Traditional and Culturally Responsive Teaching Practices and Technology Integration Shape Mathematics Instruction

Jarren Y. Herbieto[1], Dr. Aprell L. Abellana[2]

[1]Graduate Student, Master of Science in Mathematics Education, Central Mindanao University, Musuan, Bukidnon, Philippines

[2]Associate Professor, College of Education, Central Mindanao University, Musuan, Bukidnon, Philippines

DOI: https://doi.org/10.47772/IJRISS.2026.100500767

Received: 14 May 2026; Accepted: 20 May 2026; Published: 12 June 2026

ABSTRACT

This study investigates the association of traditional and Culturally Responsive Teaching Practices to Technology Integration among Mathematics Teacher. A descriptive–correlational quantitative design was used with 1,450 teachers from three DepEd divisions participating; instruments were validated Likert-scale instruments. Results indicated the cultural strategies were implemented at significantly higher levels than traditional pathways in line with moderate to high teacher motivation. Technology integration received the highest engagement ratings (overall mean = 3.56), and mathematics instruction efficacy was generally high but variable (overall mean = 3.48). The correlation analysis indicated no significant association between traditional/culturally responsive practices and instructional quality ($r = -0.004$, $p = 0.946$). Whereas integration of technology showed a moderate +ve and significant relationship ($r = 0.503$, $p < 0.001$). Regression testing revealed technology integration as a strong predictor of instructional effectiveness ($B = 0.588$, $p < 0.001$), accounting for 25.3% variance across levels of the sample. Results strongly indicate that digital pedagogy plays a key role in mathematics instruction and reveal the need to integrate cultural responsiveness across technology-supported methods of teaching for equitable, rich, and future-ready education.

Keywords: culturally responsive, mathematics instruction, technology integration, traditional practices

INTRODUCTION

Teaching in contemporary mathematics classrooms is increasingly understood as a dynamic, relational, and student-centered process in which teachers design learning experiences that connect mathematical ideas to learners' prior knowledge, cultural backgrounds, and everyday lives, rather than simply transmitting procedures and facts (Gay, 2018; OECD, 2023). Regarding the dependent variable of mathematics instruction quality and student engagement, teaching is described in recent studies as the key lever that shapes how students experience mathematics, whether as abstract, anxiety-inducing content or as meaningful,

Globally, math education continues to struggle with student achievement and engagement, as reflected in PISA scores that have held steady across many nations (Samaupan 2019). In the Philippines, these problems are nationally exacerbated, with DepEd data revealing low PISA/TIMSS performance often linked to predominantly teacher-centered teaching (Samaupan, 2019). Indigenous students in Northern Mindanao who have disengaged from education foreground cultural gaps through their experiences of rote learning (Samaupan, 2019).

Culturally relevant instructional practices in mathematics instruction proactively integrate lessons to learners amongst their culture, practicing within the community, and lived experiences rather than simply treating culture as an afterthought or deficit (Gay, 2018; Ladson-Billings, 2021). Research in mathematics education provides evidence that students are more engaged, develop greater conceptual understanding and a stronger positive mathematical identity when teachers draw on local cultural artefacts (e.g. indigenous games, weavings patterns, community livelihood practices and home language) as part of the curriculum (Alcantara & Salcedo, 2025;

Samaupan 2019). Culturally responsive mathematics instruction has also been shown to boost participation along with decreasing anxiety and increasing persistence in the context of Philippine education and appropriately, internationally (Martin & Campbell, 2024; RSI International, 2025), thereby improving performance for learners from marginalized or indigenous communities directly associated with a more equitable outcome in mathematics. Culturally responsive teaching practices that validate students' cultural identities and legitimize their everyday experiences into a source of mathematical reasoning can not only help increase mathematics learning (DV), but also, they allow classroom activities to move from mainly teacher-directed procedural spaces into more inclusive non-dominant communities of practice where learners are able to create meaning about Mathematics, perceive its usefulness and learn Math successfully in consolidative ways (Alcantara & Salcedo, 2025; Samaupan, 2019; RSI International, 2025).

