus, Semantic Scholar, and CrossRef were used to search for data. A Critical Appraisal Skills Programme (CASP, 2022) checklist was used as an instrument to appraise the strengths and limitations of the selected published studies to be included for its trustworthiness and relevance.

Data Analysis

Since meta-synthesis is a pure qualitative research design, no statistical technique or analysis was used in this study. However, thematic analysis was used to determine the emerging themes as described by Clarke and Braune (2013). It is a qualitative data analysis technique that entails reviewing a data collection and looking for themes across the data. The six steps of thematic analysis are as follows: (1) familiarizing oneself with the data; (2) creation of initial codes; (3) topic search; (4) theme evaluation; (5) theme representation; and (6) outcome interpretation.

■ RESULTS AND DISCUSSION

The data collected on the teachers' experiences from Harzings' Publish or Perish was organized using the PRISMA flow 2020 diagram, as shown in figure 1. The descriptive data of the included articles are indicated in table 1.

One thousand one hundred eighteen (1,118) initially collected studies from Harzing's Publish or Perish Software were scrutinized to remove studies that did not meet the inclusion criteria. The initial studies collected were from Google Scholar (95), Open Alex (8), Scopus (5), Semanti Scholar (10), and CrossRef (1,000).

From the 1,118 initially collected published research articles, the following studies were deleted due to: 60 studies due to duplication, 513 studies due to ineligibility, 222 studies did not meet the inclusion criteria, 246 studies were published before 2020, 24 studies have no abstract, 2 studies are not English, 28 studies are not accessible, and 8 studies did not qualify the CASP checklist. With these reasons, a total of 1,103 studies were massively reduced from the initially collected articles that yielded to final fifteen (15) studies for the meta-synthesis. The fifteen (15) studies were described as indicated in table 1.

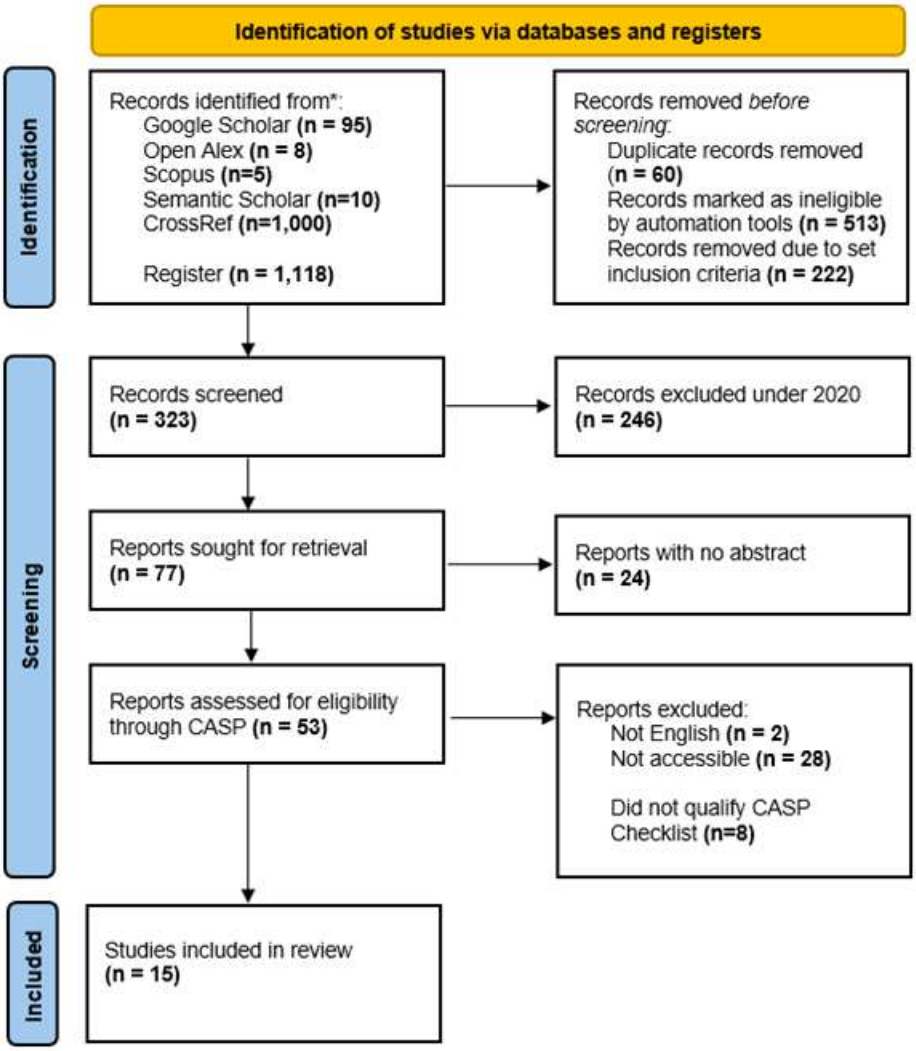

Figure 1. Prisma flow diagram on data selection

Table 1. Descriptive data of the 15 included studies on teachers' experiences on flipped classroom

No.	Author	Year	Setting	Subject	Teachers' Experiences
1.	EF Asda et al.	2022	Indonesia	Chemistry	• Need to master online learning system
2.	Zhao et al	2021	Indonesia	Science	• Acted as facilitator
3.	EC et al	2020	Philippines	English	• Increase of engagement with students
4.	Tan et al	2020	Philippines	Science	• Skeptic of teachers' capability • Additional burden • Need to master technology
5.					• Poor internet connection • Lack of technological devices • Spend more time answering

