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An Analysis of Teachers' Tpack Competence in Enhancing the Application of Differentiated Instruction across Diverse Learners

MARIALE T. JACALAN[1], SHERYLL T. CABIGUIN[2]
Cebu Technological University- Main Campus

Abstract: The integration of Pedagogical and Content Knowledge (TPACK) and differentiated instruction was essential for promoting inclusive and equitable education. However, limited evidence on how TPACK directly affected the implementation of differentiated instruction. This study assessed teachers' TPACK competency and their use of differentiated instruction in inclusive classrooms. It also examined the relationship between teachers' TPACK competency and their implementation of differentiated instruction at Talamban Elementary School, involving 50 teachers selected through purposive sampling. TPACK competency was measured using instruments adapted from Lugo and Delos Reyes (2025), and differentiated instruction was assessed using tools by Van Geel et al. (2022). A quantitative descriptive-correlational research design was used, and data were analyzed through descriptive statistics and Pearson's r correlation. The results showed that teachers were competent in TPACK and skilled in differentiated instruction, but gaps were identified in not using flexible assessments as a baseline for instructional decisions. A significant relationship was found between TPACK competency and the use of differentiated instruction. The study recommended a teacher development plan to enhance teaching practices, support professional growth, and strengthen school support for inclusive education, specifically by integrating regular TPACK training, providing continuous coaching and collaboration, and aligning teacher education, technology use, and school policies with inclusive education goals.

Keywords: TPACK competence, Differentiated Instruction, Inclusive Education, Diverse Learners, Educational Technology Integration, Teaching Practices, Cebu City, Philippines

I. INTRODUCTION

Educational environments are rapidly changing due to digital innovation and the increasing need to support inclusive education. These changes have reshaped the essential competencies required of 21st-century teachers. One framework that explains these competencies is the Technological Pedagogical and Content Knowledge (TPACK) framework, which defines effective teaching as the integration of technology, pedagogy, and content knowledge. TPACK explains how teachers use digital tools together with appropriate teaching strategies and subject-matter knowledge to support student learning. As technology becomes a regular part of classroom instruction, the TPACK framework provides a clear basis for examining teachers' ability to use technology in a meaningful and responsible way.

Inclusive classrooms consist of learners with diverse abilities, learning styles, backgrounds, and support needs. Because of this diversity, teachers cannot rely on a single teaching approach for all learners. Differentiated instruction is an educational approach that addresses these differences by adjusting lesson content, learning activities, outputs, and classroom environments to meet learners' varied needs and abilities.

The integration of TPACK and differentiated instruction is essential for promoting inclusive and equitable education because technology supports differentiation by providing multiple ways for learners to access information, express understanding, and stay engaged. When teachers clearly understand the learning context, pedagogy, classroom management, and learners' individual needs, and use technology appropriately, learning barriers can be reduced and all

learners, including learners with special educational needs (LSENs), can be effectively supported (Malik, 2024; Kyzar, 2022).

Teachers with strong TPACK competence are better able to implement flexible and inclusive teaching practices that improve learner engagement and participation in inclusive classrooms (Malisiova et al., 2023; Kjellström et al., 2025) in the inclusive classroom setting. This competence enables teachers to select appropriate digital tools, design varied learning activities, adjust instruction based on learners' needs, and implement differentiated instruction more effectively. Digital tools further allow teachers to personalize learning, provide appropriate support, and maintain clear learning goals while responding to individual differences.

International studies show that teachers' TPACK competence supports the use of differentiated instruction in inclusive classrooms. However, there is still limited evidence on how TPACK directly affects the effective implementation of differentiated instruction. This gap is linked to limited training, inadequate access to technology, and insufficient professional support focused on strengthening TPACK and inclusive classroom management (Dinçer, 2024; Gheyssens et al., 2023; Othman, 2024; Dwipa et al., 2025).

In the Philippine context, teachers demonstrate a moderate level of TPACK in delivering differentiated instruction. This is mainly due to a lack of instructional materials and resources, limited support in implementing inclusive practices, heavy teaching workloads, and weak collaboration in integrating technology into inclusive education (Alraba et al.; Lugo & Delos Reyes; Ramos et al.). At the local context, particularly in Talamaban Elementary School, teachers face similar challenges. These include limited technological resources in classrooms, large class sizes, and few professional development activities focused on inclusive practices.

Given these concerns, this study assessed teachers' level of TPACK competence and their use of differentiated instruction in teaching learners with diverse needs. It also examined how TPACK competence influences the effective implementation of differentiated instruction in inclusive classroom settings.

The findings aimed to improve inclusive teaching practices by supporting meaningful learner participation and to contribute to research on inclusive digital pedagogy by linking TPACK and differentiated instruction. The results were intended to guide teacher education institutions, professional development programs, and policymakers in strengthening teachers' readiness for inclusive education.