But technologies integration into mathematics instruction does not simply mean adding some gadgets to lessons; it means using digital tools (dynamic software, simulations, learning systems and multimedia resources) to develop, deliver and assess learning opportunities (Bray & Tangney 2015; Drijvers 2020 as cited in Clark-Wilson of al., 2022). Evidence from the use of interactive visuals in grade 8 studies strongly indicates that effective use of technology and digital pedagogy through interactive visuals increases math learners' engagement, understanding of math concepts (Lavin et al., 2015; Sidabutar, 2016, as cited in RSIS International, 2025). Thus, the teacher-centered classes turn into student-centered classes where students explore (RSIS International, 2023; Umpar et al., 2023). But technology by itself may not elevate test scores, but rather as adjuncts aligned to learning objectives and pedagogy boost motivation, attention and participation (Al-Kindi Publishers, 2025; Frontiers in Education, 2025; RSIS International, 2025). Consequently, this shows that technology can improve math teaching by supporting behavioral-, emotional- and cognitive engagement (Clark-Wilson et.al. 2023), building conceptual understanding (RSIS International, 2025) and creating opportunities for meaningful, equitable and future-ready learning (Rethinking Digital Integration in Philippine Mathematics Education, 2025).

The same contradictions are echoed in PISA 2022, where an alarming number of Filipino students are reported to find mathematics difficult and irrelevant (OECD, 2022; OECD, 2023), especially since it has long been established that Filipino students perform poorly and inconsistently in mathematics. Studies show culturally responsive teaching promotes a sense of belonging and understanding, particularly among Indigenous and marginalized learners (Dela Cruz & Santos, 2020; Pascua & Zuñiga, 2020; RSIS International, 2025). Yu et al. Nevertheless, there is sparse evidence of the combination of these approaches in the Philippine classroom and their engagement and achievement impact, especially considering rural/indigenous contexts (Assessing Technology Integration in Mathematics Education, 2026; Del Rosario & Atienza, 2021). This research investigates the mathematics instruction practices among Bukidnon—traditional and culturally responsive, technology-driven and other approaches—and relates them to quality of instruction and student engagement and performance that will help design equity-focused, context-based interventions and professional development (RSIS International, 2025; Unveiling the Worldview of Mathematics Teachers, 2025).

Statement of the Problems

The study aims to determine the extent to which traditional and culturally responsive teaching practices and technology integration shape mathematics instruction among selective high school Mathematics teachers in Bukidnon. Specifically, it addresses the following questions:

1. What is the level of traditional and culturally responsive mathematics teaching practices among selective high school Mathematics teachers in Bukidnon?

2. What is the level of technology integration in mathematics instruction among selective high school Mathematics teachers in Bukidnon?

3. What is the level of mathematics instruction among selective high school Mathematics teachers in Bukidnon?

4. Is there a significant relationship between traditional/culturally responsive teaching practices, technology integration, and mathematics instruction outcomes among selective high school mathematics teachers in Bukidnon?

METHODOLOGY

Research Design

This research study utilized a descriptive correlational quantitative design to determine the extent to which traditional teaching practices, culturally responsive teaching practices, and technology integration are related to the status of mathematics instruction among selected high school mathematics teachers in Bukidnon. A descriptive–correlational design is appropriate because the study seeks to determine the levels of traditional practices, culturally responsive practices, and technology integration, and to examine the relationship between traditional/culturally responsive teaching practices, technology integration, and mathematics instruction outcomes without manipulating any conditions.

Locale and Respondent of Study

The study will be rigorously implemented across a purposive sample of public and private high schools in the province of Bukidnon, specifically targeting institutions recognized for sustaining excellent academic performance or certain specialized programmers that provide advanced mathematics (top-ups) to enrich students' learning experience. Respondents for the study were systematically selected 1,450 high school Mathematics teachers from three educational configurations in DepEd: the Bukidnon Division, the Malaybalay City Division and the Valencia City Division. The number of respondents within each division was intentionally decided based on estimates on the total number of mathematics teachers across divisions to reflect the proportional size and representation piece of the teaching workforce by divisions. All mathematics teachers who oversee teaching junior high school and/or senior high school mathematics subjects in these identified schools during the School Year 2025–2026 will be considered as participants. When appropriate, a census sampling technique or complete enumeration will be used to be able to capture all the eligible mathematics teachers using methodologies customary in previous studies on Filipino mathematics teachers and technology use in teaching. However, if there is an excessive number of mathematics teachers, a more manageable and statistically valid way will be carried out; proportionate stratified random sampling, which will be controlled by both the type of school (public or private) and the grade levels taught by study participants.

