

## *Original Paper*

# Utilization of SAMR Model in the Delivery of Mathematics Instructions in the New Normal Learning Environment

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### **Abstract**

*The purpose of this study is to assess the utilization of SAMR model in the delivery of mathematics instruction in the new normal learning environment. Specifically, it assessed the utilization of SAMR Model on the delivery of mathematics instruction in the new normal learning environment by both students and teachers in terms of substitution, augmentation, modification, and redefinition; determined significant difference on the utilization of SAMR Model on the delivery of mathematics instruction: identified the problems encountered in the utilization of SAMR Model in the teaching and learning of mathematics; and proposed recommendations to maximize the utilization of the integration of SAMR Model in the promotion of digital literacy in the teaching and learning of mathematics. Descriptive method was used and 235 randomly selected teachers and students of mathematics during the second first semester of SY 20201-2022 participated in the survey. Questionnaire which was administered using Google Forms served as the main data gathering instrument. Results of which was organized and statistically treated using weighted mean and t-test. Results revealed from both students and teachers that substitution, augmentation, and modification were frequently utilized while redefinition was sometimes utilized. There is significant difference on the respondent's assessment on the utilization of SAMR Model in terms of substitution but no significant difference in terms of augmentation, modification, and redefinition. The expressed recommendations were believed to help in the utilization of substitution, augmentation, modification, and redefinition in the teaching and learning of mathematics.*

### **Keywords**

*mathematics instruction, new normal learning environment, SAMR Model*

## 1. Introduction

Mathematics is a subject area that needs careful introduction and set to be realized by the learners to have a great foundation to enable the learners to track what they know and what they must apply. During the time of unforeseen events where mathematics instructions cannot be delivered face to face, use of available technology to be able to continuously deliver the instruction is inevitable and a must. Thus, mathematics instruction with the integration of technology in the new learning environment is the primary task of every mathematics teacher. It is in this context that mathematics teachers and learners must be familiar with the use of latest applicable technology. Efforts for revamping mathematics instruction originally introduced by the Education Act of 1892 emphasizing the right of every individual to relevant quality education (Article XIV Section1). According to this act, Filipino students have the right to quality education. They expect a relevant curriculum, a school environment that enhances the learning process, adequate resource and learning materials, appropriate teaching methods and strategies, committed teachers and staff, and a support system.

However, Filipino learners are still in the silver lining when it comes to mathematics literacy. This downtrend performance of Filipino learners in mathematics was confirmed by the result of the 2015-2016 Global Competitiveness of World Economic Forum Report, which showed that the Philippines ranked 67th of 140 countries in quality of math and science education and the result of Program for International Student Assessment (PISA) 2018. The downward slope of proficiency in mathematics to the point that it is noticeable even among college students are challenges not only for students but for the teachers as well especially during the new normal. For this matter, instruction along this discipline is not only the goal but also the ultimate function to continue schooling in whatever scenario happens. In this case, Mathematics instruction with the integration of technology is the most challenging situation in the field of education as to its mastery of competencies; thus, it requires a lot of planning, organizing, leading, and controlling from the teacher themselves. This case scenario was observed during pre-pandemic and much more is expected during pandemic.

Teaching mathematics is experiencing strange changes that every school has a big problem on how to manage mathematics instruction in the new normal like an authentic learning assessment befitting tools for learners and the teacher's attitude and competency. It is generally accepted that the quality of learning will depend on the quality of teachers, hence, a policy required the proper selection of mathematics teachers who possess quality and competency for the job. The failure of mathematics teachers to deliver that expected task will signify the quality of citizens in the future. The task of the mathematics teachers is to make meaningful learning. As such, they have to plan properly, select the appropriate technology for instruction and evaluate the assessment tool to be used for the learners and also, they are expected to create a learning environment condition and climate with is conducive to learning. This reality was confirmed by Elis (2017), that teaching mathematics is crucially faced with a challenge and it needs to be taught with proficiency and sophistication which can only be possible in the new normal with the

integration of technology. It is surprisingly to note that with the emerging use of technology in mathematics it is evident that college students performed better in their mathematics courses as shown by their final rating. Here the gap between the learners' difficulty of mathematics and teachers' presence seems to be filled by the use of appropriate technology. Thus, the study was pursued with the end in view to assess the delivery of mathematics instruction in the new normal learning environment using a technology-based model. One of the powerful conceptual tools about technology integration is the SAMR Model, developed in 2010 by education researcher Ruben Puentedura. The SAMR Model lays out four tiers of online learning. Presented roughly in order of their sophistication and transformative power: substitution, augmentation, modification, and redefinition. SAMR Model is about being aware of the range of options and picking right strategies for lesson at hand. It's a toolbox and the goal aren't to use the most sophisticated tool, but to find the right one for the job. More importantly, it's a way to reflect on the technology integration by thinking how the lesson may be improved using technology and can teachers can empower students through technology to make online learning closely resemble authentic real-world learning. Moreover, SAMR model is believed to help educators think about the role of technology in supporting learning. It will support and enable the teacher to design, develop, and infuse digital learning experiences that utilize technology with the end in view of transforming learning experiences that will result in higher levels of achievement for students.