II. Statement of the Problem

This study assessed teachers' competency in TPACK and their ability to use differentiated instruction in teaching diverse learners in the classroom. It also examined how teachers' TPACK competence influenced their effectiveness in applying differentiated instruction to address the diverse needs of learners in inclusive classrooms at Talamban Elementary School for the School Year 2025–2026. The results served as the basis for a comprehensive development plan. Specifically, this study sought to answer the following questions:

1. What is the level of teachers' TPACK competency in terms of:
    1.1. Content Knowledge (CK);
    1.2. Pedagogical Knowledge (PK);
    1.3. Technological Knowledge (TK);
    1.4. Pedagogical Content Knowledge (PCK);
    1.5. Technological Content Knowledge (TCK);
    1.6. Technological Pedagogical Knowledge (TPK); and
    1.7. Technological Pedagogical Content Knowledge (TPACK)?
2. What is the level of teachers' competency in applying differentiated instruction in terms of:
    2.1. Identification of Educational Needs;
    2.2. Setting Differentiated Goals;
    2.3. Implementation of Differentiated Instruction;
    2.4. Use of Differentiated Tasks; and
    2.5. Evaluation of Learners' Progress and Processes?
4. Is there a significant relationship between teachers' TPACK competency and the competency in applying differentiated instruction?

III. RESEARCH METHODOLOGY

This section presents the research methodology employed in the study. It began by describing the participants, including the criteria and process used for their selection. The research design was then discussed, along with the rationale for its adoption. Furthermore, the chapter outlined the instruments utilized for data collection and detailed the procedures

undertaken during the conduct of the study. Lastly, it explained the methods of data analysis and discussed the ethical considerations observed throughout the research process.

Design

This study used a quantitative descriptive-correlational research design to analyze numerical data and examine the relationship between teachers' TPACK competency and their ability to implement differentiated instruction in inclusive classrooms. This design is appropriate because it allows the testing of hypotheses and the identification of significant relationships between variables while ensuring objectivity, reliability, and accuracy (Sharma et al., 2023). Specifically, the study determined whether a significant relationship exists between TPACK competency and differentiated instruction and how TPACK mastery influences teachers' ability to address diverse learner needs.

Flow of the Study

This study employed the Input–Process–Output (IPO) framework as its guiding model to systematically assess teachers' TPACK competency and their competency in applying differentiated instruction among teachers

The IPO framework served as a structured research model by dividing the research procedure into distinct and sequential phases—input, process, and output—thereby ensuring clarity, manageability, and logical flow. It enabled the researchers to identify the necessary inputs, understand how these inputs were processed, and determine the expected outputs. Through this approach, the study facilitated effective planning, implementation, and monitoring of the research activities, ensuring that the findings were valid, reliable, and meaningful. Ultimately, the IPO framework ensured that all inputs were appropriately managed, leading to outcomes that enhanced teachers' competency in applying differentiated instruction.

Input Phase. This phase consisted of the collection of teachers' personal information, such as age, gender, educational attainment, years of teaching experience, and type of classroom setting. It also included the assessment of teachers' TPACK competency and their competency in applying differentiated instruction. Furthermore, this phase examined whether a significant relationship existed between these variables.

Process Phase. The researcher sought approval from the DepEd Division of Cebu City to conduct the study. Upon approval, surveys were distributed to the participating teachers. The responses were statistically analyzed to determine the teachers' level of TPACK competency and their application of differentiated instruction. This analysis also explored whether teachers' TPACK competency influenced their effectiveness in managing learners in inclusive classrooms.

Output Phase. This phase presented the study's findings on teachers' TPACK competency and their ability to apply differentiated instruction. It also examined the relationship between these two variables. Based on the results, a development plan was designed to strengthen the TPACK competency of secondary school receiving teachers, thereby enhancing the effective implementation of differentiated instruction in inclusive classroom settings.

Environment

This study was conducted at Talamban Elementary School, which follows the Department of Education (DepEd) protocols and guidelines. According to DepEd Order No. 44, s. 2021, also known as the Inclusive Education Policy Guidelines, teachers are encouraged to use inclusive teaching practices and technology to make learning accessible to all learners; thus, teachers are expected to be skilled in the use of technology and capable of applying instructional strategies that address the needs of diverse learners in inclusive classrooms. However,

in this school, no assessment had been conducted to determine how teachers' competency in the TPACK framework contributes to their effectiveness in implementing differentiated instruction to accommodate the diverse needs of learners in inclusive classroom settings. Figure 3 presents the research environment.

Respondents

The primary respondents of the study consisted of receiving teachers from Talamban Elementary School. Specifically, these included early childhood and elementary teachers who were employed under the Department of Education at the time of the study. A total of 50 teachers were selected to participate in the study. Table 1 showed the distribution of teacher-respondents.

