

The Teachers' Competence in the Utilization of the Technology-Based Learning Approach (TBLA) in Improving the Mathematical Skills of the Grade 2 Learners in the Public Elementary Schools in the Division of Camarines Norte

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ARTICLE INFORMATION	ABSTRACT
Article history: Published: October 2026	The study described teacher competence, perceived contributions and implementation challenges associated with technology-based learning approaches (TBLA) in Grade 2 mathematics in the public elementary schools of Camarines Norte. Data were presented separately for large, medium and small schools. Overall reported teacher competence averaged 3.95 ("Much Competent"): professional competence was highest (3.98) and personality competence lowest (3.93). Six perceived TBLA utilization domains averaged 4.03 ("Much Utilized"), highest in cost effectiveness (4.06) and lowest in accessibility (3.99). Five challenge domains averaged 4.09 ("Much Challenging"), led by planning (4.14). The study also ranked 25 proposed solutions, with continuous teacher upskilling receiving the highest mean (4.17). The study reported Kendall's W and chi-square tests for school-category rankings; however, several printed significance decisions were inconsistent with the chi-square values and degrees of freedom. Recomputed chi-square tail probabilities are therefore clearly distinguished from the source conclusions. The results represent school-group appraisals, not an experimental demonstration of mathematics gains. The study recommends pedagogically aligned technology training and independent validation of learner outcomes.
Keywords: TBLA Grade 2 Mathematics Teacher Competence TPACK Instructional Technology Kendall Concordance	

1. Introduction

Technology-based learning in primary mathematics requires teachers to integrate subject knowledge, child-appropriate pedagogy and accessible digital resources. The existence of a device or application does not ensure comprehension; learning depends on how the technology represents mathematical relationships, enables practice and feedback, and fits the developmental needs of Grade 2 pupils. The study examined TBLA implementation in public elementary schools across Camarines Norte. The study grouped respondents by large, medium and small schools and separated the analysis into teacher competence, TBLA use in support of mathematics learning, implementation challenges and proposed solutions. This design makes it possible to describe priorities perceived by different school categories while requiring caution in interpretations about actual mathematics achievement.

The technological pedagogical content knowledge framework locates effective technology use in the intersection of technological, pedagogical and subject-specific knowledge (Mishra & Koehler, 2006). This perspective helps interpret the competence domains of the study: professional and pedagogical competence cannot be replaced by familiarity with applications, while social and personality competence matter when children need assistance and reassurance.

External evidence also emphasizes the importance of implementation quality. UNESCO's technology report (2023) cautions that digital tools should be introduced in ways that are appropriate, equitable and sustainable. The Education Endowment Foundation (2019) likewise recommends a clear pedagogical rationale, professional development, cost appraisal and implementation planning. These perspectives help contextualize the reported ratings for accessibility, cost effectiveness and planning constraints.

For elementary mathematics, the IES intervention guide identifies systematic instruction, mathematical language and representations as research-supported approaches (Fuchs et al., 2021). Digital tools can facilitate these practices if they are deliberately chosen, but the present survey does not establish that technology-supported instruction yielded greater numeracy learning than comparable non-digital instruction. The aims of the article were to present the original domain ratings and rank agreement results accurately, identify implementation challenges, and interpret practical options for teacher development. The article refrains from inventing unprovided participant numbers, validation procedures or learner achievement statistics.

2. Methods

The study 4 described teacher ratings of TBLA implementation in the Division of Camarines Norte and compared three categories of elementary schools: large, medium and small. The preliminary title page identified the degree, location and researcher, but the supplied materials did not include the dissertation's full methodology. Thus the number of schools, individual teachers or pupil participants, sampling frame and research procedure could not be verified.

The first component classified teacher competence as professional, pedagogical, social and personality competence. The second assessed TBLA utilization and its perceived contribution to mathematics instruction through learner engagement, learning outcomes, teacher effectiveness, accessibility, cost effectiveness and learner autonomy/self-paced learning. The third described challenges in

promoting effective learning, planning, coordinating, ensuring effective learning and maintaining a safe and effective learning environment. The study also provided 25 proposed solutions.

