Evaluation Studies in Social Sciences (ESSS)

eISSN 0128-0473 Vol 1/ 2022 (1-10)
https://ejournal.upsi.edu.my
DOI: https://doi.org/10.37134/esss.vol3.1.1.2022

A Conceptual Framework to Teach Primary Mathematics Using the Hybrid Collaborative Teaching Model in Malaysia

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Received: 28 February 2022; *Accepted*: 12 April 2022; *Published*: 28 June 2022

ABSTRACT

Recently, researchers have shown an increasing interest in flipped classroom pedagogical frameworks. This new paradigm flips the role of teachers and pupils in the classroom. Meanwhile, the recent pandemic has changed education dramatically with the distinctive rise of hybrid learning. Therefore, this study attempts to propose a new conceptual framework of how primary school Mathematics teachers collaboratively incorporate flipped classroom pedagogy in teaching Year Five Mathematics for hybrid learning. This paper discusses the literature review on the flipped classroom, collaborative teaching, and current teaching interventions during the new norm. The four main constructs supporting the conceptual framework are big ideas, tasks, tools, and talk. The new conceptual framework supports a hybrid collaborative teaching model for teaching Year Five Mathematics in Malaysia.

Keywords: *Hybrid Learning, big idea, primary school Mathematics, flipped classroom, collaborative learning*

INTRODUCTION

Mathematics acts as an essential tool for understanding the world (Haylock & Manning, 2019). Mathematics teachers directly affect how the pupils will solve problems and gain experiences in their life, for example, managing home expenditures, bank accounts, online or in-store shopping, dining out and so on (Lehmann, 2015). It is significant to motivate the pupils to enjoy learning it, understanding it, and making sense of Mathematics (Haylock & Manning, 2019). There are many methods to teach Mathematics, for example, the teachers can create a conducive environment in which the pupils are given opportunities to collaborate, explain, reason, and justify Mathematics using mathematical tasks. Effective Mathematics teaching involves posing the tasks that engage the pupils in understanding the mathematics they are expected to learn (Lehmann, 2015). Through exploration, problem-solving, communication, and practical experience, the pupils may build up their own mathematical ideas and their own strategies (Haylock & Manning, 2019). Moreover, they will learn to seek the relationship among mathematical ideas and feel empowered to use Mathematics in the real world (Haylock & Manning, 2019).

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Teaching Mathematics in today's classrooms can be challenging, but it also provides teachers with many thrilling chances to impart mathematical knowledge and skills to their pupils in diverse ways (Lehmann, 2015). Due to the COVID-19 epidemic, Malaysian schools were closed from 2020 to 2021, and pupils began an unexpected period of studying from home (Mohamad Nasri et al., 2020). Moreover, Mäkelä et al. (2020) reported that the inappropriate pedagogical preparation and technical issues will influence the quality of the learning from home. Fortunately, many researchers found out that flipped classroom (FC) is one of the effective ways to continue Mathematics education during this new norm (Cevikbas & Kaiser, 2020; Fernández-Martín et al., 2020; Fung et al., 2021; Strelan et al., 2020; Walker et al., 2021). However, Strelan et al. (2020) uncovered only three studies in the primary school level out of 198 studies in their systematic literature review. These results showed us a gap that there is still insufficient empirical data to support the implementation of the flipped classroom to teach Mathematics at the primary level. In addition, collaborative teaching among the teachers has not been fully explored and applied although many studies have proved its uniqueness and advantages in Mathematics education (Bature & Atweh, 2019, Robutti et al., 2016). In this paper, we aim to develop a conceptual framework to teach Primary School Mathematics using the hybrid collaborative teaching model in Malaysia.

LITERATURE REVIEW

Flipped classroom

The flipped classroom is also known as an "inverted classroom". It flipped the traditional classroom teaching by delivering the instructional contents by videos or tasks prior to the class and filling the in-class with various activities such as discussion and presentation (Erbil, 2020; Tang et al., 2020). Traditionally, the teachers introduce and explain concepts during class, and the pupils would practise and apply the concepts in their homework. With flipped learning, pupils would explore concepts by watching videos, reading articles, or carrying out the tasks assigned to them before class. The class interaction later involves discussion and active learning under the teacher's guidance. Walker et al. (2020) indicated that flipped classrooms can improve pupils' motivation in different educational settings based on much empirical academic research. Furthermore, Walker et al. (2020) suggested that in employing flipped classrooms, the teachers may more easily readily recognise low-performing pupils and cater to diverse ability groups. Cevikbas and Kaiser (2020) also pointed out that the flipped classroom (FC) is one of the contemporary innovative pedagogical approaches that are potentially useful to transform the teaching of Mathematics. A systematic review on the flipped classroom methods in Mathematics learning showed positive impacts on Mathematics achievement, student attitudes, and involvement in learning (Md Saleh & Siti Mistima, 2021). In brief, flipped classrooms (FC) can combine the use of technology in teaching and have the potential to enhance Mathematics teaching as well.