	RLB Antonio	2022	Philippines	Social Studies	queries • Monitor student progress and provide more feedback to students • Improved engagement between student and teachers
6.	Fulgueras & Bautista	2020	Philippines	English	• Maximizes teachers time • Need to carefully plan the materials
7.	Triatmojo & Priyadi	2021	Indonesia	Physics	• Need to pay some materials
8.	Ketsaraporn Suanse, Chokchai Yuenyong	2021	Thailand	Math	• Increased work efficiency • Have more time to communicate with students
9.	Kevin Fuchs	2021	Thailand	Science	• Teacher's involvement faded as the sessions progressed
10.	Ngo Hui Kiang, Melor Md Yunus	2021	Malaysia	English	• Increased interaction to students • Worried since some students have access to gadgets
11.	S. Ramadhanty, Nina Puspitaloka	2020	Indonesia	English	• Expected to have strong internet connection
12.	Ahmad Ahmad	2021	Indonesia	Math	• Assisted student more
13.	Nabayra	2020	Philippines	Math	• Acted as a facilitator
14.	Rafon & Mistades	2020	Philippines	Physics	• Improvement on the students' interaction
15.	Hung	2022	Vietnam	English	• Teachers facilitate student to become self-directed learners • Organized interactive and productive activities

Fifteen (15) included studies were from South-East Asia (SEA). SEA teachers' experiences from the 15 studies were described as indicated in table 1, including the discipline or subject taught. These experiences were clustered and were analyzed using the six-step thematic analysis, which resulted in five (5) themes, namely: (1) shifted role, (2) improved teacher-student interactions, (3) worries and anxieties, (4) challenge experienced, and (5) teachers' efficiency. Clustering all themes have emerged one meta-theme, teachers' experiences of flipped classrooms. The said themes and meta-theme are described below.

Theme 1. Shifted Role

The flipped classroom changed teachers' roles from lecturers to facilitators (Nabayra, 2020; Hung, 2022; Zhao et al., 2021). Instead of just providing lesson information to students, the instructor takes on the role of a facilitator by encouraging student participation (Yeboah et al., 2020). In a flipped classroom, the facilitator's position is drastically altered. The instructor takes on the role of a resource for the students, showing them how to utilize the tools, improve their information processing, and utilize the fundamental ideas in practical contexts. The flipped classroom allows instructors to step away from the traditional

staged method of instruction and become learning facilitators.

Teachers were facilitators to assist pupils in comprehending and retaining what they had learned (Yusiff, 2022). They do this by directing students through the learning process, facilitating student discussion, and promoting various activities. Teachers must comprehend various ways they might be productive in their classrooms. A teacher may be a facilitator of learning by allowing students to share their thoughts and experiences, demonstrating how to build on the ideas of others, using a range of teaching strategies, and demonstrating successful conduct (Bye, 2017). A teacher must get knowledgeable about the subject matter and be able to communicate it in a manner that pupils can comprehend (Lee & Lai, 2017). Additionally, they must foster an atmosphere where students feel comfortable asking questions and exploring new concepts.

Theme 2. Improved Teacher-Student Interactions

Teachers who employed the flipped classroom method were able to personally address a more considerable number of students throughout the class (Tan et al., 2020), offer them more support (Ahmad, 2021), and allow outstanding contact with those students (Fasli, 2021). Teachers can offer immediate feedback and assistance to students (Liu, 2021), monitor students' development, and provide further input. In addition, teachers could provide more input and students a greater variety of feedback. Both the students and the teacher could acquire new knowledge due to their degree of engagement, displayed equally by both parties (Karmila et al., 2022). As a result, there was an increase in the amount of engagement on the part of the students and the teachers (Antonio, 2022).

A flipped classroom increases students' knowledge of the idea by giving them ample time to talk about their issues (Asad et al., 2022). In order to foster productive classroom interactions with students, teacher educators employed the flipped classroom strategy (Aidoo, 2022). It was able to detect students' problems via teacher-student interactions for potential feedback (Ferrer & Martinez, 2021). Flipped classes engage students and promote more significant learning by maximizing teacher-student contact and scaffolding learning via ongoing instructor feedback and encouragement (Wei, 2021).

Theme 3. Worries and Anxieties

Teachers were worried about how all students will be able to have the required hands-on experience with the tool that would be used in the flipped classroom (Kiang & Yunus, 2021), and they were especially concerned about children who do not have access to computers at home. The teachers were concerned about the irregularity of the internet connection (Ramadhanty & Puspitaloka, 2020), the exorbitantly expensive cost of the necessary equipment (Magaña et al., 2022), and the significant time investment needed to painstakingly prepare the lectures (Fulgueras & Bautista, 2020). They were working under the assumption that they lacked the qualifications required to teach in flipped classrooms and that to meet this need (Jdaitawi, 2021), they needed to become experts in the technologies related to the subject matter they were teaching. Teachers also noted that they doubted their talents and capabilities in handling flipped classes (Tan et al., 2020). The teachers also reported that they experienced anxiety in the flipped classroom.

Due to the fast advancement of quality-oriented education, such as flipped classrooms, the primary function of instructors in educational

activities has changed considerably (Shi, 2017). Because all learning aspects must be carefully integrated, recording lectures necessitates a significant amount of work on the instructor's part (Fulgueras & Bautista, 2020). Teachers use their funds to purchase items such as laptop computers, mobile phones, printers, and similar gadgets, as well as internet access, which are required to enhance teaching and learning (NRCP, 2021). Their wages remain stagnant, and many seek a second job to help them make ends meet (Walker, 2018).

Theme 4. Challenges Experienced

Tan (2020) noted that teachers took on extra responsibility and addressed students' inquiries more (Antonio, 2022). They tend to struggle to set up flipped classrooms due to a lack of resources and time, which adds to teachers' work (Fasli, 2021). The teachers were unsatisfied with several concerns, including the lack of adequate understanding of computer technology and needing more time to experiment with new technologies (Yadav, 2021). Teachers also express their sentiments on their slow internet connection, including their students' internet connection which hampered the flipped classes. Teachers often struggle to locate proper technical tools to utilize in flipped classrooms, making learning more difficult for students and leading to teacher fatigue (Bernauer, 2020).

