

Technology Integration Practices of Grade 7 Mathematics Teachers in the Delivery of Mathematics Instruction

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Abstract— This is a qualitative descriptive study focused on technology integration practices of Grade 7 mathematics teachers in mathematics instruction. More precisely, the study identified the tools of technology employed by teachers, examined instructional functions of the tools and described teachers' instructional practices through the SAMR framework. Seven Grade 7 teachers in selected public secondary schools in Sorsogon Province served as the participants through purposeful sampling. Data were collected through open-ended survey questionnaires and document analysis of validated lesson plans. Teachers were found to use common tools like power point presentations and with hyperlinks, Kahoot!, Mentimeter, and Geogebra for content delivery, student interaction, visual representation of concepts and for diagnostic and formative assessment. Teachers most of their instructional practices belonged to Substitution and Augmentation levels while there were minimal applications at the Modification and Redefinition levels. The study also showed that gamified quiz platform and interactive mathematics software improve student's engagement, interaction and understanding. However, insufficient number of computers and limited internet access, limited number of available technologies and inadequate trainings provided as constraint to more in-depth technology integration. Strengthened technology infrastructures and context-based training programs were suggested to improve student centered math instruction.

Keywords— Mathematics Instruction, SAMR Model, Technology Integration, Technological Tools.

INTRODUCTION

In the current educational environment, mathematics teaching need structures to help teachers effectively utilize various digital tools. Intelligent use of technology in education means more than tool substitution; it creates student-centered learning, narrow deep learning disparities, and develops 21st century thinking. For junior high, particularly for Grade 7, introduction of secondary math involves abstract and conceptually complex subject matter that requires strong pedagogical strategies for effective conceptual learning, mental stimulation and student perseverance for problem-solving. However, pedagogical transformation seems to be elusive since classroom situations tend to reveal considerable impediments ranging from under-utilization of the tool to poorly integrated technology environment. Consequently, exploring the actual technology integration in teaching practice by Grade 7 math

teachers would allow us to get closer to knowing how the classroom environment can be revolutionized by technology.

In contemporary mathematics learning, there are a number of digital learning tools that influence the students' cognitive and affective development. The available academic papers suggest that different digital tools (such as dynamic geometry and algebra software, online tests and intelligent tutoring systems) are useful for secondary school students, and they all have significant, positive effects on the students' learning achievements. In actual practice, the use of multimedia tools, presentation software with interactive features such as links and embedded games, and online response systems is widespread in classroom learning to set a baseline for active learning. The use of such digital tools opens possibilities for interaction problem-solving (Hillmayr et al., 2020; Omer et al.,

2025), as students may investigate properties of geometrical shapes and algebraic variables simultaneously by dynamic tools as they create an environment of interaction through real-time animation, for example when they study geometrical shapes and variables together in dynamic tools to explore geometric concepts and abstract ideas in the form of visual presentations.

The success of these digital tools is contingent on their structured inclusion into curriculum instruction. The Substitution, Augmentation, Modification, and Redefinition (SAMR) model provides the road map of the progression of technology integration through four stages: Substitution, Augmentation, Modification, and Redefinition (which range from using technology for enhancement of traditional methods of instruction to its use for fundamental transformation of the learning experience). Substitution and Augmentation-the Enhancement stages of the SAMR model-utilize tools in simple ways, such as transposing paper to digital form, playing a video lecture, or running a straightforward series of instructions. Transformation requires that teaching approaches shift from delivering information toward inquiry-based methods of facilitating student learning. It is with this deeper use of technology that, according to the high-indexed literature, educators must integrate pedagogical and technological knowledge along with subject matter expertise to harness the pedagogical benefits of technology, as illustrated by TPACK. Instructional models such as this facilitate interactive modeling and individualized instruction.

Behind the integration of technology into the mathematics classroom there lies the following instructional and pedagogical aims. First, technology acts as an imperative element in the visualization and understanding of concepts, students are able to create a concrete spatial understanding of the 3D shapes and dynamic processes that will facilitate the closing of the conceptual gap by creating the visual context that is indispensable for many students' understanding. Second, technology implementation has been motivated by increased motivation and task engagement. Through gamification and interactive multimedia what would normally be rote exams

becomes data-driven contests to increase interest and minimize anxiety. Last, it has allowed for increased opportunities for formative assessment and real-time feedback, software such as Kahoot! Or Mentimeter instantly provides the instructor with real-time results and feedback enabling a data driven pedagogical approach, preventing grade repetition and reaching struggling or under-performing students.