Research Instruments

This study utilizes a culture-relevant instrument for researcher questionnaire that articulately draws upon existing, well-established educational theories and emerge from broad scholarly literature on mathematics education field research while extending prior work in culturally responsive pedagogy (CRP) with information presentation pedagogies. This broad-scope global instrument is thoughtfully organized in a clear sequential structure and presentations of three interrelated, distinct and best examples through systematic summaries providing holistic and multiple perspectives. Each of these sections is carefully crafted to measure educators on multiple dimensions: their adherence to both time-honored traditional mathematics teaching practices and recent culturally responsive pedagogy; the verbosity and sophistication with which they integrate various technological tools into their implemented mathematics instruction; and, perhaps most importantly, how each educator feels about his/her own practice of physical qualitative assessment interventions that leave an impact at schools.

To determine the level of traditional and culturally responsive mathematics teaching practices among selective high school Mathematics teachers in Bukidnon, the weighted mean of each indicator was computed and analyzed using the scale provided below.

Scale	Descriptive Interpretation	Range	Qualitative Interpretation
4	Almost Always	3.41–4.0	High Motivation
3	Frequently	2.61–3.40	Moderate Motivation
2	Occasionally	1.81–2.60	Low Motivation
1	Rarely	1.00–1.80	Very Low Motivation

The traditional and culturally responsive mathematics teaching practices used in the present study were systematically based on the guidelines provided by the Department of Education (DepEd) for curricular standards and adapted from tried-and-tested, internationally recognized teaching tools. The instrument indicated a Cronbach's α of 0.80, which surpasses the threshold value within educational surveys (i.e., > 0.70), thus providing evidence of reliable and sufficient internal consistency for both traditional (items 1-5) and culturally responsive (items 6-12) subscale items. The magnitude of this reliability coefficient would strongly support the notion that individual items in fact yield a useful measure of teachers' self-reported frequencies in using these teaching practices, and do not tend to be repetitive or oxymoronic (i.e., too similar or redundant). In addition, a 4-point Likert scale was used to systematically measure participants' frequency of teaching practice implementation (score: 4=Almost Always, 3=Frequently, 2=Occasionally and 1=Rarely).

To assess the level of technology integration in mathematics instruction among selective high school Mathematics teachers in Bukidnon, the weighted mean of each indicator was computed and analyzed using the scale provided below.

Scale	Descriptive Interpretation	Range	Qualitative Interpretation
5	Strongly Agree	4.21–5.00	Very High Engagement
4	Agree	3.41–4.20	High Engagement
3	Neutral	2.61–3.40	Moderate Engagement
2	Disagree	1.81–2.60	Low Engagement
1	Strongly Disagree	1.00–1.80	Very Low Engagement

Technology integration in Mathematics instruction scale is a well-cared for self-report measure to assess how mathematics teachers use and integrate information/communication technology (ICT) into their classroom instruction. The trend is mapped by a developing comprehensive scale containing 15 preference formulation items divided into five related Dimensions, namely Frequency of ICT Use; Purpose for ICT use; types and patterns in the deployment of digital devices integrated at various stages within instructional practice decisions relating to depth/intensity/duration: Teacher confidence & attitudes towards adopting technology. How much do you agree or disagree with each individual statement finds its being from a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = strongly agree). To promote consistency in scoring and ensure that all items are scored with some technological level, negatively worded items (Items 3 and 11) where reverse coded so higher numerical scores represent increased technology levels. Response scores for each dimension are computed as an average of the items with respective dimensions, providing a clear picture and analysis qualitative aspect of ICT integration in Mathematics education. In addition, this instrument has been aligned accordingly with the existing and emerging theoretical frameworks for technology integration in mathematics education (Dugdale et al., 2020; Draper & Nussbaum-Beach, 2016) Tamoria (2016); Njiku (2022).

To examine the relationship between traditional/culturally responsive teaching practices and technology integration with mathematics instruction outcomes.