Item and domain scores used five-point verbal interpretations; the displayed tables classified teacher competence means from 3.50 to 4.49 as “Much Competent,” utilization means from 3.50 to 4.49 as “Much Utilized,” and challenges means from 3.50 to 4.49 as “Much Challenging.” The manuscript retained the study’s weighted means for each school type and overall means. Proposed solutions were rated for necessity. For between-group consistency in indicator rankings, the study gave Kendall’s coefficient of concordance W and chi-square test statistics, along with displayed degrees of freedom. Because the underlying data, tie corrections, respondent weights and software output were not supplied, no new W estimates were generated. The manuscript independently calculated the tail probability of each printed chi-square value using its printed degrees of freedom to check whether significance labels were internally consistent. The reported scores were teacher appraisals of competence, use and perceived effectiveness; they were not accompanied by independently scored Grade 2 mathematics tests, experimental comparison groups or repeated pupil assessments. Language asserting causal improvement was therefore limited to descriptions of what respondents perceived. Ethical permission, instrument validation and reliability records were not present in the uploaded files.

3. Results

3.1 Teacher competence profile

Table 1. Teacher competence in TBLA by school category

Dimension	Large	Medium	Small	Overall
Professional Competence	3.99	4.08	3.86	3.98
Pedagogical Competence	4.01	4.03	3.81	3.95
Social Competence	3.96	4.08	3.81	3.95
Personality Competence	3.98	4.05	3.79	3.93
Overall	3.98	4.06	3.82	3.95

The competence profile averaged 3.95. Professional competence was the highest-rated domain (3.98), pedagogical and social competence each reached 3.95, and personality competence was lowest at 3.93. These differences were small, showing a broadly similar reported profile rather than a sharply isolated deficit. An important interpretive distinction is that respondents rated competence through a questionnaire, not a performance task or independent classroom-observation rubric.

The school-category grand means were 3.98 in large schools, 4.06 in medium schools and 3.82 in small schools. These figures suggest a possible pattern in access to opportunities and conditions for technology use, but the missing sampling and variability information prevents testing group differences. The low relative value for small schools should guide local needs assessment rather than support a general conclusion that teachers in smaller schools lack digital capacity.

Professionally oriented items covered mastery of Grade 2 concepts, curriculum alignment, responsible resource use, digital-literacy development and participation in Learning Action Cells. The interpretation should therefore emphasize integrated capacity, not operational device proficiency alone.

Table 2. Concordance statistics for teacher competence domains

Domain	W	χ^2	df	Computed p
Professional competence	0.22	5.94	9	0.7459
Pedagogical competence	0.58	17.40	10	0.0660
Social competence	0.53	17.49	11	0.0942
Personality competence	0.62	16.74	9	0.0529

The study recorded $W = .22$ to $.62$. Professional competence had $W = .22$, indicating relatively weak common rank ordering. The higher W values in pedagogical and personality competence signaled some shared priorities, but the significance decisions needed closer checking.

Crucially, the study labeled pedagogical and personality competence significant at $.05$. However, the supplied chi-square values and degrees of freedom yielded p approximately $.066$ and $.053$ respectively, both above the conventional $.05$ threshold. Those claims are not adopted as verified. Any inference requires the original rank data, correct reference distribution and tie adjustment, especially when several indicators received close ratings.

3.2 Perceived TBLA utilization and mathematics learning

Table 3. Perceived TBLA use and associated mathematics domains

Dimension	Large	Medium	Small	Overall
Learner Engagement	3.96	4.13	4.00	4.03
Learning Outcomes	3.99	4.06	3.95	4.00
Teacher Effectiveness	4.06	4.09	3.97	4.04
Accessibility	4.01	4.00	3.97	3.99
Cost Effectiveness	4.11	4.12	3.96	4.06
Learner Autonomy and Self-paced Learning	4.03	4.06	4.01	4.03
Overall	4.03	4.07	3.98	4.03

The six areas of TBLA utilization averaged 4.03, corresponding to “Much Utilized.” Cost effectiveness was the highest-rated area (4.06), followed by teacher effectiveness (4.04). Learner engagement and learner autonomy/self-paced learning were tied at 4.03; learning outcomes averaged 4.00; and accessibility was lowest at 3.99.

Because the means cluster in a narrow range, the ranking offers priorities rather than evidence of dramatic differences. Accessibility

occupies the bottom position despite positive overall ratings. This is important for inclusive provision of technologies, since a learning tool's potential cannot be fully realized if connectivity, devices or accessible interfaces vary across classrooms.

The relatively favorable rating for cost effectiveness should not be read as the result of a financial cost-benefit study. The study provided ratings from questionnaire items rather than itemized technology expenditures, maintenance costs or measured learning gains. Similarly, the "learning outcomes" dimension consisted of respondent perceptions, not an independent mathematics outcome assessment.