Appropriate access to technical help, infrastructure availability such as software, and time is given to adopting new technologies are critical problems for instructors (Hyndman, 2018). Furthermore, not all kids or instructors have a computer at home, enough data, or an internet connection. There is a digital gap in computer literacy among Indigenous, lower socioeconomic, or regional/rural pupils. This presents difficulties for instructors if they assign various activities to different pupils or avoid assigning homework with a digital component (Sullivan, 2013). There is a need for training and development for teachers to manage the many challenges they face online.

Theme 5. Teachers' Efficiency

Because of students' increased participation, teachers could have a better overall experience teaching in flipped classrooms (Wang, 2020; Zhao, 2021). This improvement was possible because of the students' increased ownership of the learning process. Teachers improved their work efficiency and overall experience level as they took on the role of learning facilitators in their classrooms (Suanse & Yuenyong, 2021; Chen, 2021; Nabayra, 2020). The teachers could make the most productive use of their time by assisting the students in their academic endeavors, which allowed them to maximize the effectiveness of the time they had available (Fulgueras & Bautista, 2020). In addition, the instructors claimed that the amount of stress in their lives had decreased due to participating in the program (Hajebi, 2020).

Access to quality learning materials outside the classroom may be more straightforward for students employing digital learning platforms, increasing the possibility that individual study time will be fruitful (Cae, 2022). Even while teachers often have a variety of materials to go along with their lectures, flipped learning dramatically improves the efficiency, usefulness, and accessibility of that process. Teachers may use recorded short films to connect things and give out books, games, and movies. By creating key lecture content once and using it across multiple class segments for succeeding years, teachers can save time. They can also continuously improve certain lecture content by reviewing analytics, video comments, and in-class discussions. Teachers can also invest time in learning and distributing new, more detailed content for upcoming lessons or classroom discussions (Panopto, 2022).

Meta-Theme. Teachers' Experiences on Flipped Classroom

The concept of the "flipped classroom" is being adopted by an increasing number of schools throughout the globe (Lo & Hew, 2017). Overall, the flipped classroom method is well-received by students and is actively pursued by them. Increases in students' communication abilities, a rise in the number of self-directed students, and a shift in student's study habits are just a few of the indirect educational benefits that have been documented. The flipped classroom model also frees up class time for teacher- and student-centered activities like collaborative projects and one-on-one feedback. The significant effort of instructors in generating flipped learning materials and the lack of interest among students in an outside study session are the two primary downsides of utilizing the flipped classroom strategy (Acedo, 2022). Teachers' ability to inspire their pupils to use what they have learned at home is crucial to the success of flipped classrooms.

■ CONCLUSIONS

Teachers implementing flipped classrooms have multifaceted roles in their teaching experiences using the said instructional approach. The various benefits of a flipped-classroom approach extend not only to students but also to teachers. These allowed them to use their expertise and skills better by spending less time lecturing and more time helping to develop students' understanding. However, teachers also faced various challenges and felt anxious in delivering lessons in flipped classroom. Several teachers were developed to be more efficient that help them maximize their effectiveness in class. It is recommended that teacher education institutions provide teachers with comprehensive training on using appropriate technology for the flipped classroom and providing emotional and psychological support for the teachers.

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The Use of Graphing Calculators in Teaching Mathematics: A Meta-Synthesis

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Abstract: The Use of Graphing Calculators in Teaching Mathematics: A Meta-Synthesis. **Objectives:** This study aimed to explore the use of graphing calculators as a tool in teaching and learning mathematics employing a meta-synthesis method. **Methods:** A meta-synthesis was used in this study. The final 16 articles used in this study were the result in using the Critical Appraisal Skills Programme (CASP) checklist and the PRISMA 2020 flow diagram**. Findings:** Six themes emerged from the data: (1) influences students' solving and basic skills; (2) the need for complex technical skills; (3) readiness in learning mathematics; (4) facilitative role of the teachers; (5) excellent aid for better comprehension and representation; and (6) increases students' cognitive achievement. The study's meta-theme emerged as the "exploration and navigation on the use of the graphing calculators". **Conclusion:** The use of graphing calculators was found very useful in teaching mathematics. It is recommended that a training the use of the graphing calculator be given to both teachers and student; the offering of elective subjects which deal on the use of different technologies useful in Math teaching/learning be considered.

Keywords: graphing calculators, meta-synthesis, systematic review, teaching mathematics

Abstrak: Penggunaan Kalkulator Grafik dalam Pengajaran Matematika: Suatu Kajian Meta-Sintesis. ***Tujuan:*** *Penelitian ini bertujuan untuk mengeksplorasi penggunaan kalkulator grafik sebagai alat bantu dalam pembelajaran matematika dengan metode meta-sintesis.* ***Metode:*** *Suatu kajian meta-sintesis digunakan dalam penelitian ini. Sebanyak 16 artikel terpilih yang digunakan dalam penelitian ini merupakan hasil penerapan checklist Critical Appraisal Skills Program (CASP) dan diagram alur PRISMA 2020.* ***Temuan:*** *Enam tema muncul dari data: (1) memengaruhi keterampilan dasar dan pemecahan masalah siswa; (2) kebutuhan akan keterampilan teknis yang kompleks; (3) kesiapan belajar matematika; (4) peran fasilitatif guru; (5) bantuan yang sangat baik untuk pemahaman dan representasi yang lebih baik; dan (6) meningkatkan prestasi kognitif siswa. Meta-tema studi muncul sebagai "eksplorasi dan navigasi pada penggunaan kalkulator grafik".* ***Kesimpulan:*** *Penggunaan kalkulator grafik sangat bermanfaat dalam pembelajaran matematika. Disarankan agar pelatihan penggunaan kalkulator grafik diberikan kepada guru dan siswa; penawaran mata pelajaran pilihan yang berhubungan dengan penggunaan berbagai teknologi yang berguna dalam pengajaran/pembelajaran matematika dapat dipertimbangkan.*