Table 1

Distribution of Teachers Respondents

Name of School	n	Percentage

Talamban Elementary School Early Childhood Education Department	10	20
Talamban Elementary School Elementary Department	40	80
TOTAL	50	100

To be included as respondents, participants had to meet the following criteria: (1) they were basic education teachers; (2) they had at least one year of teaching experience at the early childhood or elementary level under the DepEd; (3) they were 25 years old or older; (4) they were active employees of the Department of Education; and (5) they were teaching in elementary or secondary education programs within the identified research locale at the time of data collection.

Further, purposive sampling was used in the selection of respondents. This sampling method was deemed appropriate because participants were intentionally chosen based on specific characteristics that were directly relevant to the research objectives. By deliberately selecting individuals who met predetermined inclusion criteria, the study ensured that the respondents possessed the necessary qualifications and experiences to provide meaningful and reliable data. Consequently, this sampling technique strengthened the alignment between the participants' attributes and the focus of the investigation.

Instrument

This study utilized an adapted research survey tool that consisted of three parts, specifically designed to collect data from basic education teachers. The first part of the instrument focused on the demographic profile of the respondents. This section aimed to obtain background information pertinent to the study, such as age, gender, years of teaching experience, educational attainment, and teaching assignment.

The second part measured the teachers' TPACK competency. This section was based on the original instrument developed by Valtonen et al. (2017), titled "TPACK Updated to Measure Pre-Service Teachers' Twenty-First Century Skills." For the purpose of this study, however, the adapted and modified version developed by Lugo and Delos Reyes (2024), entitled "Teachers' Competencies for Pedagogical Practice in Special and Inclusive Education towards the Development of a TPACK Framework," was employed. The instrument assessed seven domains corresponding to the components of the TPACK framework, namely: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The tool consisted of a total of 49 statements, with seven items representing each component. The respondents indicated their perceived level of competency using a 4-point Likert scale with the following descriptors: (1) Not Competent, (2) Less Competent, (3) Competent, and (4) Highly Competent.

The third part of the instrument evaluated the teachers' level of competency in applying differentiated instruction to address the needs of diverse learners in inclusive classroom settings. This section was adapted from the work of Van De Weijer-Bergsma et al. (2014), titled "Validity and Reliability of an Online Visual–Spatial Working Memory Task for Self-Reliant Administration in School-Aged Children," published in Behavior Research Methods. For this study, the research instrument from the study of Van Geel et al. (2022), How Teachers Develop Skills for Implementing Differentiated Instruction: Helpful and Hindering Factors, was utilized.

The adapted instrument contained 36 statements distributed across five areas: Identification of Educational Needs (5 items), Setting Differentiated Goals (8 items), Implementation of Differentiated Instruction (7 items), Use of Differentiated Tasks (8 items), and Evaluation of Learners' Progress and Processes (8 items). This part aimed to determine how effectively teachers implemented differentiated instruction in inclusive classrooms.

IV. Results and Discussions

This section presents the results of the study based on the statistical analysis of data collected through the survey questionnaire. The results were shown in tables for a clear and organized presentation. This chapter also explained and interpreted the findings in relation to the study's objectives.

V. TEACHERS' LEVEL OF TPACK COMPETENCY

Tables 2 to 9 showed the skill level of general education teachers in using TPACK in inclusive classrooms. Teachers had to plan, deliver, and adjust lessons to meet the diverse needs of learners. This required a strong understanding of content, effective teaching strategies, and the appropriate use of technology to help learners engage and learn in ways suited to their needs. TPACK integrated content, pedagogical, and technological knowledge, fostering 21st-century skills like critical thinking, communication, collaboration, and creativity. Teachers with strong TPACK were able to choose and use technology that aligned with lesson objectives and supported the diverse needs of learners in inclusive classrooms.

Table 2
Teachers' Content Knowledge Competence

Statement	Mean	SD	Interpretation
I have sufficient knowledge in my field.	3.34	0.593	Highly Competent
I know basic concepts such as definitions in my field.	3.34	0.593	Highly Competent
I understand the structure (organizations) of topics of content I teach.	3.40	0.606	Highly Competent
I can present the same subject matter at different levels.	3.14	0.606	Competent
I can explain background details of concepts and definitions in my field.	3.20	0.639	Competent
I have adequate knowledge in explaining relations among different concepts on the subject matter.	3.20	0.606	Competent
I can make connections with the content I teach and daily life.	3.46	0.613	Highly Competent
Average	3.30	0.541	Highly Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

Table 2 showed that the respondents' overall mean score for content knowledge competence was 3.30 (SD = 0.541), with a verbal description of Highly Competent. The highest mean score was for "I could make connections with the content I taught and daily life," with a mean of 3.46 (SD = 0.613), interpreted as Highly Competent. The middle-ranked indicators were "I could explain background details of concepts and definitions in my field" (M = 3.20, SD = 0.639) and "I had adequate knowledge in explaining relations among different concepts in the subject matter" (M = 3.20, SD = 0.606); both had a verbal description of Competent. The lowest mean score was recorded for "I could present the same subject matter at different levels," with a mean of 3.14 (SD = 0.606), interpreted as Competent.