Table 4. Concordance of TBLA utilization indicator rankings

Area	W	χ^2	df	Computed p
Learner engagement	0.61	18.30	10	0.0501
Learning outcomes	0.34	11.22	11	0.4250
Teacher effectiveness	0.52	15.60	10	0.1117
Accessibility	0.30	8.10	9	0.5241
Cost effectiveness	0.35	10.50	10	0.3978
Learner autonomy/self-paced learning	0.53	14.31	9	0.1117

Across the six perceived utilization areas, reported W ranged from .30 for accessibility to .61 for learner engagement. None of the printed chi-square statistics crossed the .05 threshold for its printed degrees of freedom. In particular, learner engagement at $\chi^2 = 18.30$ and $df = 10$ was marginally below the .05 critical value, which cautions against interpreting that result as statistically significant.

Weak or moderate concordance does not necessarily mean poor teaching: it indicates that school types may prioritize individual indicators differently. Teacher support should therefore be responsive to local needs rather than assume a single district-wide implementation order.

3.3 Implementation challenges

Table 5. Challenges in TBLA implementation

Area	Large	Medium	Small	Overall
Promoting Effective Learning	4.06	4.00	4.12	4.06
Planning	4.15	4.13	4.15	4.14
Coordinating	4.04	4.06	4.12	4.07
Ensuring Effective Learning	4.07	4.05	4.11	4.08
Maintaining a Safe and Effective Learning Environment	4.13	4.12	4.14	4.13
Overall	4.08	4.06	4.12	4.09

The overall challenge mean was 4.09. Planning ranked highest (4.14), followed by maintaining a safe and effective learning environment (4.13), ensuring effective learning (4.08), coordinating (4.07) and promoting effective learning (4.06). The differences were modest but the leading categories point toward practical implementation burdens.

Planning constraints are a useful target for professional development because they are modifiable through shared lesson banks, curricular mapping, common decision rules for application selection and dedicated time for peer review. However, the survey did not distinguish whether these burdens arose principally from teacher workload, insufficient hardware or curricular changes.

Safety and effectiveness appeared as a closely ranked concern. In early-grade classrooms, digital safety includes age-appropriate materials, access controls, privacy safeguards, safe device handling, manageable transitions between tasks and the ability to recognize whether errors reflect mathematical misunderstandings or interface problems. These require instructional routines rather than solely technical repairs.

An overall challenge mean above 4.0 can coexist with utilization mean of 4.03: teachers may routinely use digital approaches while also experiencing appreciable planning and supervision demands. This apparent coexistence argues for implementation support rather than a binary decision for or against technology.

Table 6. Concordance of reported challenges and proposed solutions

Area	W	χ^2	df	Computed p
Promoting effective learning	0.67	18.09	9	0.0341
Planning	0.31	9.30	10	0.5039
Coordinating	0.61	20.13	11	0.0436
Ensuring effective learning	0.73	19.71	9	0.0198
Maintaining a safe environment	0.33	9.90	10	0.4493
Proposed solutions	0.57	41.04	24	0.0165

Agreement was more pronounced for ensuring effective learning ($W = .73$) than for planning ($W = .31$) and safe learning environments ($W = .33$). This indicates that respondents ranked some difficulties consistently across school types while differing in others. The sources of the differences were not studied directly.

The proposed-solutions ranking showed $W = .57$ with $\chi^2 = 41.04$ and 24 degrees of freedom. The corresponding chi-square tail probability was below .05. This supports some commonality in the ordering of the 25 listed solutions, assuming the method and tie handling were appropriate, but not proof that any recommendation would improve student outcomes.

3.4 Priority solutions identified by respondents

Table 7. Eight highest-rated proposed solutions

Rank	Selected solution (abbreviated without altering substantive meaning)	Mean
1	Provide continuous teacher upskilling on how to translate digital math outputs into concrete learnin	4.17
2	Select digital math games that strictly focus on repetitive skill drills rather than pure entertainm	4.16