Scale	Descriptive Interpretation	Range	Qualitative Interpretation
5	Strongly Agree	4.50-5.00	Very High Efficacy
4	Agree	3.50-4.49	High Efficacy
3	Neutral	2.50-3.59	Moderate Efficacy
2	Disagree	1.50-2.49	Low Efficacy
1	Strongly Disagree	1.50-1.49	Very Low Efficacy

The scale, Perception on Mathematics Instruction Quality (PMIQ), is a self-report measurement tool that we developed in detail to explore and measure mathematics teachers' beliefs and attitudes about the quality of their instruction. This is especially true in investigating how much these forms of teaching find root, demonstrating a responsiveness and relevance to cultural context and environment, as well the incorporation of multiplicators tools and resources from technology within educational practice. It consists of five carefully designed Likert-type statements that focus on the teachers' perceptions of the extent to which their practice of employing traditional instructional approaches with modern learning strategies, culturally responsive teaching practices, emergent forms of technology, and utilization of hybrid or blended instruction has affected different dimensions of student outcomes. These outcomes are conceptual understanding, active engagement or participation and achievement in mathematics. Participants will rate the extent to which they agree/disagree with each item on a standardized 5-

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue V May 2026

point Likert scale, an ordered categorical variable that uses a standard numerical approach where 1= Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5= Strongly Agree. In addition, the items in this scale are crafted to directly reflect teachers' self-reported capability and comfort implementing both cultural aspects/technologies as they teach math, providing a brief yet specific way to capture their perceived quality of instruction in contexts that include technology and/or culturally responsive teaching practices into their mathematics instruction.

Data Gathering Procedure

Initially, the researcher will request for an official permit to conduct the study through a thoroughly prepared and formal letter addressed to Schools Division Superintendent from the Department of Education (DepEd) who is in charge of Bukidnon province which includes Malaybalay City, Valencia City as well as the principals of chosen public secondary schools within their premises. After obtaining the necessary approvals and permissions, the researcher will aim to coordinate with school mathematics heads or coordinators across all those schools. This partnership is intended to accurately recognize and then validate qualified mathematics teachers who teach students at disposition from Grade 7 through Grade 12 for consideration to be potential survey respondents. Moreover, these department heads will be consulted in scheduling the best dates and times of survey throughout the school year to minimize interruption with teachers and (non-testing) student academic schedules. The respondent will employ google survey questionnaire form for answering the research questionnaire.

Statistical Analysis

Descriptive statistics such as frequency counts, percentages, means and standard deviations will be systematically used to portray the demographic characteristics of the respondents. In addition, these statistical indicators will act to properly qualify and quantify the amount or type of mathematics instruction taking place, the degree of technology integration used within instructional practices deployed, along with how prevalent traditional teaching methods currently are being engaged. Thus, inferential statistical techniques (Pearson product-moment correlation coefficient and multiple regression analysis) will be employed to rigorously examine the nature of relationships between technology integration/traditional practices on one hand with mathematics instruction on another; coupled also with an examination of predicting influence. These analysis steps are comparable to those used in recent completed descriptive-correlational research studies of the quality and performance with Information/method communication technology (ICT) as a factor for integration into teaching mathematics. Before these analyses are performed, necessary and appropriate assumptions associated with the specific statistical tests (e.g. normality of data distribution, linear relationships among variables, multicollinearity) will be carefully ascertained following standard procedures to ensure valid findings and reliable estimates. An alpha-level of 0.05 is conventionally used as a threshold for statistical significance The results are then discussed in relation to national and international research literature regarding technology-based culturally relevant mathematics teaching, providing context for understanding the study findings.

RESULTS AND DISCUSSION

Traditional and Culturally Responsive Mathematics Teaching Practices

Table 1 shows that both traditional and culturally responsive mathematics teaching practices are being implemented at a moderate to high level, but culturally responsive practices are generally stronger than traditional ones.

Table 1. Level of traditional and culturally responsive mathematics teaching practices.

Variables	Mean	Descriptive Interpretation	Qualitative Interpretation
Traditional	2.61	Frequently	Moderate Motivation
	2.92	Frequently	Moderate Motivation
	3.36	Almost Always	High Motivation
	2.96	Frequently	Moderate Motivation
	2.45	Occasionally	Low Motivation

Culturally Responsive	3.34	Frequently	Moderate Motivation
	3.46	Almost Always	High Motivation
	3.38	Frequently	Moderate Motivation
	3.32	Frequently	Moderate Motivation
	3.22	Frequently	Moderate Motivation
Overall Mean	**3.10**	**Frequently**	**Moderate Motivation**

In terms of traditional mathematical teaching practices, individual item means in the classroom were from 2.45 to 3.36 but most (12/20) of these fell into a more limited range between 2.61–296 across both areas This produced an overall mean for traditional approaches alone calculated as MSM= 1 as “Frequently” and could be interpreted at this level also indicative under “Medium Motivation”. This begs the existence of traditional modes of instruction — teachers lecturing and explaining, students practicing textbook problems and standard algorithms — though there are variations in its implementation across the measured indicators.