Apart from these documented pedagogical advantages, school mathematics teachers face grave structural and intrinsic challenges which impede systematic integration. Across the globe and locally, teachers' digital proficiency and beliefs play significant roles; Thurm and Barzel (2022) emphasized that a teacher's self-efficacy determines how the tool is used in practice; a tech-comfortable teachers may just integrate digital tools as a way to enhance or simplify rudimentary presentation elements of a lesson. Indeed, Courtney et al. (2022) identify technology integration in the classroom as a means that could unintentionally increase students' distractions and further exacerbate existing digital divide without diligent control. At the institutional level, inherent barriers of teachers' lack of preparation time, lack of constant professional development regarding more sophisticated software, volatile internet access and lack of technology in schools remain entrenched barriers

Although existing literature has been robust in detailing the effects of digital tools or local software independently, there is a specific niche in research literature that needs to be addressed concerning the interlocking of various pedagogical frameworks in directing daily mathematics instruction. Studies of models like SAMR or TAM will often examine the entire model as separate from anything else, solely observing what the final output of the task looks like rather than what the real classroom setting is like. Therefore, addressing the gap that exists in interdisciplinary integration of knowledge in educational technology studies, this research examined how Grade 7 mathematics teachers implemented technology using an integrated model derived from the SAMR, TPACK, and UTAUT models to explore their usage of technological tools, the extent of their implementation, their intended

purposes for these tools, and their exact implementation obstacles to build empirical evidence to design contextualized, learner-centered technological models that educate contemporary students for a technology-rich environment.

METHODOLOGY

A qualitative descriptive research design was used in this study to examine how Grade 7 mathematics teachers implement technology in the teaching and learning process. This qualitative descriptive research was suitable as it aimed to collect clear and detailed description of what and how Grade 7 mathematics teachers implement technology. Seven (7) Grade 7 mathematics teachers from public secondary schools in the second district of Sorsogon Province participated in this study. These teachers were selected through purposive sampling because of their experience in teaching Grade 7 Mathematics and their usage of technological tools in teaching. The instrument that was used was the researcher-made open-ended survey questionnaire and the document analysis of the teachers' lesson plans. Through the questionnaire, participants described the technology they use, why they use technology, and what challenges they encounter. Through the analysis of lesson plans, the extent of technology integration and how it was used in teaching were observed. The SAMR model: Substitution, Augmentation, Modification, and Redefinition, was used as an analytical framework. The tools were classified according to the level of technology integration as prescribed by the SAMR model through content analysis. Likewise, thematic analysis was done to identify the common themes of teachers' pedagogical practices, the classroom practice, and student engagement and teachers' implementation of technology. The participants' answers in the questionnaire and lesson plan were compared and contrasted through triangulation of sources. During data gathering, the researcher ensured all ethical considerations such as gaining authority's and participants' permission, maintaining participants' anonymity and confidentiality were followed.

RESULTS AND DISCUSSION

Technological Tools Utilized by Teachers in Mathematics Instruction

Content Delivery

The results indicated that the use of PowerPoint, PowerPoint with Hyperlinks, Kahoot!, Mentimeter, and GeoGebra were the most frequently used tools by Grade 7 mathematics teachers when conducting mathematics instructions. In which, the PowerPoint is the most popular used technology by teachers. PowerPoint were used to deliver concepts, definitions, examples, instructions, and games during class discussion and motivation.

From the results it could be observed that the teachers used technology for structuring the lesson as well as enhancing the presentation. Some interactive PowerPoint were developed and used to make the learner's schema more active, as well as make the learner's response increase to such activities like "Hulaan Mo" and "Squid Game." The use of PowerPoint with links also makes the transitions of lessons between the PowerPoint itself, practices, and answer keys more direct and the use of time become more productive.

According to Papadakis et al. (2021) the use of the digital presentation tool also promotes cognitive offloading whereby learners were able to spend more time on reasoning and on building conceptual knowledge rather than copying the teacher's instructions on the board. Similarly, Trouche et al. (2020) states that presentation tools act as a fundamental mediating device. The presentation tool act as an initial scaffolding for the use of more sophisticated digital tool.

Gamified Assessment and Student Engagement

There is an increasing trend in the implementation of interactive and gamified assessments where the integration of Kahoot! Reflected a tendency to move away from traditional assessment methods. Kahoot! Is mainly employed for formative assessments where students' level of comprehension was assessed with immediate feedback, and their enthusiasm for the assessment practice boosted with competitive quizzes.