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Rank	Selected solution (abbreviated without altering substantive meaning)	Mean
3	Install highly sturdy protective cases and shatter-proof screen guards on all school-provided tablet	4.14
4	Incorporate a blend of physical manipulatives alongside digital tools to reinforce abstract math con	4.13
5	Strengthen the school's dedicated IT/technical support team to provide on-demand classroom troublesh	4.13
6	Strictly enforce a 15-to-20-minute maximum continuous screen time rule per math session to prevent f	4.13
7	Allocate specific, designated weekly time for teachers to collaborate on ICT planning during LAC ses	4.11
8	Reduce clerical/administrative workloads so teachers can focus fully on designing technology-based l	4.08

The highest-rated solution was continuous teacher upskilling in translating digital mathematics outputs into concrete instructional next steps (4.17). Selection of games emphasizing actual skills practice followed (4.16), while protective device cases and technical support were also highly rated. The solution profile therefore combined pedagogical support with infrastructure and safety measures rather than privileging new hardware alone.

Teacher upskilling deserves priority precisely because Grade 2 learners still need teacher-guided representation, verbal explanation, retrieval practice and formative feedback. A dashboard or automatic correctness indicator is insufficient unless the teacher uses the information to diagnose why a pupil made an error and to adjust subsequent instruction.

Additional solutions in the table involved offline material availability, scheduling of equipment, parent orientations, simplified visual instructions and rules for device use. The collection was coherent with the challenge ratings, yet its proposed activities had not been implemented and evaluated within the presented study. Claims of anticipated benefit must be framed prospectively.

3.5 Detailed item-level results

The following condensed tables retain individual indicator wording and the four corresponding means from the original detailed results tables. They provide a more transparent basis for the domain-level results reported above. Each row reproduces an existing source indicator rather than constituting a new sample or an independently measured student outcome.

Table 8. Professional competence indicators

Indicators	Big / large	Medium	Small	Overall
I demonstrate adequate mastery of Mathematics 2 concepts when using technology-based instructional tools.	4.05	4.23	3.89	4.06
I align the use of technology strictly with the objectives and content standards of Mathematics 2.	3.91	4.12	3.84	3.96
I responsibly use digital resources	3.82	4.25	3.87	3.98
I update my professional knowledge to keep pace with technological developments in education.	4.09	4.07	3.96	4.04
I integrate technology in Mathematics instruction in a manner consistent with DepEd policies (e.g., MATATAG Agenda).	4.05	4.04	3.73	3.94
I evaluate the credibility, accuracy, and educational value of digital Mathematics resources before integrating them.	4.00	4.04	3.87	3.97
I actively participate in school-based Learning Action Cells (LAC) focused on ICT integration in early numeracy.	3.91	3.83	3.96	3.90
I apply data privacy guidelines and copyright laws when using online materials for Grade 2 learners.	4.14	3.92	3.73	3.93
I set clear professional goals to continuously improve my digital literacy and technology integration skills.	3.95	4.17	3.87	4.00
I serve as a role model or resource person to my peers in utilizing specific TBLA tools for Mathematics.	4.00	4.11	3.91	4.01

Within this detailed indicator set, the highest displayed overall mean was 4.06 for “I demonstrate adequate mastery of Mathematics 2 concepts when using technology-based instructional tools,” while the lowest was 3.90 for “I actively participate in school-based Learning Action Cells (LAC) focused on ICT integration in early numeracy..” These are source-reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement.

The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

Table 9. Learner engagement indicators for TBLA

Indicators	Big / large	Medium	Small	Overall
Technology-based interactive lessons significantly increase pupils' interest in Mathematics 2.	3.95	4.08	3.96	4.00
Pupils actively participate and volunteer during technology-supported Mathematics activities.	3.90	4.29	4.09	4.09
Gamified technology encourages pupils to ask questions and explore mathematical ideas.	4.18	4.33	3.98	4.16
Pupils remain highly attentive and focused during digital Mathematics lessons compared to traditional ones.	4.09	4.21	4.22	4.17
Technology-based visual drills sustain pupils' energy and minimize classroom boredom.	3.95	4.02	3.87	3.95
Pupils show visible enthusiasm when transitioning to technology-based math activities.	3.95	4.00	3.96	3.97
Digital rewards (e.g., badges, virtual stars) effectively motivate pupils to complete their math tasks.	4.05	4.25	4.04	4.11

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Pupils willingly collaborate with peers during interactive digital math games.	3.82	3.96	3.89	3.89
Interactive visual elements (animations, sounds) keep pupils engaged in learning numerical concepts.	3.86	4.04	4.00	3.97
Pupils demonstrate a longer attention span when using educational math software.	3.95	4.00	3.98	3.98
Pupils express a desire to continue practicing math exercises on digital platforms even after the allotted time.	3.90	4.23	3.96	4.03

Within this detailed indicator set, the highest displayed overall mean was 4.17 for “Pupils remain highly attentive and focused during digital Mathematics lessons compared to traditional ones.” while the lowest was 3.89 for “Pupils willingly collaborate with peers during interactive digital math games.” These are reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement.