It is in this light that the study was conceptualize. Result of which will be used to propose strategies that will fully utilize the integration of SAMR Model in the promotion of digital literacy in the teaching and learning of mathematics.

## **2. Objectives**

The purpose of this study is to assess the utilization of SAMR model in the delivery of mathematics instruction in the new normal learning environment.

Specifically, it aims to do the following objectives: to assess the utilization of SAMR Model on the delivery of mathematics instruction in the new normal learning environment by both students and teachers in terms of substitution, augmentation, modification, and redefinition; to determine significant difference on the utilization of SAMR Model on the delivery of mathematics instruction in the new normal learning environment as assessed by the two sets of respondents; to identify the problems encountered by both students and teachers in the utilization of SAMR Model in the teaching and learning of mathematics; and to express recommendations that will help in the utilization and integration of SAMR Model in the promotion of digital literacy in the teaching and learning of mathematics.

### 3. Methods

Descriptive method was used. Since the present study dealt with the mathematics instruction in the new normal learning environment the researcher believes that this design is deemed appropriate. The respondents of the study were the randomly selected students and teachers in the College of Accountancy Business Economics and International Hospitality Management who took their Mathematics in the Modern World course during the first semester of SY 2021-2022.

The study used survey questionnaire, as data-gathering instruments that were subjected to validation using Cronbach alpha and a reliability index of .972 were found which indicates excellent consistency of the instrument (George and Mallery, 2003). This researcher made questionnaire with a 4-point scale rating which was administered using Google Forms served as the main data gathering instrument. Results of which was organized and statistically treated using weighted mean and t-test.

### 4. Results

Based on the results of the data gathered, it was found out in Table 1 that in terms of substitution, a kind of technology that act as direct substitute with no functional change (Puentedura, 2010), it was revealed that the mathematics teachers frequently or almost always

**Table 1. Assessments on the Utilization of SAMR Model on the Mathematics Instruction in the New Learning Environment in terms of Substitution**

Items	Weighted Mean	Weighted Mean
	Students	Teachers
1) use laptop to prepare lecture notes, assignments, and examinations	3.29	3.72
2) utilize PowerPoint presentation method to deliver lectures	3.21	3.53
3) communicate to the students using yahoo mail when they have inquiry about the lesson	2.34	2.57
4) refer students to electronic databases for reference materials instead of hard copy textbooks.	2.52	3.71
5) communicate with students using cellphone when they have clarification about the lesson	3.56	3.57
6) prefer students to submit their course work assignments through Gmail	2.06	2.92
7) communicate with the students through social media such as Facebook, Twitter, chat rooms, discussion boards, etc. to clarify the lessons	3.47	3.44

8) administer multiple-choice questions for tests/examinations through a Web APP to avoid heaps of paper to mark	2.26	2.95
9) take video/audio recordings of my lectures and use them in subsequent years to teach the same course to another cohort of students	2.32	2.85
10) use the Internet Explorer in mathematics teaching for general reference	3.12	3.21
<b>Composite Mean</b>	<b>2.81</b>	<b>3.25</b>

*Note.* Legend: 4.00-3.50-Always, 3.49-2.51-Frequent, 2.50-1.50-Sometime, 1.49-1.00-Seldom.

Utilize substitution in their teaching of the course as shown by the composite mean value of 2.81 from the students and 3.25 from the teachers. This means that they saw that their teachers are engaging themselves in the use of technology as a direct tool in the delivery of instruction to replace the traditional approach. This was validated by the result which exposed that the teacher communicates with their students using cellphone when they have clarification about the lesson (3.56), and 3.44 from their teachers aside from their efforts to communicate with the students through social media such as Facebook, Twitter, chat rooms, discussion boards, etc. (3.47) which was also confirmed by the teachers as shown by the weighted mean value of 3.44. These teacher efforts find support from Alberta (2011), which confirms that mobile devices not only eradicate many of the access issues, but it also provides evidence of enriched learning instantly. This is a strong manifestation on how used of technology find support in learning which for Stosic (2015) also explicitly pronounce the role of using educational technology in teaching as of great importance.