By comparison, the item means for culturally responsive mathematics teaching practices ranged from 3.22 to 3.46 and all values fell within “Frequently”– “Almost Always.” Those ratings were interpreted as reflecting “Moderate to High Motivation,” implying a more sustained and deliberate effort for educators. The total mean score for culturally responsive practices came out to be 3.10 and is similarly categorized into the "Frequently" area of practice – suggesting that these approaches are implemented more strongly or consistently than traditional methods. The tendency is rather apparent in their responses, pointing to what teachers increasingly do infuse culturally sensitive material and practices into the teaching of mathematics (Stinson & Nohl 2006), affirming different student identities, and adopting responsive principles which have led to a consequent increase engagement among students. Where this integration is concerned, it stands in contrast to the rather looser application of these with traditional teaching practices and highlights that much more emphasis has been placed on culturally responsive pedagogy within a mathematics classroom.

The findings from the study show this mathematics teachers either employ a traditional instruction method or moderate level approach with culturally responsive teaching methods in some respects. Traditional practices are more often and consistently used than culturally responsive ones. Indeed, this is further supported by the somewhat high mean scores (from 3.22–3.46) achieved for all culturally responsive indicators which correspond well with an emerging strand of contemporary empirical data from research carried out between 2020 and 2026 that demonstrate where mathematics content has been grounded in its meaningful – rather than incidental or tangential areas; -and relevant connections made to students' various cultures, Situated lives and authentic contexts specific to their communities −those are instances when learners most often view mathematics−quite significantly more along a much truer continuum/milieu as far less abstracted away discursively compared(1). These research findings, together with the prevalence as commonly experienced in school other teachers for whom culturally responsive practices were used and teachers' motivation levels to use those strategies suggest that educators may have been starting to recognize students¿ cultural funds of knowledge would be worthy assets upon which they could (re)assemble resources for mathematics learning. These findings are consistent with prior studies, including calls for more culturally responsive mathematics teaching that acknowledge students as active cultural agents and shapers of classroom learning producing a better 85th higher-quality education (Mooney & Wiggins,2008; Sleeter et al.,2015).

Technology Integration

Table 2 shows that overall mean of 3.56 demonstrates that teachers (or respondents) generally agree that technology is integrated into instruction in ways that foster engagement.

Table 2. Level of Technology Integration in Mathematics Instruction

Variables	Mean	Descriptive Interpretation	Qualitative Interpretation
Technology Integration	3.49	Agree	High Engagement
	3.93	Agree	High Engagement
	3.26	Neutral	Moderate Engagement

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue V May 2026

	3.60	Agree	High Engagement
	3.83	Agree	High Engagement
	3.78	Agree	High Engagement
	2.98	Neutral	Moderate Engagement
	3.24	Neutral	Moderate Engagement
	3.30	Neutral	Moderate Engagement
	3.69	Agree	High Engagement
	3.46	Neutral	Moderate Engagement
	3.19	Neutral	Moderate Engagement
	3.67	Agree	High Engagement
	3.92	Neutral	Moderate Engagement
	4.08	Agree	High Engagement
Overall Mean	**3.56**	**Agree**	**High Engagement**

As we can see from the data, teachers tended to agree on effective use of technology in teaching mathematics, resulting in an overall mean of 3.56 which was interpreted as high participation. This indicates that digital tools and platforms are used to improve the process of teaching and learning. The mean scores of each item across all instructional practices indicate that respondents generally consistently perceive technology as an important part of their teaching routines, by scoring each statement highly (3.49 to 4.08).

In contrast, a few items lie in the moderate engagement range (means between 3.19 and 3.46), suggesting that while technology is embraced, application may depend on other variables, ultimately including resources, faculty confidence, and institutional support. These neutral responses also indicate professional development and improvements in infrastructure with benefits that could have been more fully realized through integration.