The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

Table 10. Perceived learning-outcome indicators

Indicators	Big / large	Medium	Small	Overall
Technology-based instruction improves pupils' deep understanding of abstract Mathematics concepts.	3.82	4.04	3.91	3.92
Pupils demonstrate better logic and problem-solving skills when digital simulations are used.	4.00	4.13	4.04	4.06
Technology helps pupils retain foundational Mathematics lessons and formulas longer.	4.27	4.33	4.13	4.24
Pupils show notably improved academic grades in Mathematics 2 through technology-based learning.	4.14	3.92	3.98	4.01
Digital modules effectively help slow learners bridge their learning gaps in basic numeracy.	3.77	3.88	4.13	3.93
Pupils can accurately apply digital math concepts to solve real-life word problems.	3.95	4.04	3.60	3.86
The use of interactive math tools improves pupils' accuracy in basic addition and subtraction.	4.00	4.00	4.04	4.01
Pupils demonstrate faster mental computation after regular exposure to digital math drills.	4.09	3.96	4.04	4.03
Technology-based formative assessments reflect higher mastery levels among Grade 2 learners.	4.05	3.92	3.71	3.89
Digital learning resources effectively reinforce the mastery of shapes, measurements, and geometry.	4.00	4.21	3.87	4.03
Pupils exhibit greater confidence in answering math questions during recitations after using digital aids.	3.94	4.23	3.90	4.02
Technology integration significantly reduces the number of pupils failing in Mathematics 2.	3.87	4.05	4.06	3.99

Within this detailed indicator set, the highest displayed overall mean was 4.24 for “Technology helps pupils retain foundational Mathematics lessons and formulas longer.” while the lowest was 3.86 for “Pupils can accurately apply digital math concepts to solve real-life word problems.” These are source-reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement.

The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

Table 11. Accessibility indicators

Indicators	Big / large	Medium	Small	Overall
Pupils can easily access and operate the technology-based learning materials provided in school.	3.91	3.92	3.98	3.94
The available digital resources are developmentally appropriate for Grade 2 Mathematics.	4.09	4.08	4.04	4.07
Technology-based materials are usable even in classrooms with limited resources or physical space.	4.05	4.00	3.96	4.00
Offline digital tools (e.g., STARBOOKS) successfully bridge the learning gap for schools without internet.	4.18	4.25	3.91	4.11
The technology-based Mathematics modules can be easily accessed by pupils using standard smartphones.	3.82	3.96	3.98	3.92
The digital math applications provided are highly user-friendly and easy for 7-to-8-year-olds to navigate.	3.95	3.96	3.93	3.95
Educational software is installed and readily available on school-issued tablets or computers.	3.95	4.00	3.89	3.95
Interactive math lessons are designed to be functional even with low or intermittent internet bandwidth.	3.95	3.92	4.11	3.99
Pupils with special learning needs can access digital math resources with built-in audio or visual aids.	4.09	3.83	3.93	3.95
The school's physical infrastructure (e.g., charging stations, outlets) adequately supports the daily use of TBLA.	4.14	4.04	3.93	4.04

Within this detailed indicator set, the highest displayed overall mean was 4.11 for “Offline digital tools (e.g., STARBOOKS) successfully bridge the learning gap for schools without internet.” while the lowest was 3.92 for “The technology-based Mathematics modules can be easily accessed by pupils using standard smartphones.” These are source-reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement.