Kata kunci: *kalkulator grafik, meta-sintesis, reviu sistematis, pengajaran matematika.*

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INTRODUCTION

Technological advances have inspired many strategies to improve the teaching- learning process in general, and especially in Mathematics. Math teachers are encouraged to use technology to help students understand Math concepts meaningfully and to enable them to explore mathematical ideas (Ministry of Education in Malaysia, cited in Tajudin, Tarmizi, Wan Ali & Majid, 2007). "Technology is essential in teaching and learning mathematics, it influences the mathematics that is taught and enhances students' learning" (NCTM, 2000, p. 24).

There are many kinds of technologies considered relevant in teaching mathematics - from very powerful computer software like Mathematica, Maple, MathLab to less powerful technologies such as paper and pencil (Tajudin, Tarmizi, Wan Ali & Majid, 2007). Currently, the use of hand-held technologies such as the graphic calculators in teaching Mathematics has been encouraged due to its accessibility, affordability and ease of use (Kissane cited in Tajud, Tarmizi, Wan Ali & Majid, 2007). Graphic calculators can draw and analyze graphs, compute values of mathematical expressions, solve equations, perform symbolic manipulations, statistical analyses, computations, programmable, and communicate information between devices (Jones cited in Tajudin, Tarmizi, Wan Ali & Majid, 2007).

Many studies in developed countries have shown positive impacts from the use of graphic calculator in the classrooms and in examinations (Adams, 1997; Burill et al., 2002; Connors & Snook, 2001; 2000; Dunham, 2000; Dunham & Dick, 1994; Gage, 2002; Graham & Thomas, 2000; Hennessey, 2000; Hong et al., 2000; Horton et al., 2004; Noraini Idris, 2004, Noraini Idris et al., 2002, 2003; Kastberg & Leatham, 2005; Keller & Russel, 1997; Penglese & Arnold, 1996; Quesada & Maxwell, 1994; Ruthven, 1990, 1996; Smith & Shortberger, 1997; Waits & Demana, 2000). In Malaysia, the Curriculum Development Centre introduced the graphic calculator in the early of 1990s (Muhd. Khiriltitov Zainudin, 2003). However, the use of graphic calculators in Philippine schools is still in its infancy (Noraini Idris, 2004 - change), and therefore its use has yet to be fully explored. Thus, there is a need for further research in this area, specifically in the context of teaching mathematics at the Philippine secondary school level.

Education professionals need to adopt new teaching and learning approaches that incorporate active, integrated real-world applications as technological breakthroughs increase. The effective use of technology in the field of education has become one of the important research topics, along with the widespread use of technology in daily life. Mathematics teaching is one of the leading fields affected by technology when training and education activities are considered (Akkaya, 2016). The successful implementation of the targeted learning outcomes is supported by the use of technology in education because it improves student comprehension of the ideas or material being taught. The utilization of these instructional tools will also assist students in understanding abstract concepts, being creative, feeling confident, and being able to work alone or in groups. Tajudin and Zarkasi, (2014) also emphasized that the use of technology in mathematics instruction and learning has grown crucial since it aids in modernizing the educational strategy to foster a more engaging and fascinating comprehension of mathematical ideas.

Additionally, using technology in mathematics instruction improves student accomplishment and attitudes toward math, which in turn raises the quality and durability of teaching. Technology gives teachers the chance to extend their lessons beyond the confines of the classroom. The support of school administrators is necessary for teachers to feel empowered, for

example, by extensively funding educational technology resources and giving teachers opportunities to gain proficiency with these resources. Effective educators can maximize the possible benefits of technology to increase student competency in mathematics, foster student enthusiasm, and broaden student knowledge (TLS & Herman, 2020).

All facets of life should adjust to cutting-edge technologies in the digital age, but education should be a particular priority. According to the National Council of Teachers of Mathematics (NCTM, 2000), electronic technology, including computers and calculators, have replaced most other subjects in practically all classes in schools and colleges. Mathematical educational technology has evolved and become dynamic. A change in the technology available to math instructors and students has steadily improved; specifically, four applications for mobile technologies, computers, graphing calculators, function calculators, and scientific calculators (Montijo, 2017).

Math educators, curriculum designers, and teachers have recently shown a steadily rising interest in employing handheld devices, particularly graphic calculators. Students can investigate, model, and view several representations of mathematical issues by using graphing calculators while learning mathematics (Parrot, & Leong 2018). Tajudin and Zarkasi (2014) also supported, based on the results of their study, the pedagogical impact in incorporating the latest trends in mathematics education, namely, integrating the graphing calculator to maximize the mathematical and pedagogical benefits to students.

In the recent years, research on calculator use in the learning of school mathematics has tended to move from an emphasis on student learning to the influence of the teacher, recognizing their key role in the use of the device (Amanyi, et.al. 2016). Lee and McDougall (2010) studied the different learning experiences of students and instructors in their use in various topics in mathematics. The use of graphing calculators in the mathematics classroom is influenced by teachers' personal experiences and teaching practices, as well as students' technological proficiency. When graphing calculators are used effectively in the mathematics classroom, they can be a powerful tool in assisting teachers in creating an environment in which their students can construct their mathematical knowledge and understanding.

Calculators are now widely used in math classes. Ellington (2003) concluded in a recent meta-analysis of findings from 54 research studies that when calculators were used as part of testing and instruction, students' operational skills and problem-solving skills improved. When calculators were not used in the assessment, the results for both skill types were mixed, but calculator use did not hinder the development of mathematical skills in any case. Calculator users had more positive attitudes toward mathematics than non-calculator users. More research on the retention of mathematics skills after instruction and the transfer of skills to other mathematics-related subjects is required.