Table 2 revealed that in terms of Augmentation, a kind of technology that act as direct substitute with functional improvement (Puentedura, 2010), result tends to show that their teacher is frequently or almost always utilizing augmentations in their teachings of mathematics as revealed by the composite mean value of 2.76 and 2.85 from the teachers themselves. From the result it is still evident that they always used search engines like Google to look for vital

**Table 2. Assessments on the Utilization of SAMR Model on the Mathematics Instruction in the New Learning Environment in terms of Augmentation**

Items	Weighted Mean	Weighted Mean
	Students	Teachers
1) use search engines like Google to look for vital research content in discipline.	3.26	3.26
2) use MS Excel in math worksheet to correct errors in any document	3.13	3.12
3) use Wikipedia to make meaning of the words/phrases that I do not understand	3.10	3.15
4) use digital libraries as a source of useful content for lectures	2.84	2.92
5) use Internet group lists to contact students in matters related to their academics	3.00	3.00
6) use Merriam Webster app in find mathematics word synonym	2.28	2.39
7) encourage students to use Microsoft word to accomplish group assignments/course work	2.34	2.67
8) use bulk messaging to contact students in matters related to their academics	2.78	2.87
9) subject scholarly work to a plagiarism test using plagiarism detection software	2.10	2.35
10) use different you tube videos to illustrate different case studies during lectures	2.75	2.77
<b>Composite Mean</b>	<b>2.76</b>	<b>2.85</b>

*Note.* Legend: 4.00-3.50-Always, 3.49-2.51-Frequent, 2.50-1.50-Sometime, 1.49-1.00-Seldom.

Research content in discipline as revealed by the weighted mean value of 3.26 from both the students and teachers. This result could be attributed to the fact that majority if not all uses the world wide web to look for information. This fact was verified by Ashman et al. (2018), when they found out that Google is the most popular search engine among students not only among undergraduate students, but also doctoral students who depend on Google as their primary source of academic information. This expressed used of internet is one of the most powerful educational tools for teaching and learning Deore (2012).

It was also evident that teachers always used of MS Excel in math worksheet to correct errors in any processed document as shown by the weighted mean value of 3.13 from the students and 3.12 from the teacher themselves. This result can be attributed to the fact that MS excel is commonly used tool in Mathematics since it is widely available and relatively easy to use. In fact, according to Chaamwe et al. (2016), they found out that Microsoft Excel is a powerful that can be used to teach subjects like

Statistics in Mathematics. They agreed that the use of tools like MS Excel in the delivery of Statistics lessons enhances the understanding of such subjects. In addition, Zheng et al. (2016) reiterated that discovering teaching and learning tools save time, contribute to learner achievement and help motivate teachers to learn more about effective uses of technology.

Revealed in Table 3, modification, which is define as the technology that allows for significant task redesign (Puentedura, 2010), it was revealed that their teachers were frequently utilizing it as shown by the composite mean value of 2.51 which was confirmed by the teachers themselves based on the result of composite mean value of 2.69. It was also revealed that their teachers ask them to use Google Forms to encode their solution in the derivation of the formula for quite sometime as shown by the mean value of 2.06 from the students and 2.49 from the teacher themselves. Results tend to show that in spite of the world-wide utilization of the different forms of online tools from the point of view of the students and their teachers as well they admittedly fall short in maximizing the benefit task redesigning brought about by the recent

**Table 3. Assessments on the Utilization of SAMR Model on the Mathematics Instruction in the New Learning Environment in terms of Modification**

Items	Weighted Mean	Weighted Mean
	Students	Teachers
1) use open educational resources	2.81	2.88
2) teach math lessons using Blackboard Collaborate	2.00	2.31
3) use BlueJeans Meetings software in teaching Math	2.22	3.38
4) use WeChat to communicate with students	3.39	2.40
5) use online assessment tools to rate the students' performance	2.41	3.38
6) use Cisco Webex Meeting to deliver lectures	2.36	2.72
7) share Math worksheets using Microsoft Outlook	2.27	2.51
8) ask students to collaborate and create their own worksheets to be shared in their Facebook group	2.25	2.48
9) ask students to create a set of interactive notes that include pictures, weblinks, and video that supports their works	2.29	2.38
10) ask students to use Google Forms to encode their solution in the derivation of the formula	2.06	2.49
<b>Composite Mean</b>	<b>2.51</b>	<b>2.69</b>

Note. Legend: 4.00-3.50-Always, 3.49-2.51-Frequent, 2.50-1.50- Sometime, 1.49-1.00-Seldom.