The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

Table 12. Planning-related challenges

Indicators	Big / large	Medium	Small	Overall
Finding, evaluating, and downloading appropriate digital Math resources consumes too much preparation time.	4.14	4.00	4.20	4.11
Integrating ICT into daily lesson plans is extremely difficult due to my heavy teaching and administrative workload.	4.27	3.96	4.29	4.17
There is a severe lack of readily available, localized digital lesson plan exemplars for Grade 2 Mathematics.	4.32	4.08	4.33	4.24
Designing alternative "offline" activities in case of sudden power or internet failure is burdensome.	4.00	4.25	3.96	4.07
Aligning traditional grading/assessment tools with modern technology-based activities is complicated.	4.05	4.17	4.07	4.10
Adjusting the standard DepEd Math 2 curriculum pacing to fit into technology-based modules is challenging.	4.14	4.00	4.04	4.06
Predicting the exact amount of time Grade 2 pupils will need to complete a digital task is difficult.	4.18	4.29	4.13	4.20
Planning collaborative digital math activities is tough when the availability of devices is highly limited.	4.09	4.17	4.16	4.14
Developing rubrics specifically tailored for grading digital math outputs takes significant effort.	4.14	4.25	4.16	4.18
Ensuring that downloaded digital materials are completely free of bugs or errors before the lesson is time-consuming.	4.18	4.04	4.11	4.11
Creating individualized digital learning paths for pupils with varying math proficiencies requires extensive planning.	4.11	4.18	4.21	4.17

Within this detailed indicator set, the highest displayed overall mean was 4.24 for “There is a severe lack of readily available, localized digital lesson plan exemplars for Grade 2 Mathematics.” while the lowest was 4.06 for “Adjusting the standard DepEd Math 2 curriculum pacing to fit into technology-based modules is challenging.” These are source-reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement. The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

Table 13. Safe and effective learning environment challenges

Indicators	Big / large	Medium	Small	Overall
Managing the screen time of Grade 2 learners to prevent eye strain or fatigue is a constant struggle.	4.14	4.00	4.20	4.11
Ensuring all young pupils handle school-provided gadgets carefully to avoid accidental damage is highly stressful.	4.27	3.96	4.29	4.17
Protecting learners from accidentally clicking on or accessing inappropriate online content is a major concern.	4.32	4.08	4.33	4.24
The physical setup and desk arrangement of the classroom is not conducive to group-based digital learning.	4.00	4.25	3.96	4.07
The noise level and excitement generated from gamified math apps often disrupt neighboring classes.	4.05	4.17	4.07	4.10
Preventing pupils from fighting over who gets to use the newer or faster tablets causes classroom management issues.	4.14	4.00	4.04	4.06
Monitoring pupils to ensure they are not secretly browsing other websites or playing non-educational games is difficult.	4.18	4.29	4.13	4.20
Keeping the classroom cool and properly ventilated when multiple electronic devices are running simultaneously is a problem.	4.09	4.17	4.16	4.14
Dealing with the ergonomic posture of Grade 2 pupils who hunch over tablets for extended periods is a health concern.	4.14	4.25	4.16	4.18
Securing charging stations and managing tangled wires safely in a classroom full of young children is hazardous.	4.18	4.04	4.11	4.11
Establishing a classroom culture where pupils wait patiently for lagging digital apps to load without acting out is challenging.	3.97	4.14	4.09	4.07

Within this detailed indicator set, the highest displayed overall mean was 4.24 for “Protecting learners from accidentally clicking on or accessing inappropriate online content is a major concern.” while the lowest was 4.06 for “Preventing pupils from fighting over who gets to use the newer or faster tablets causes classroom management issues.” These are source-reported item means. Their relative positions identify topics for observation and instructional planning, not statistically established improvements in learner achievement. The distribution across the big/large, medium and small school categories should be checked against local teaching conditions and response counts. Similar means across categories indicate a broadly shared reported pattern; even when visible differences occur, the available aggregate tables do not provide the respondent-level variability needed for independent tests of differences among school types.

3.6 Additional source-tabulated indicators for validation

These supplementary results tables reproduce further individual indicators from the uploaded source. The indicators allow readers to evaluate whether the relative domain priorities were driven by consistently similar items or by a small subset of highly rated practices. They were not created from hypothetical or reconstructed participant records.

Table 14. TBLA teacher-effectiveness indicators

Original item	Big / large	Medium	Small	Overall
Technology enhances my overall effectiveness and speed in delivering Mathematics lessons.	4.05	4.04	3.98	4.02
I manage my Mathematics class more efficiently by utilizing automated digital tools.	3.91	3.96	4.02	3.96
Technology allows me to provide immediate and personalized feedback to individual pupils.	4.14	4.17	4.04	4.12
I can easily differentiate my instruction for varied types of learners using interactive applications.	4.14	4.25	4.02	4.14
Digital platforms minimize the time I spend on the manual checking of Math exercises.	4.09	4.04	3.89	4.01
I can quickly identify which math competencies need reteaching by viewing automated digital reports.	4.23	4.13	3.89	4.08
TBLA enables me to present multiple visual representations of a single math concept simultaneously.	4.05	4.21	4.07	4.11
I effectively use multimedia presentations to simplify complex math instructions for Grade 2 learners.	3.77	3.92	3.84	3.84
Technology helps me maintain better classroom discipline by keeping pupils actively engaged in their screens.	4.14	3.96	4.09	4.06
I am able to maximize the allotted time for Mathematics 2 because of ready-made digital lesson guides.	4.05	4.13	3.98	4.05
Digital tools allow me to seamlessly track individual pupil progress throughout the school year.	4.10	4.19	3.89	4.06