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Collaborative teaching

Teacher collaboration has been perceived as "*a continuum ranging from mere aggregates of individuals to strong team collaboration*" (Vangrieken et al., 2015). These vary from one-on-one or small group interactions within the school to inter-school collaboration to exchange ideas with other professionals (Darling-Hammond et al., 2017). Previous studies found that teaching in isolation constitutes an impediment to the teaching and learning process (Saka, 2021). In contrast, many positive outcomes of teacher collaboration were reported from pupils' level (improvement in understanding and performance), teachers' level (more motivated, decreased workload, improvement of teacher morale, greater efficiency, improved technological skills) to school levels (supportive school climate, professional learning culture (Vangrieken et al., 2017). We propose that the flipped classroom model is to be co-designed and implemented by Mathematics teachers, teacher trainees, officers, and teacher education institution lecturers with strong mathematical and pedagogical backgrounds in this conceptual framework.

Current interventions for teaching during this new norm

Research studies have revealed that Malaysian teachers put a lot of effort into teaching and learning approaches from home during the new norm by implementing various methods. Nurul Ashikin et al. (2021) reported that synchronous and asynchronous online class was largely implemented during the Movement Control Order (MCO) as Malaysia's households have access to the internet (90.1%) and smartphones (91%) (Strategic Communication and International Division, 2020). Google classroom was commonly used as an online platform (Ministry of Education, 2019b) and Malaysia was the number one Google Classroom user among 52 regions worldwide between March 18, 2020, to May 2, 2020 (Google Trends, 2020).

Other than a systematic Learning Management System (LMS), researchers have proposed that technology-based interventions can help the pupils to learn subject knowledge positively in this new norm such as using telegram applications (Ismail et al., 2021), WhatsApp applications (Harona et al., 2021), mobile applications (Abd Samad et al, 2021), learning via ZOOM, Google Meet, WebEx applications (Chung et al., 2020), YouTube channels (Musa et al., 2021), Educational TV (Nurul Ashikin et al., 2021) and so on. The aforementioned teaching interventions during this new norm have yielded promising results in contributing to the teaching and learning approach for the pupils.

However, Siti Baizura dan Nurfaradilla (2020) pointed out that one of the teaching challenges in this new norm is the difficulties in building up two-way communication effectively between the teachers and the pupils. The dynamic adjustment in education reshapes the educational approaches and strategies. Hence, we propose adapting a new conceptual framework to cater to the dynamic changes in teaching primary school Mathematics that incorporates the big idea (Askew, 2015) and the teaching tripod which includes three elements: task, tool, and talk (Askew, 2015) to the flipped classroom to fill up the gap.

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Conceptual framework

Big idea

The big idea in Mathematics teaching and learning is about the idea must be broad enough to connect various parts of Mathematics, but it is still in a bounded area (Askew, 2019). Additionally, Askew (2019) further explained that using the idea involves a longer period spent in school as the pupils can recall big ideas clearly. Although the ideas will evolve, there will be a core of commonality around which learning can be built. Working within big ideas is a way of coping with classroom diversity and being inclusive; all pupils can be engaged in thinking about a great idea, but at different developmental levels (Askew, 2019).

Putting it into our context, we propose a big idea with an emerging theme of learning Mathematics through career exploration. The theme was carefully selected to connect the pupils' mathematics content and learning skills learning to the real world. There are three main topics included in these themes: junior architects, junior entrepreneurs, and junior data analysts (see Figure 1).