Despite the fact that many qualitative studies were conducted, no systematic synthesis was conducted in summarizing the experiences of the informants. Through the different scientifi literature and theories mentioned in the preceding paragraphs that this systematic review was employed. Hence, this study aims to explore the use of graphing calculators as a tool in teaching and learning mathematics employing a meta-synthesis method using available scientific literature which conducted qualitative studies across the different journals.

METHODS

Research design

This study used a meta-synthesis research strategy that aims to interpretatively synthesize findings from many connected studies (Walsh & Downe 2005). According to, it is the systematic review and integration of information from qualitative studies (Lachal et al., 2017).

Search Strategy

Through the use of Publish or Perish software, Google Scholar, Semantic Scholar and some academic publications connected to the Use of Graphing Calculators in Teaching Mathematics were found in an electronic database for scholarly research. All research published between 2000 and 2021 that are pertinent to the use of graphing calculators in teaching mathematics have been downloaded and examined. Further, the descriptors or keywords entered in the software were as follows: graphing calculators and experiences. The keywords mentioned earlier were selected to draw out articles. A flow diagram using PRISMA 2020 was then utilized to sort out the screened data.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria provide a basis on which the reviewer draws valid and reliable conclusions (Meline, 2006). Included studies were selected on the basis of inclusion criteria protocol: (a) must include studies related to the use of graphing calculators; (b) must utilize qualitative design; (c) must be written in English; (d) must qualify using the Critical Appraisal Skills Programme (CASP). Selected papers were screened with the set inclusion criteria. The figure below shows the search strategy of the included studies.

Data Analysis

The emerging themes were determined using the thematic analysis procedure described by Clarke and Braune (2013). It is a qualitative data analysis technique that entails reviewing a data collection and looking for themes that run across the data. The six steps of thematic analysis are as follows: (1) familiarizing oneself with the data; (2) creation of initial codes; (3) topic search; (4) theme evaluation; (5) theme representation; and (6) result interpretation.

RESULTS AND DISCUSSION

The findings are interpreted in accordance with the study's objective, based on a meta-synthesis of the selected studies. Exploration and Navigation on the Use of the Graphing Calculators was identified as the meta-theme. Consequently, nine sub-themes emerged from the meta-theme, namely, influences students' solving and basic skills, the need for complex technical skills, readiness in learning mathematics, facilitative role of the teachers, excellent aid for better comprehension and representation, and increases students' cognitive achievement.

There were three (3) stages of the research paper selection using the PRISMA Flow Diagram. The three stages are the following: Identification, Screening, and Included. On the identification stage, One Hundred Fifty (150) studies were registered in Google Scholar, and Twelve (12) studies were registered in the Crossref database totaling to One Hundred Sixty Two (162) studies on the initial screening using the Publish or Perish software.

The teaching and learning experiences in using the Graphing Calculators were used to generate initial codes highlighting the 16 studies considered in the meta-synthesis. Table 1 reflects the title of the study and its corresponding authors with the generated codes used for thematic analysis.

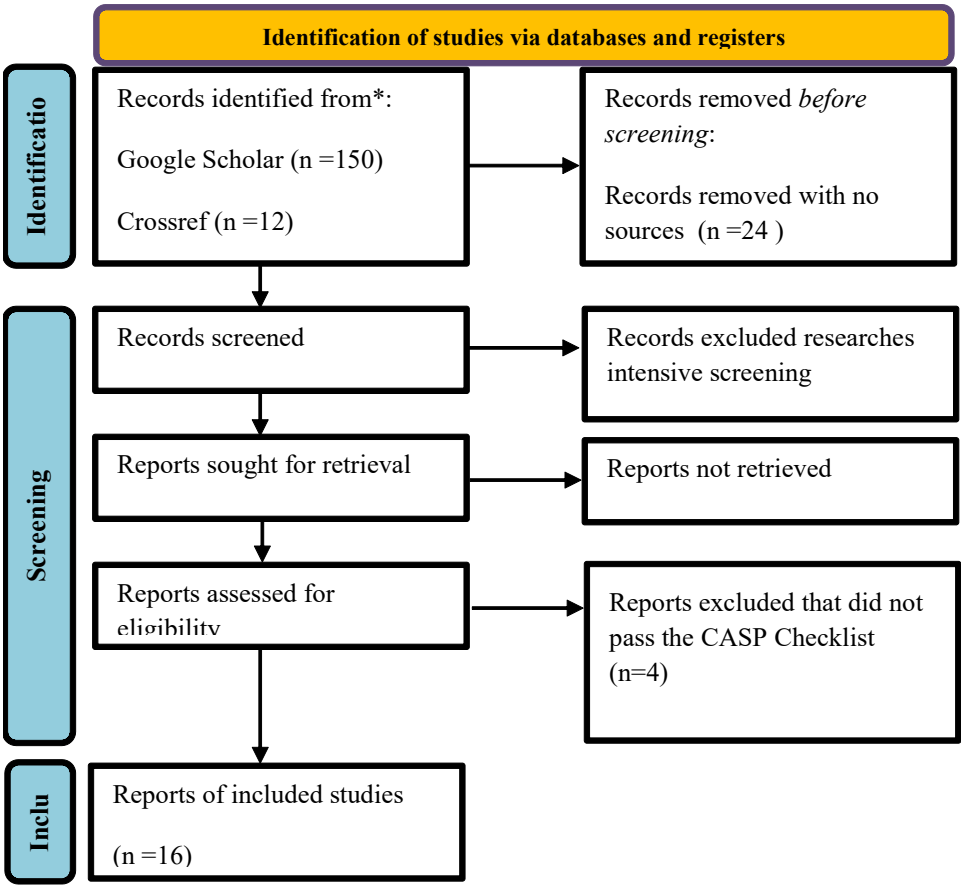

Figure 1. Search strategy using prisma

Table 1. Studies highlighting the use of graphing calculators in teaching mathematics