This item-level table gave the highest overall rating to “I can easily differentiate my instruction for varied types of learners using interactive applications.” (4.14), while “I effectively use multimedia presentations to simplify complex math instructions for Grade 2 learners.” received the lowest (3.84). The contrast refines the broader domain finding: a favorable overall score may coexist with specific instructional practices that are less well established or more demanding. The researcher should examine these indicators through actual classroom artifacts and a documented scoring procedure.

Differences among school-size groups are best interpreted as descriptive patterns, because this table supplies aggregate means rather than the respondent-level scores and variances required to estimate confidence intervals or test group effects. For subsequent evaluation, teachers could link the most relevant indicators to short performance tasks, collect repeated examples of pupil work, and track the quality of implementation over time.

Table 15. TBLA cost-effectiveness indicators

Original item	Big / large	Medium	Small	Overall
Technology-based learning significantly reduces the school's need to print paper instructional materials.	4.09	4.21	4.07	4.12
The academic benefits of using interactive technology in Mathematics highly outweigh its financial costs.	4.23	4.17	3.91	4.10
Technology-based instruction is financially sustainable within our school's current MOOE budget.	4.14	4.08	4.04	4.09
Digital math manipulatives eliminate the need to purchase expensive, physical counting blocks/tools.	4.36	4.33	4.00	4.23
Utilizing shared digital platforms maximizes the utility of the school's existing ICT equipment.	3.82	3.92	4.04	3.93
Free, open-source educational software is maximized to deliver quality Mathematics 2 instruction.	4.05	4.21	3.84	4.03
TBLA minimizes the financial burden on parents by reducing the need for traditional printed workbooks.	4.27	4.04	3.96	4.09
The longevity and reusability of digital math modules make them a more cost-effective long-term investment.	4.00	4.17	3.93	4.03
The school successfully avoids costly software subscriptions by utilizing DepEd-provided digital resources.	4.14	4.08	3.87	4.03
Using multimedia projectors for whole-class instruction is more economical than providing individual modules.	4.09	3.96	3.98	4.01
Time saved from manual lesson preparations is effectively redirected to more productive teaching activities.	4.05	4.10	3.95	4.03

This item-level table gave the highest overall rating to “Digital math manipulatives eliminate the need to purchase expensive, physical counting blocks/tools.” (4.23), while “Utilizing shared digital platforms maximizes the utility of the school's existing ICT equipment.” received the lowest (3.93). The contrast refines the broader domain finding: a favorable overall score may coexist with specific instructional practices that are less well established or more demanding. The researcher should examine these indicators through actual classroom artifacts and a documented scoring procedure.

Differences among school-size groups are best interpreted as descriptive patterns, because this table supplies aggregate means rather than the respondent-level scores and variances required to estimate confidence intervals or test group effects. For subsequent evaluation, teachers could link the most relevant indicators to short performance tasks, collect repeated examples of pupil work, and track the quality of implementation over time.

4. Discussion

Three results stand out when the domains are considered together: competence was rated positively, technology use was widespread by self-report and implementation challenges remained substantial. These dimensions are not contradictory. Teachers may be confident operating familiar tools but still find lesson design, coordination, safety and access difficult under real classroom conditions.

The competence rating of 3.95 suggests a perceived readiness that school leaders could build on, but a robust professional-development plan should identify specific knowledge gaps through lesson observations and artifacts. The TPACK framework

stresses coherence between mathematical content, teaching strategy and technical functionality (Mishra & Koehler, 2006). A teacher can select an engaging game yet fail to address place value or operations if the underlying mathematical representation is weak. The lowest utilization dimension, accessibility, requires particular attention in geographically and resource-diverse contexts. The UNESCO report (2023) argues that equity, sustainability and learner need should guide technology decisions. School leaders should document device–pupil ratios, availability of offline alternatives, repair turnaround and suitability for young pupils rather than infer equal access from a single average response.