It seems that gamified digital assessment could facilitate the providing of feedback in a real-time setting, and raise students' engagement and motivation with cooperative learning styles and competitive challenges.

The use of Kahoot! Has actually moved the traditional paper-based testing toward an interactive technology-based assessment in order to help teachers immediately spot out students' difficulties and misunderstandings in classroom. In consistency with the argument of Wang and Tahir (2020), they noted that the platform for the game-based assessment enhanced student motivation and engagement and gave the immediate formative assessment.

Also, Mentimeter was used as a medium to encourage students to participate and to share their ideas on certain issues anonymously. As a result, interactive response systems encouraged students' interaction in the classroom and also promote an inclusive and more active classroom environment among hesitant and timid students. Similar conclusions have been obtained from the investigation carried out by Pichardo et al. (2021), where Mentimeter significantly improved engagement and participation in the classroom.

Conceptual Visualization through Dynamic Mathematics Software

GeoGebra was found to be an effective tool in helping teachers with visualization and with inquiry-based mathematics instruction. Teachers made use of the software to create visuals of graphs, transformations of geometry, and 3D dynamic models in which students were able to manipulate variables and observe the related concepts in real time.

The results showed that dynamic mathematical software leads to a deeper conceptual understanding because it makes mathematical concepts tangible. Students were able to discover mathematical relationships through interaction with the models they created; they developed higher inquiry skills and spatial skills because they had been able to move the models on their own.

This is consistent with the work of Uwineza et al (2023) which concluded that dynamic mathematical software facilitates instrumental genesis: the digital tool becomes an embodiment of the students' mathematics; while Weigand et al (2024) reported that visualization technologies enhanced secondary students' spatial reasoning and conceptual understanding.

Levels of Technology Integration Based on the SAMR Model

Examination of lesson plans revealed most teachers were working at the Substitution and Augmentation levels within the SAMR framework. Substitution activities in this class took a PowerPoint presentation in direct place of chalkboards or printed materials such as charts and diagrams to allow for better visual arrangement and efficient classroom flow; but it did not alter learning tasks. Augmentation activities did provide a functional addition; teachers used links to embed information, but a teacher could have provided that information from notes, or, the ability to respond via an electronic survey like Mentimeter provided a quicker classroom management strategy and student interaction option. Most lessons, if Transformational integration was evident, were only found at the Modification or Redefinition levels. Kahoot! is an example of Modification, allowing for transformation of traditional multiple-choice questions to a team-based, competitive, interactive format, while GeoGebra is an example of Redefinition, enabling the learning of math content and skills that would have previously been impossible without a computer such as creating interactive models. The results indicate teachers continue to use technology in math education to enhance learning rather than for transformation and increased opportunities for student creation and collaboration, highlighting the need for increased professional development on transformative and student-centered learning environments.

Challenges in Technology Integration

Although teachers reported understanding the positive implications of integration with technology, there were many impediments that stood in the way of transformative teaching practices. These were inadequate internet access, lack of personal

computer/device ownership among the students, inadequate technology infrastructure in the classrooms, and inadequate teacher professional development regarding the advanced digital tools.

These findings are consistent with the research done by de Freitas & Spangenberg (2020) where limited resources for the implementation of ICT and lack of training for the teachers stood as key impediments in mathematics classrooms.

CONCLUSIONS AND RECOMMENDATIONS

The study established that Grade 7 mathematics teachers consistently use a range of technological tools to help them in lesson delivery, classroom interaction and assessment and visualization of concepts. Kahoot! PowerPoint Presentations, Mentimeter, and GeoGebra were found to be the most frequently used technologies in mathematics teaching.

Most of the instructional practices fell within the Substitution and Augmentation levels of the SAMR framework, suggesting that technology was mainly used to augment rather than fully transform traditional instructional methods. But the use of gamified assessment tools and dynamic mathematics software showed the power of technology in fostering student engagement, collaboration and conceptual understanding.

From the study, it was also concluded that poor technological infrastructure, non-existent connectivity and lack of digital resources and the lack of appropriate teacher training are still hindering the use of transformative technology. In fact, the identified challenges experience by teachers in integrating technology prevent them from accessing the pedagogical potential of complex technological solutions.

Based on the findings of the study, it is highly recommended to both policy makers and educational institutions to promote professional development programs for teachers to enhance transformative technology use in mathematics education. Institutions should also build a sound technological infrastructure with proper internet access and the availability of

sufficient digital resources. Lastly mathematics teachers should be persuaded to build further student-centered and inquiry based digital learning environments beyond augmentation-level technology use.

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