Article	Author/s & Year Published	Generated Initial Codes on the Use of Graphing Calculators in Teaching Mathematics
1	L. Ndlovu, M. Ndlovu (2020)	• Graphing Calculator (GC) assisted them to understand quadratic inequality problems better • Learners indicated that GC provided them with opportunities of employing more than one approach to solve quadratic inequalities • Using a GC potentially raised learners' cognitive achievement in quadratic inequalities, in particular as they were able to observe the different representations connected to the concept.
2	Kandemir, M.A. & Demirbag Keskin, P. (2019)	• Productive, and more concrete • Graphical calculator program made learning both fun and efficient • The thing that I liked was that the teacher knew the graphics calculator software very well
3	Ndlovu, L. (2019)	• The graphing calculator shows the solutions and the graph which makes it simpler for me to understand the inequality. • I used to have fear with quadratic inequalities and this topic was always very difficult. I never did well in quadratic inequalities. The use of the GC helped me to gain confidence in learning quadratic inequalities as it uses graphs to show the solutions of quadratic inequalities. • After the use of the GC my comprehension has increased

4	Roorda, G., Vos P., Drijvers, P, & Goedhart, M. (2016)	• The idea that use of the GC encourages students to create links between graphical and symbolical representations
5	McCulloch, A., Kenney, R., & Keene, K.A. (2013)	• Confidence in their mathematical abilities • I never trust the graphing calculators answer if it doesn't match mine. However, if they don't match, I check both my work and what I input in the calculator. • The calculator does not show all the steps and it is easy to make mistakes when putting information into the calculator.
6	Tan, C.K. (2012)	• User-friendly. It is not surprising that majority of students had found the GC easy to operate. • GC enabled them to perform several types of calculations that cannot be performed by other calculators. • Students also felt that the lessons with the use of GCs were more interesting and enjoyable as they were more involved and more interactive. They constantly communicating, discussing, comparing and exchanging views on the solutions that they obtained with the use of GCs. • The GC is perceived as a crunching machine as it saved students the tedious calculations, sped up as well as made the calculations easier.
7	McCulloch, A. (2008)	• Reflect on the multifaceted role of the calculator in their problem-solving process.
8	Gerren, S. S. (2008)	• Realizes how helpful a calculator can be to help understand the material, to verify work, to visualize problems, to prepare for tests to succeed on tests, and to ease test anxiety • Overwhelmed with its use in the lesson • Helpful and relieved a lot of mathematical stress. • The instructor played a vital role in initiating, promoting, and supporting student behaviors during integrated instructional activities that led to the establishment of graphing calculator use and related interactions as classroom norms • Enhanced understanding, solution strategies, saving time, making problems easier, visualization, improved test performance
9	Reznichenko, N. (2007)	• GC makes easier doing mathematics by removing lengthy calculations and other demanding mathematical tasks • Using the calculator takes less time • To me, it [learning mathematics] would find it more difficult without using a calculator • believed that with the constant use of GC, some mathematical skills were unused and then forgotten • by using a calculator, you lose your basic skills? Yes, that's harder for me to remember, like multiplying, because you're so used to plugging it in, and doing multiple things, you can lose the basic skills of what you have learned in the past.

10	McCulloch, A.W. (2007)	• I feel more comfortable with the calculator next to me • No more computations • change the cognitive demand of a task • Engage in a playful mathematical activity • Manage time
11	Dreiling, K. (2007)	• Encourage students to use the graphing calculator • The graphing calculator is a necessity • In order to help give the students a visual perspective on the logarithmic properties and concepts that we are currently studying in this lesson • Reinforce the use of graphing calculator • Graphing a function lets students actually 'see' the concept
12	Noraini Idris (2006)	• Beneficial in terms of students' level of understanding, communication skills, and achievement • Encourage students to participate in classroom discussion • Creating a climate for success.
13	Horton, R. M., Storm, J., & Leonard, W.H. (2004)	• Inappropriate use of calculators may cause students not to learn what they should • Observe and assess their students' achievement carefully and consistently
14	Ng Wee Leng (2005)	• An important tool in teaching and learning mathematics
15	Roorda, G.; Vos, P.; Drijvers, P.; Goedhard, M. (2016)	• The graphing calculator can have complex and subtle effects. • Connection between symbolical and graphical representations remains weak
16	Robova, J (2002)	• A helpful tool for mathematics teaching and learning • The actual result depends on teachers themselves • The visualization can help the student to understand and remember better the mathematical abstract concepts via their graphic representations

As shown in table 1, the initial codes on the use of the graphing calculators in teaching mathematics were generated to search for themes. The general codes were analyzed using the thematic analysis approach, which emerged with six (6) themes and one (1) meta-theme. The themes generated are the following: (1) influences students' solving and basic skills; (2) the need for complex technical skills; (3) readiness in learning mathematics; (4) teachers' role in the facilitation; (5) excellent aid for better comprehension and representation; and (6) increase students' cognitive achievement;

Challenges of Using the Graphing Calculators

This category describes the challenges encountered in using graphing calculators in teaching mathematics. The following themes under this category were discussed below:

Theme 1: Influences Students' Solving and Basic Skills

Studies acknowledged how using a graphing calculator can improve students' conceptual comprehension, but studies also mentioned how it would deskill students.