Technology development. As a matter of fact, An et al. (2018) confirms that Google Forms as a free online tool can be used in the classroom to improve students' participation, engagement and evaluation of teaching and learning. Moreover, it is user-friendly, easy to administer, and helps the teachers save paper and time grading assignments.

Shown in Table 4, redefinition, a kind of technology that allows for the creation of new task previously inconceivable (Puentedura, 2010).

**Table 4. Assessments on the Utilization of SAMR Model on the Mathematics Instruction in the New Learning Environment in terms of Redefinition**

Items	Weighted Mean	Weighted Mean
	Students	Teachers
1) instruct students to make their own notes from the group discussion threads in Google classroom	2.24	2.41
2) use open education resources to create my teaching materials	2.60	2.76
3) use Google meet to encourage group discussions	2.99	2.57
4) use Kahoot in assessment of learning	1.92	2.08
5) use Massive Open Online Courses (MOOCs)	2.27	2.47
6) Use Padlet in students to do a performance task	1.71	1.83
7) required students to record their mathematics explanation using MiMiostudio	1.57	1.74
8) use messenger calls to discuss mathematics lessons	2.91	2.94
9) ask students to create portfolio in OneDrive	1.89	2.11
10) use screen cast—O-matic to record video lesson of mathematics	1.84	2.14
<b>Composite Mean</b>	<b>2.19</b>	<b>2.30</b>

*Note.* Legend: 4.00-3.50-Always, 3.49-2.51-Frequent, 2.50-1.50- Sometime, 1.49-1.00-Seldom.

Terado (2020) also explained that in redefinition stage, there is a fundamental learning which the traditional teaching in classroom cannot deliver because by using technology the impossible activity will be possible. It was revealed that the teachers are sometime utilizing this kind of technology as evident from the composite mean value of 2.19 from the students and 2.30 from the teachers. This was validated by the result that their teachers sometimes required them to record their mathematics explanation using MiMiostudio and the seldom requirement to the students on the of Padlet to do a performance task as reflected from the weighted mean value of 1.57 and 1.74 from the students and teachers and 1.71 and 1.83 from the students and teachers respectively. These findings of sometime



utilization of the identified technology specifically the on the use of Padlet got support from (LESF) who claimed that it is a very crucial task to do. LESF survey revealed that 8.8 million parents all over the Philippines prefer to use modular distance learning and Padlet is considered a difficult task because this is online and it is not familiar. Though, Kleinsmith (2017) found out that Padlet increased the academic engagement of learning in mathematics and the learners were satisfied with the use of Padlet which tends to show that if properly utilized will help in the augmentation of the teaching and learning of mathematics.

On the other hand, there are also new technologies that are sometimes utilized by the teachers as shown in the use of Massive Open Online Courses (MOOCs) with the weighted mean value of 2.27 from the students and 2.47 from the teachers. This data reflects that in redefinition stage, the respondent has a rigid mechanism to ensure the continuity of the learning and it further confirms that the teachers are open to changes and innovations. This observation was confirmed by Aljaraideh (2019) who found out that teachers face several barriers when using MOOC but it also reveals that teachers perceived MOOC as a great advantage for the users. Likewise, teachers confirmed that MOOC provides better learning opportunities than their counterparts. This becomes Aljaraideh's basis on his recommendations that all the higher learning education should introduce and implement MOOC for its numerous advantages.

Same was found in the use of messenger calls to discuss mathematics lessons as evident from the weighted mean value of 2.91 from the students and 2.94 from the teachers themselves which shows that this technology is frequently being used in the conduct of classes. This further confirms that the students saw how their teachers find ways and means to utilize the technology to facilitate the teaching and learning process. Since messenger is one of the most popular social media application, majority of the people are enjoying the use of free communication. Aside from its popularity, messenger has also a lot of features that enables the users to attach document which is good in submission of projects or assignments (Constine, 2017). In fact, El Alfia et al. (2013), found out that this web-based application can improve communication among students and between teachers and students.

Table 6 shows the difference on the respondent's assessment on how teachers utilized the SAMR Model on their conduct of mathematics instruction. Result showed that there is significant difference on the assessment on how teachers utilized the SAMR Model as revealed by the t-value of -2.658, and p-value of .008, for substitution which are all less than .05 level of significance. Which leads to the rejection of null hypothesis. This result mean that students and teachers' assessment varied specifically on the use of power point presentation. Though it is a fact that use of PPT is one of the most effective ways of presenting the lessons.