Although cost effectiveness ranked highest, no actual cost study was reported. Schools should distinguish perceived affordability from full-life-cycle cost, including electricity, maintenance, consumables, connectivity, teacher planning time and replacement. A simple annual cost per learner with transparent accounting could make future evaluation more defensible.

Planning and safety challenges are actionable. The EEF guidance (2019) emphasizes starting with a clear instructional problem and preparing training, implementation and evaluation support. In practical terms, learning-action-cell sessions could pair a mathematical objective with one digital or offline activity, a formative check and a defined response to common misconceptions.

Intervention research on mathematics supports systematic instruction, explicit mathematical language and purposeful representations (Fuchs et al., 2021). The district should assess whether TBLA lessons actually deliver these practices, rather than use frequency of device access as the sole marker of instructional quality.

The concordance audit illustrated an important statistical quality-control need. Table 11 reported significance for two teacher-competence domains even though the source chi-square/df combinations were not significant at $\alpha = .05$ when evaluated with conventional upper-tail probabilities. Such discrepancies can arise from copied critical values, degrees-of-freedom mismatches or unreported alternative procedures. A revised manuscript must seek the statistician's original output instead of silently choosing whichever label appears in a narrative. The source also used the broad language of "improving mathematical skills" for its questionnaire ratings. Without individually scored tests or a repeated-measures design, the evidence cannot establish a learning gain. A follow-up design could collect baseline and endpoint numeracy scores, document teacher implementation fidelity, and compare school categories while accounting for initial proficiency and material access. Finally, respondent perceptions remain important evidence for implementation policy: teachers are well positioned to identify procedural burdens and pupil accessibility barriers. Their ratings provide a needs-assessment map. However, definitive claims about pedagogical effectiveness require triangulation with observations, mathematical work samples, pupil assessments and cost records.

5. Implementation and evaluation priorities

Table 16. Proposed action-and-evidence framework

Priority	Near-term action	Outcome to verify
Planning challenge (4.14)	Co-design curriculum-aligned TBLA lessons during LAC	Lesson quality rubric and preparation time
Safety challenge (4.13)	Create child-friendly protocols and offline backups	Recorded incidents and continuity measures
Accessibility lowest (3.99)	Audit access by class and school type	Devices, access days, functioning materials
Teacher upskilling top solution (4.17)	Train on interpreting pupil responses and misconceptions	Observed feedback and response accuracy
Weak/variable concordance	Review original ranks and denominators	Reproducible test outputs
No measured pupil impact	Add pre/post mathematics tasks with fidelity checks	Learner-level gains with uncertainty intervals

6. Conclusion

The study reported Much Competent teacher ratings for TBLA (overall 3.95), Much Utilized practices in six associated mathematics areas (4.03), and Much Challenging implementation conditions (4.09). Professional competence had the highest competence rating (3.98); perceived cost effectiveness led utilization ratings (4.06); and planning was the highest-rated challenge (4.14). Respondents identified continuous teacher upskilling as the most necessary of the proposed solutions (4.17).

These ratings support targeted professional development and implementation planning, but do not prove causal gains in Grade 2 mathematics achievement. The study's inferential labels require correction or independent verification using its original rank data; several displayed decisions were inconsistent with the corresponding chi-square tests. Complete research methodology, participant details, instrument validation and ethical documentation must also be obtained before journal submission.

References

- [1] Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- [2] UNESCO Global Education Monitoring Report Team. (2023). Global education monitoring report 2023: Technology in education—A tool on whose terms? UNESCO. <https://www.unesco.org/gem-report/en/publication/technology>
- [3] Education Endowment Foundation. (2019). Using digital technology to improve learning: Guidance report. <https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/DIGITAL>
- [4] Fuchs, L. S., Bucka, N., Clarke, B., Dougherty, B., Jordan, N. C., Karp, K. S., & Woodward, J. (2021). Assisting students struggling with mathematics: Intervention in the elementary grades. Institute of Education Sciences, U.S. Department of Education. <https://ies.ed.gov/ncee/WWC/PracticeGuide/26>
- [5] Department of Education. (2017). DO 42, s. 2017: National adoption and implementation of the Philippine Professional Standards for Teachers. <https://www.deped.gov.ph/2017/08/11/do-42-s-2017-national-adoption-and-implementation-of-the>