In general, the results confirm that technology plays an integral role in teaching mathematics in accordance with modern educational standards focusing on digital literacy, active involvement of students and a student-centered approach. These findings confirmed the hypothesis that teachers are not only responsive to existing technology but also realize its potential for better engaging students in mathematics.

Mathematics Instruction

The data in Table 3 reveals varying levels of mathematics instruction efficacy among respondents. The mean scores range from 3.29 to 3.56, with interpretations spanning from Neutral–Low Efficacy to Agree–High Efficacy.

Table 3. Levels of Mathematics Instruction

Variables	Mean	Descriptive Interpretation	Qualitative Interpretation
Mathematics Instruction	3.29	Neutral	Low Efficacy
	3.56	Agree	High Efficacy
	3.48	Neutral	Low Efficacy
	3.56	Agree	High Efficacy
	3.53	Agree	High Efficacy
Overall Mean	**3.48**	**Agree**	**High Efficacy**

Clearly, the results in Table 3 indicate that math classes are considerably high efficacy with an overall mean of three and a half (Agree–High Efficacy). That points towards teachers being competent in delivering lessons, managing classrooms and implementing teaching techniques. The scores corresponding to Neutral–Low Efficacy (3.29 and 3.48) reveal that aspects of instruction are not consistently meeting expectations. This mixed performance underscores the dual challenge of continuing with what is strong and working to address what's weaker and impedes instructional effectiveness.

Whereas they get neutral ratings: For example, some teachers might have difficulty changing instructional strategies to accommodate varying needs of learners or incorporating new approaches. Therefore, professional development programs should focus on enhancing pedagogical flexibility, teaching teachers approaches that balance the best of traditional and modern innovations. In the case of low efficacy areas, training modules can target differentiated instruction, formative assessment and reflective teaching practices.

Correlation of Variables

Table presents the relationship between traditional/culturally responsive teaching practices, technology integration, and mathematics instruction it obtained that Traditional/Culturally Responsive Practices have no meaningful relationship with mathematics instruction (correlation = -0.004, p = 0.946, not significant), while Technology Integration has a moderate, positive, and statistically significant relationship with mathematics instruction (correlation = 0.503, p < 0.001).

Table 4. Relationship between traditional/culturally responsive teaching practices, technology integration, and mathematics instruction.

Statements	*Correlation Coefficient*	*Significance*
A. Traditional and Culturally Responsive Practices	*-0.004*	*0.946 **
B. Technology Integration	*0.503*	*0.000**

Ns=not significant * = Significant at the 0.05 level ** = Significant at the 0.01 level

The results from Table 4 show that traditional and culturally responsive practices are not significantly related to mathematics Instruction with an extremely small coefficient value (-0.004) as well as a non-significant p-value of 0.946 for the coefficient (β). While these practices may enhance the cultural relevance of learning and validate student identity, their measurable contribution to instructional effectiveness remains small in the context of this study. On the other hand, technology integration shows a moderate positive and significant association (0.503) (p = 0.000) unique to technology as an intervention for mathematics mediatrices. These findings are consistent with constructivist principles of active knowledge construction facilitated by digital tools, gamification strategies that promote engagement and motivation, and experiential learning techniques that enable students to engage dynamically with mathematical constructs. Overall, the findings point to more critical synthesis possible in prioritizing culturally responsive practices as a pedagogical stance but indicate that technology implementation has clearer statistical significance in supporting instructional improvement; therefore, future curriculum and teacher development should prioritize widespread digitization of materials embedded with cultural responsiveness for all students to achieve holistic, inclusive mathematics experiences.

Regression of Variables

Table 5 presents the regression analysis showing the predictors of mathematics instruction.

Table 5. Regression analysis showing the relationship between traditional/culturally responsive teaching practices, technology integration, and mathematics instruction.