Reznichenko (2007) found that some participants in his study claimed that using graphing calculators can lead to calculator dependency and deskilling because some mathematical skills were unused and forgotten. Additionally, Gerren (2008) cited Hennessy et al. (2001) that the usage of a graphing calculator may lessen the cognitive load in doing mathematical operations by handling the mechanics of the translation procedures so that the user may concentrate on comprehending the topic. Students can focus on understanding the problem sets but not training them to master the process and the solving skills. This is congruent with the findings of Quesada (1994) that during the introduction of calculators, most of the students had lack of understanding of some basic concepts of graphs already. Graphing calculators, according to Roorda, et al (2016) had not improved the symbolical and graphical representations of students in mathematical concepts. This was the same with the findings of Boers and Jones (1993) that graphing calculators had not helped students in reconciling the graphs in calculus in its algebraic information.

Although this negative effect of using graphing calculators remains a great debate among researchers, it is suggested that proper integration of the use of this technology should be implemented in the classroom for it to be effective.

Theme 2: The need for complex technical skills

One of the challenges encountered by students in using graphing calculators in the classroom is its need for mechanical and technical skills. Using graphing calculators entails students to memorize some key pressing steps and mechanical processes. According to Ndlovu & Ndlovu (2020), although learners acknowledge the potential of graphing calculators in assisting them in their learning, they also mentioned that they experienced some technical difficulties in setting the right windows of the tool. McCulloch, et al (2013) also found that some students easily experience mistakes in inputting information into the calculator making it difficult to trust the results. Hong et. al (2001) also cited that some studies demonstrated that there are really some difficulties associated with using graphing calculator, just like using incorrect syntax for formulas leading to wrong results. As Ocak (2008) also found out that students without proper experience on using graphing calculators lead to struggles on the technical details of the graphing calculators. Moreover, he concluded that students' prior experience and knowledge on the mechanical and technical aspects of the graphing calculators they are using can affect their attitude and their understanding as well as the tasks given to them.

This is the reason Gerren (2008) suggested that students should have prior exposure and experience in using graphing calculators before integrating its usage in the class. In order for students to better retain and apply the procedures and understand the practical value of calculator use, Steele (2007) also recommended that specific lessons on calculator keys, functions, and procedures be planned; that skills that are required for particular problems be reviewed prior to each lesson; and that the calculators be used in other subjects, such as social studies and science. These strategies are important for students who have learning problems to succeed in using calculators for mathematics.

Success of using the Graphing Calculators

This category describes the positive and successful experiences in using graphing calculators in teaching mathematics. The following themes under this category were discussed below:

Theme 3: Readiness in Learning Mathematics

Among all of the research articles for this study, four of them indicated that the experience of the students while using graphing calculators provided them with the sense of confidence in learning the subject matter (Ndlovu, 2019; McCulloh, 2007; Tan, 2011; & McCulloh, et.al., 2013). Confidence refers to the feeling or belief that one can rely on the calculators as a tool in answering problems or re-checking values along their solution process. The use of calculators made them feel comfortable in learning. Furthermore, they could also depend on them on complex operations and multi-step solutions. Graphing calculators have been used in the mathematics classroom for speed, to leap hurdles, to make connections among representations, and to permit realism through the use of authentic data (Horton, et. al., 2004). However, the usage of calculators can depend on the knowledge that a student has on how to use them. This drawback oftentimes causes the misuse and mistreatment of calculators in solving mathematical concepts (Horton, et. al., 2004).

In the study of McCulloh in 2007, students viewed graphing calculators as a tool that improved their comfortability in their classes. The presence of the device helped them in accomplishing complex tasks and calculations. According to Keiner, et.al, in 2014, if a student feels comfortable in their environment, they will do their best work. When learning becomes hard, these feelings of significance, belonging, and fun will motivate a student. Students can produce at a higher level if they feel this. Furthermore, using GCs help students feel comfortable with technology. The use of such tools enables the students to have more options to make tasks easier and improve accuracy.

The qualitative results of the study of Ndlovu (2019) found out that students have negative feelings regarding the Mathematics subject, however, the use of GCs lifted their fear of numbers and gained positive feelings that enabled them to solve complex problems. From time to time, tools are used and the pedagogical aspects of teachers are changed in order to meet the needs of the students. The use of calculators is one way of bridging the gap between the subject and the students. Mathematics has always been one of the most difficult subjects in the curriculum worldwide. Having interactive tools such as GCs can provide motivation for students to learn more and be confident in their mathematics class (Rodriguez, 2019).

Theme 4: Facilitative Role of the Teachers

All of the articles of the study highlight the importance of the teacher's role in the use of calculators in the classroom. The effectiveness of the implementation of this tool in the classroom is not independent of the teaching strategies of the teachers. As Gerren in 2008 described that the instructors play a vital role in initiating, promoting, and supporting student behaviors during integrated instructional activities which can lead to the establishment of graphing calculator use and related interactions as classroom norms. This notion was supported by the study of Horton et.al. in 2004 which indicated that the inappropriate use of calculators may cause students not to learn what they should and that teachers should observe and assess students' achievement carefully and consistently throughout their activities.

Introducing innovation in teaching requires that the teachers involved demonstrate a positive attitude towards the innovation because they play a crucial role in technology integration into instruction (Amanyi, et.al., 2016). However, in this same study in 2016, there were impeding hindrances on its implementation. The results showed that factors that the obstructions on the

use of calculator at the secondary level include the lack of calculator know how, lack of competence in using calculator, lack of skills in the use of calculators, teacher's phobia in calculator's usage, time factor as well as lack of confidence in calculator usage. Therefore, it is a must to equip teachers with the experiences and technical knowledge on the use of GCs to be integrated in the class. This will be the first step in the successful facilitation of GCs in individual classes of the teachers.