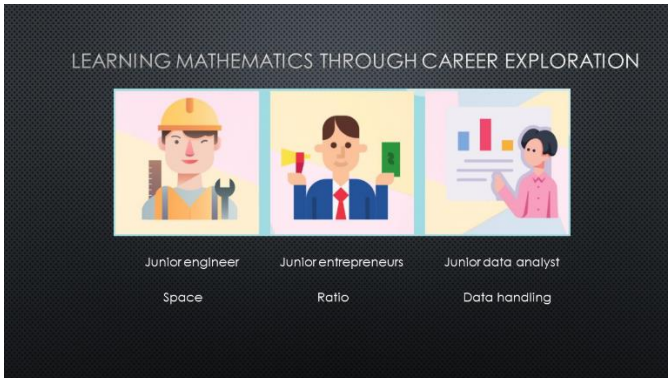

Figure 1. Big idea: Learning Mathematics through career exploration

The first topic is about junior architects which focuses on teaching the topic of space (regular polygons; angles; perimeter and area; the volume of solids and problem solving). The pupils play the roles of architects to observe and identify buildings with different polygons in the real world, state the characteristics, measure angles, and design building models by determining the perimeter, area, and volume based on the tasks given. The second topic is junior entrepreneurs, which covers the topic of coordinates, ratio, and proportion. The pupils are given the chance to play the roles of Cafe owners to choose the most strategic location (applying coordinates), design their drinks (using ratio), and plan their interior set-up (applying proportion). The last topic is junior data analysts which covers the topic of data handling. The

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pupils play the roles of data analysts who calculate the weekly sales and profits in a restaurant to make wise decisions about operating hours and choice of menus based on the collected data.

Teaching Tripod

Askew (2015) argued that teaching Mathematics requires a careful combination of preparation and improvisation. After developing the big idea, we embedded the teaching tripod: task, tool, talk to the mechanism framework to implement this big idea and impart the mathematics knowledge and skills which are underlined in the Curriculum and Assessment Standard Document (Bahagian Pembangunan Kurikulum, 2019). The Mathematics Curriculum Framework for Primary school takes into consideration four important elements: Learning Area; Attitude and Value; Mathematical Skills and Mathematical Process.

The task in teaching Mathematics

Tasks are central to Mathematics lessons, and they embody the relationship between teaching and learning (Askew, 2015). We try to create tasks that motivate pupils to think logically, use different strategies to solve the problems, and promote their reasoning skills. Our tasks aim to engage the pupils to build their mathematical confidence, curiosity, and a have-a-go attitude toward learning Mathematics. There are differences between Mathematics activities and mathematical tasks. Mathematics activity provides explicit instructions that the pupils must follow, which may lead to short-term success, but not long-term learning. For example, pupils are asked to follow the instruction to fold the paper into four parts and label each part with one quarter. For mathematical tasks, pupils are asked to compare, reason, and interpret the answers and deepen their mathematical understanding and concepts as well. For instance, pupils are asked to use the knowledge of coordinates to find the treasures on a map. Supporting videos are given with the task to scaffold the pupils' learning about the concept of coordinates concepts. In addition, a task that requires the pupils to choose the most strategic location engages the pupils' higher-order thinking skills as well as communication skills to explain and justify their answers.

Tool

Effective teachers design tools to promote pupils' learning. Manipulative tools and digital tools are useful to explain mathematical concepts to the pupils (Askew, 2015). Within the framework, a variety of tools was designed and incorporated in the pre-lesson tasks as well as the synchronous virtual lessons. For examples, digital manipulative tools, Google Earth, Microsoft Excel, Applications to measure angles, video recordings, and other alternatives suggested by pupils after their exploration.

There is a general statement about the importance of models and pictures in helping the pupils understand Mathematics, but there is a lack of clarity regarding why they are important and how to use them (Askew, 2015). Askew (2015) further indicated that models and pictures are

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useful when someone is using them as tools to explain the mathematical concepts to the pupils and support the pupil's mathematical tasks. On the other hand, we distributed the tasks to the pupils, then asked them to complete the tasks by video recording and sending them back to us using Google Form. Hence, the teachers collect all the relevant pupils' works as pictures and models, then the teachers present pupils' interpretations and explain the mathematical concepts and misconceptions through the YouTube channel.

Talk

Mathematical meaning emerges through giving voice to tasks and tools (Askew, 2015). When we discuss about a talk, it includes listening and speaking skills as well. Askew (2015) states that pupils need to be active listeners, engage with the Mathematics tasks, build connections with their own mathematical voice and construct sense-making. Putting into our context, the tasks are designed to let the pupils explain their answers and present their ideas through video recordings. The one-way talk extends to many ways of interaction during the virtual live lesson. Listening and speaking skills are well-established while the teachers conduct live lessons through YouTube Channel and the pupils can interact with the teachers by texting in real-time. Therefore, two-way dialogue can happen through which mathematical ideas are inspired, in-ordered, and expressed until the collective understanding is properly established. Dialogue has a different meaning to mathematical learning. It is not about trying to debate or trying to impose one's view upon the other. It is more about an exchange of views, an attempt to understand the other better. In our context, the pupils are given chances to express and reason the way they get the answer online so that other pupils can learn other's alternative methods. When the pupils react to and consider one another's methods, it is likely that a dialogue emerges about the relative advantages of various methods that are more effective, rather than merely if just whether they are correct in answering the questions.