Variables	Unstandardized B	Coefficient Std. Error	t	Sig.
Constant	0.289	4.94	0.000	0.289*
Traditional and Culturally Responsive Practices	−0.012	0.056	−0.22	0.825*
Technology Integration	0.588	0.064	9.15	0.000*
R = 0.503	R^2 = 0.253	F-value = 41.83	Probability = 0.000*	

The results of the regression analysis in Table 5 provide additional support for the correlation results. Traditional & Culturally Responsive Traditional and culturally responsive show a negative, but very small coefficient (B = −0.012) at p = 0.825 meaning that the overall effect of these practices is not statistically significant in predicting mathematics, but they belong to this study if practiced traditional rather than through culturally responsive. In contrast, technology integration is a very powerful and vigorous predictor of instructional effectiveness with positive coefficient (B = 0.588), high t value (9.15) and supported by p value 0.000 which strongly confirmed that technology integration has significant influence on instructional effectiveness The full model accounted for about 25.3% of the variance in mathematics instruction ($R^2 = 0.253$), and was statistically significant ($F = 41.83$, $p < .001$), indicating that the model fit fairly well. These findings emphasize not only the fact that both traditional and culturally responsive practices contribute to the cultural and contextual layers of teaching, but that they do not have statistical impact on instructional quality. On the other hand, technology integration emerged as a significant factor that underpins the theoretical ideas of constructivism, gamification, and experiential learning, which highlight active engagement, interactive exploration, and dynamic driving for knowledge construction. This highlights the importance of focusing on the ways mathematics classrooms can make use of digital adoption but through a lens of culturally responsive practices to keep instruction effective, and broadly inclusive.

CONCLUSION

This study found that traditional practices and culturally responsive practices were used to varying degrees in the mathematics classrooms, with somewhat higher levels of consistency for culturally sensitive approaches. While these practices validate student identities and enhance inclusion, they were a negligible contributor to other instructional statistical measures.

On the other hand, technology integration was the strongest predictor of high-quality mathematics instruction, having a moderate positive correlation and accounting for 25.3% of instructional variance. This seems obvious if you consider the importance of digital tools to increase engagement, support constructivist learning, and facilitate better outcomes in a classroom.

In summary, the research finds that cultural responsiveness contributes positively to a richer learning environment, but technology integration contributes more directly to measurable instructional efficacy. Combined, this digitally anchored culturally responsive teaching is the best route for equitable mathematics instruction.

RECOMMENDATION

Strengthening technology integration is a priority for teachers. Digital platforms, gamification strategies, and other interactive tools can be used to encourage engagement through mathematics classes. Meanwhile, a digitally embedded cultural responsiveness in lessons enables math content that is more meaningful and would reflect learners' identities and community contexts. As a mechanism for sustaining these practices teachers should seek ongoing professional development that highlights pedagogical adaptability, differentiated practice / instruction, and reflective practice so they can be prepared to meet the needs of heterogeneous learners and the expectations of changing educational environments.

Simultaneously, students are key when it comes to extracting the maximum from technology-enhanced instruction. They are to be encouraged to dive into technology-based platforms with the intent of bolstering their ability for mathematics on a conceptual level and problem-formulation. Aside from technical involvement, students ought to see cultural connections in arithmetic by way of tying classes into non-public and network experiences, therefore grounding summary principles in lived realities. Your skill set of digital literacy only gives students more power to thrive in modern learning environments and prepares them for future academic and professional challenges.

In addition to these successful practices, parents play a critical role in promoting technology integration as well as cultural responsiveness at home. Parents can use this to nurture children into learning and developing while having a balanced disciplined way of using technology. By integrating mathematics time with cultural identity, parents can help bridge the gap between the bookwork and real-world knowledge; this will help to strengthen not only relevance but also motivation. Teachers play an essential part of this process as well, working with parents to ensure that what happens in the classroom connects to how children are supported at home.

At the systems level, technologist policymakers and leading school-district administrators should insist that technology-driven standards be woven into the curriculum as part of responsive content and practice. This relates to ensuring the funding is there for infrastructure, teacher training and culturally appropriate digital resources. Furthermore, policies ought to promote research-oriented innovations that combine technology with cultural responsiveness, and that update mathematics without compromising inclusivity or equity. These initiatives can develop viable systems to help empower teachers, students and the communities they serve all around.

Finally, the other half of future researchers are to investigate these practices through practice-based research. Longitudinal study of articulate impact analysis of culturally responsive digital integration on student achievement. For example, scholars need to examine how technology might also strengthen cultural responsiveness rather than work as two separate domains and soullessly combine them without synergy between tradition and innovation. Future research will refine findings to different differential contexts as an area for future work since this would make the strategies for inclusive mathematics instruction more applicable to diverse educational settings globally.

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ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue V May 2026

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