**Table 6. Difference on the Utilization of SAMR Model in the Delivery of Mathematics Instruction in the New Normal Learning Environment as Assessed by the Students and Teachers**

Variables	t-value	p-value	Decision on $H_0$	V.I
Substitution	-2.658	.008	Reject $H_0$	Significant
Augmentation	.333	.739	Failed to Reject $H_0$	Not Significant
Modification	-.699	.485	Failed to Reject $H_0$	Not Significant
Redefinition	.533	.595	Failed to Reject $H_0$	Not Significant

*Note.* Criteria for Rejection  $P < .05$ .

Also, the students varied on their assessments that their teachers can be able to communicate with them through social media such as Facebook, Twitter, chat rooms, discussion boards, etc. to clarify the lessons. This is possible even if both mathematics teachers and students do have their social media account and at the same time, they are proficient in using it. This result confirms the contentions of Sampebua et al. (2020), about the era of industrial revolutions that requires the world of education to be able to adjust the development of digital technology towards improving the quality learning and achieving competence. With the smart school mobile application, it is hoped that it can change the mindset and culture of mobile phone use for students so that it can be utilized properly and efficiently in learning mathematics.

Further, results revealed that there is no significant difference on the respondents assessments in terms of augmentation, modification, and redefinition as evident from the t- values of .333, -.699, and .533 and matching p-values of .739, .485, and .955 which are all greater than .05 level of significance. The two groups of respondents are one on their assessment that augmentation and modification were frequently utilized while redefinition stage was sometimes utilized. Based on the overall result, it was found out that the SAMR Model was not fully utilized in the delivery of mathematics instruction specifically in terms of redefinition. It could be that both teachers and students were not comfortable to integrate and embrace the new normal in the teaching and learning of mathematics. This find supports from Raja and Nagasubraman (2018), who reiterated out that technology consist of pros and cons which need proper use to take the advantage of this in the good light and eliminate the drawbacks which are pulling back many of students as well as schools from achieving excellence.

Whereas, good technology integration isn't about using the fanciest tool, it's about being aware of the range of options and picking the right strategy or strategies for the lesson at hand (Terada, 2020). In this age of technological revolution, computer and gadgets literacy that facilitates the teaching and learning is a minimum requirement knowing that teacher and students are in a situation that almost all of the school activities are technology driven. In fact, Fastiggi (2014) recommends the use technology to expose students to the outside world. This not only helps improve their cultural understanding and

international mindedness, it can be great for building key literacy skills as well.

Even as we return to physical schools and take advantage of face-to-face opportunities there's likely to be a greater emphasis on digital learning. Thus, recommendations to maximize, utilize, and integrate one of the technology-driven models-SAMR Model in the delivery of instructions thereby promoting digital literacy in the teaching and learning of mathematics were expressed. Hence, it can be materialized by sharing a common language across disciplines as teachers strives to personalize learning and help students visualize complex concepts which leads to forward the foregoing recommendations.

In terms of substitution, it was found out that one of the best options is to communicate with students using cellphone when they have clarification about the lesson. One of the best strategies to the address the matter is to keep things simple and available. In doing so; free, easy, and available communication channel like messenger which is always free can be utilized to facilitate the teaching and learning process.

As to augmentation, use of search engines like Google to look for vital research content in discipline is an advantage and appears on the top list. To be able to get the best out of it, encourage students to maximize the use of the Google search engines that is always accessible to augment the teaching and learning process.

In terms of modification, it was found out that use of online assessment tools to rate the students' performance was given high regard. This strategy of using online assessments were able to open new opportunities to help students who have been traditionally marginalized to benefit from several alternatives/options that encourage participation.

Lastly, in redefinition, it was found out that the use of Google Meet encourage group discussions is among the top on the list. It could be because it provides opportunity to bring authentic experience that were previously impossible in the classroom. That being found, it is best to maximize the use of the aforementioned platform so that students will not be deprived of the chance to have authentic classroom experience.

Forthwith, integrating simple technologies like Power Points, games, internet homework and assignments, or online grading system can be difference makers in students' growth in the classroom but all of these can be materialized by sharing a common language across disciplines as teachers strives to personalize learning and help students visualize complex concepts which can be characterize as active, collaborative, constructive, authentic, and goal directed to adept with the demands of technology integration as to entry, adoption, adaptation, infusion and transformation.

## 5. Conclusions

Results revealed from both students and teachers that substitution, augmentation, and modification were frequently utilized while redefinition was sometimes utilized. There is significant difference on the respondent's assessment on the utilization of SAMR Model in terms of substitution but no significant difference in terms of augmentation, modification, and redefinition. The expressed recommendations were believed to help in the utilization of substitution, augmentation, modification, and redefinition in the teaching and learning of mathematics.

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