To summarize, the varying experiences of teachers and students in the use of GCs in the classroom had proved the underlying importance of the intercession of teachers towards the use of them. The importance of the teachers' role in this innovation paved the way for students to appreciate the use of GCs in their math class experiences. More so, a teacher can only give what they have. With this, the importance of training and field experiences of the instructors in the use of the GCs helped in the proper utilization that led to greater results in students' performance. As the study of Kandemir in 2019 highlighted, teachers having wide knowledge on the use of GCs was a feature liked by the students in class.

Theme 5: Excellent Aid for Better Comprehension and Representation

Several studies using GCs in mathematics instruction enhance students' abilities to solve algebraic problems in practical contexts, comprehend graphs, and demonstrate broad cognitive comprehension. As cited by Ndlovu & Ndlovu (2020), students who use GCs can have relative advantage while solving mathematical problems. Furthermore, students that use GCs consistently exhibit greater creativity, speed, and accuracy in their problem-solving techniques, as well as superior reasoning in their responses and better representation of graphs and abstract concepts. The use of a GC can also potentially improve learners' organization of written work, and the correct use of notation and symbols (Shahriari, 2019). Additionally, learners using GCs can consistently display more innovation, speed and accuracy in their problem-solving strategies as well as better reasoning in their answers and better visualization of graphs and abstract concepts (Ndlovu & Ndlovu, 2020).

The use of graphing calculators as cited by DeLoach (2013) may facilitate learning by increasing students' abilities to recognize and organize mathematical concepts in an abstract manner, leading to an increased level of understanding.

Towers (2018) also noted that in education, there are a number of technological tools that can be used in order to increase student achievement in mathematics: One of those tools is the use of the graphing calculator in the classroom. The graphing calculator is a tool which enables students to have the ability to supply answers with confidence in mathematics in both classroom instruction and assessment.

Theme 6: Increases Students' Cognitive Achievement

When it comes to increasing student achievement, there are numerous theories. Each individual has a unique sense of accomplishment, making success unique. The path to achieving this individual success is also unique to each person based on their unique life circumstances. Calculators help bridge the gap for students who struggle with mathematics. A calculator can not only be seen as an intervention for struggling students but also one for students who achieve success in mathematics (Doller, 2018).

Using a GC potentially raised learners' cognitive achievement in quadratic inequalities, in particular as they were able to observe the different representations connected to the concept. The varied representations (algebraic,

arithmetic, geometric, number pattern) of quadratic inequalities helped learners to gain insight into the big ideas in mathematics (Ndlovu and Ndlovu, 2020). According to Towers (2018), graphing calculator increased students' achievement in the all class models; that anticipated outcome occurred as was demonstrated by the scores on assessments. In mathematics, the role of computers and calculators as cognitive tools is the most useful in the development of thinking skills and for problem solving.

In the study of Tan (2012), findings showed that the use of GCs benefits students of all levels, that is, high, average and low mathematics achievers. Qualitative data provides a more lucid picture of how GCs aid in improving understanding and performance.

As cited by Ndlovu & Ndlovu (2020), several researchers report that the use of GCs in mathematics education improves learners' achievement in solving algebra problems in applied contexts, interpreting graphs and general cognitive understanding. In the study of Kandemir and Demirbag-Keskin (2019), graphing calculator program supported transformation mathematics instruction has made a meaningful difference in the academic achievement of students.

Meta-Theme: Exploration and Navigation on the Use of the Graphing Calculators

Graphing calculators are portable technological devices that are currently used in mathematics classrooms. The application of GCs in classrooms has proven to be a useful technological tool to enhance teaching and learning and as a result, improve students' mathematical understanding (Kissi, et.al, 2016). When technology, such as graphing calculators, is used effectively, it has been shown to improve student motivation, attitude, and achievement (Tan, 2012; & Rodriguez, 2019). Similarly, Dibble (2013) reported that students had a better attitude toward problem solving when the graphing calculator was used. GCs also provide an alternative way of learning for teachers to employ and students to undergo. It was proven to be advantageous because the multiple representation of a concept enhances clarity and understanding (Parrot & Leong, 2018). This emphasizes that calculators support students' learning through visual representations and making an abstract concept to be an observable one.

Integrating technology in the mathematics curriculum has become a necessary task for curriculum developers as well as mathematics practitioners across the world and time (Kharuddin & Ismail, 2017). In general research studies, seeking a better understanding of how best to integrate mathematics analysis tools with mathematics subject matter normally observe mathematics lessons to be taught in classrooms conducive enough for GCs to be integrated such as computer, science, or mathematics laboratories. Results of the study of Tan (2012) indicate that the GC instruction approach is an alternative to the conventional approach, especially in some topics of mathematics that involves understanding of concepts and tedious calculations.

The experiences of the students in this study mostly proved that GCs have the potential to affect the students' performance. Students appreciate the use of it in various situations that need complex computations. Moreover, GCs also promote visual learning and improved manipulative skills through the manual encoding of data. Graphs help students visualize the information and problems that they are solving. Hence, the integration of the use of GCs is much likely recommended in teaching and learning mathematics.

CONCLUSIONS

All aspects of life should adapt to cutting-edge digital technologies, but education should be a top priority. As technology advances, educators must adopt new teaching and learning strategies that include active, integrated real-world applications. Mathematics education is one of the areas where various forms of technology should be used because it helps to modernize the educational strategy and foster a more engaging and fascinating understanding of mathematical ideas. One application of technology is the use of graphing calculators in mathematics education. Handheld devices, particularly graphic calculators, have recently piqued the interest of math educators, curriculum designers, and teachers.

RECOMMENDATION

It is recommended the use of graphing calculators as a tool in teaching mathematics considering the proper supervision of teachers, without compromising the quality of learning. Also, providing enough training on the use of the graphing calculator especially to those who have not experienced yet on how to navigate the said device. Lastly, consider the offering of elective subjects which deal with the different technologies useful in Math teaching/learning.

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