DISCUSSION AND CONCLUSION

This contemporary study has developed a new conceptual framework that aims to teach Year Five Mathematics to the pupils through hybrid learning during this new norm (see figure 2). The conceptual framework is developed based on Askew's (2015) big idea and teaching tripod which consists of three elements such as tasks, tools, and talk.

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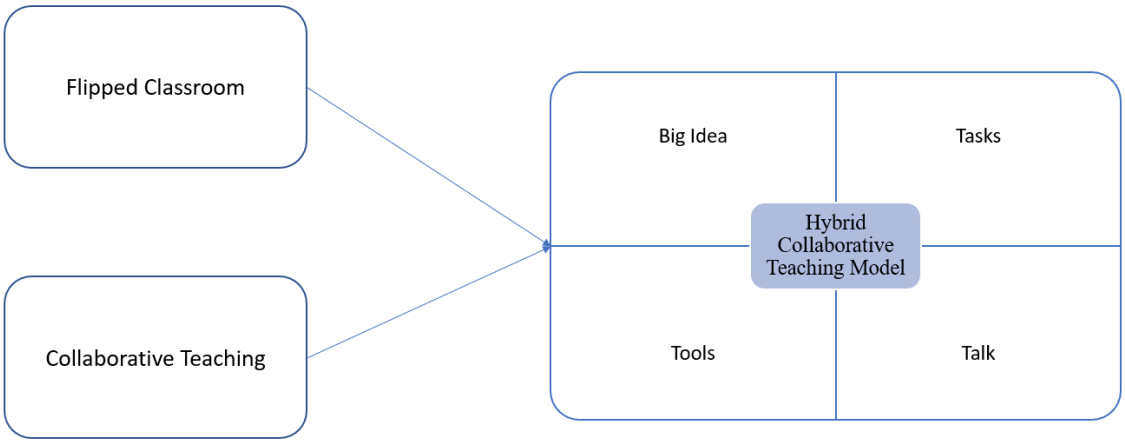

Figure 2. Conceptual framework for hybrid collaborative teaching model

The design for the teaching and learning process involves Mathematics teachers, teacher trainees, education officers as well as lecturers from teacher education institutions. They work in collaboration to brainstorm and design the learning plans based on the Standard Document of Curriculum and Assessment before creating the learning materials and tools. The benefits of teacher collaboration such as changes of knowledge, thinking and beliefs are obvious as pointed out by Jaworski et al. (2017). The prototype was validated, and a pilot study was carried out to check the feasibility of the learning process. Tasks were planned and distributed to the pupils throughout the countries through participating school teachers. Pupils are asked to complete the tasks and submit them to the provided Google Classrooms which were created earlier on. Teachers looked through the pupils' work which was collected within two weeks through a Google Form. These tasks aim to develop the pupils' thinking skills such as problem-solving skills, making decisions, comparing, analysing and so on. This aim is parallel to Askew's (2015) proposition that teaching and learning Mathematics should focus on mathematical reasoning as well as Çelik & Özdemir's (2020) finding which shows that mathematical thinking is the predictor of critical thinking dispositions.

Next step, the teachers will select some of the pupil's work and present it live through a YouTube channel. Similar to Askew's (2015) point of view, the models and pictures are functional when the teachers utilise them as tools to explain the mathematical concepts to the pupils and support pupils' mathematical tasks. During this teaching step, teachers aim to point out the mathematical concept and misconceptions to the pupils. This requires teachers' competency in pedagogical content knowledge (Mishra, 2020). Lastly, talks will be well-established while the teachers teach live via YouTube Channel and pupils can text in real-time with the teacher.

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Limitation of the study

A limitation of this study is that this current conceptual framework was piloted using Mathematics Standard Document for Curriculum and Assessment (*Dokumen Standard Kurikulum dan Pentaksiran*) of National-Type School or Vernacular schools (*Sekolah Jenis Kebangsaan*) Primary School Year Five. Thus, the scope of study may be limited in terms of types of school and levels. Since the analysis showed positive outcomes from the quantitative and qualitative findings (not reported in this article), further study could explore on the feasibility and efficacy of this hybrid collaborative teaching model in National School (*Sekolah Kebangsaan* or SK) and for other years (besides Primary School Year Five). Despite its exploratory nature, this study offers some insight into future teaching approaches which involve all practitioners from distinct levels in education to co-design and co-develop learning activities and assessments through diverse ways of leveraging the technology.

To summarise, this new conceptual framework is one of the potential ways for primary Mathematics education through a collaborative effort among educators in the new era even after the pandemic. More importantly, it changes the paradigm and encourages educators to think differently about educational delivery.

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