The data showed that teachers had strong content knowledge, clear lesson organization, and the ability to connect topics to real-life contexts, which reflected their familiarity with the curriculum and helped them explain concepts and show relationships across topics. However, they needed to improve in unpacking complex ideas, sequencing concepts logically, and adjusting explanations for diverse classrooms. This gap existed because many teachers knew the content but were not fully prepared to transform it into teachable and learner-friendly forms. They had limited training in differentiated and inclusive pedagogy and worked under an overloaded curriculum with limited time. The results showed that effective teaching did not depend on content mastery alone but also on strong pedagogical skills such as clear conceptual explanation, instructional coherence, differentiation, and flexible and responsive strategies for learners in different contexts. Therefore, professional development needed to move beyond content knowledge and provide targeted interventions that improved teachers' explanatory skills, deepened conceptual understanding, and strengthened differentiated instruction.

Teachers knew their subject well, so they could organize what they taught and explain it in ways that learners could connect to everyday life. However, studies showed that teachers still found it hard to present lessons at different difficulty levels and to match instruction to each learner's needs and context. This meant that teachers needed to improve their skills in planning, delivering instruction, and evaluating their lessons after teaching (Van Geel et al., 2023), as well as in making careful instructional adjustments based on their reflections and decisions (Jager, 2024). Schools faced challenges when using a modified curriculum. Despite support from a multidisciplinary team, teachers struggled to deliver the curriculum in a way that suited each learner's individual needs (Hayati et al., 2024). However, differentiated instruction, including adjusting content levels, varying learning processes, and using different materials, proved effective in meeting the needs of diverse learners (Ouyang & Ye, 2023; Sari et al., 2023).

Table 3
Teachers' Pedagogical Knowledge Competence

Statement	Mean	SD	Interpretation
I can use different approaches to teach.	3.32	0.587	Highly Competent
I can select appropriate teaching styles for students from different backgrounds.	3.22	0.616	Competent
I can use a variety of tools (approaches) to assess students' learning.	3.24	0.625	Competent
I consider students' backgrounds, interests, motivation, and other needs in my teaching.	3.36	0.598	Highly Competent
I can plan individual and group learning activities effectively.	3.22	0.616	Competent
I have knowledge in different pedagogies of teaching and learning.	3.16	0.650	Competent
I have knowledge in different components of teaching (i.e., instruction, assessment).	3.18	0.560	Competent
Average	**3.24**	**0.533**	**Competent**

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

The lowest-rated indicator was "I had knowledge in different pedagogies of teaching and learning" mean score of 3.16 (SD = 0.650), which was still interpreted as Competent, implying that while the respondents demonstrated functional pedagogical competence overall, broader mastery of varied pedagogical frameworks may have remained an area for further strengthening.

The data showed that teachers demonstrated strong practical skills in lesson planning, using varied teaching methods, assessing learning, and applying differentiation to support diverse learners in regular and inclusive classrooms, adapting instruction through multiple approaches rather than relying on a single method. However, inclusive strategies and activity planning were applied only when needed and were not systematically integrated. Teaching decisions were mostly based on routine practice and experience rather than on clear theory-based analysis, as shown by the limited explanation of their pedagogical foundations. This was due to limited formal training in inclusive education and the weak connection between theoretical coursework and actual classroom practice, which led teachers to rely on experience and trial and error instead of theory-guided instruction. They also prioritized classroom management, curriculum coverage, and time demands over reflective pedagogical analysis, a situation that was more evident in contexts with large class sizes, heavy workloads, limited pre-service specialization, inadequate in-service training, and the absence of sustained coaching or mentoring. These findings indicated the need for professional development that would strengthen the link between instructional adaptations and pedagogical theory and promote consistent learner-centered practices where the curriculum, materials, learning environment, and instructional experiences were intentionally aligned with learners' contexts.

Teachers tried to base their teaching on each learner's needs and situation, but many had weak skills in using

assessment tools to collect baseline data. This matched findings that some teachers used few formative assessment strategies, showing limited assessment literacy that made it hard to adjust teaching to learners (Asamoah et al., 2025). When teachers did not have enough knowledge of assessment methods and learners' past learning, they could not plan well for differentiated instruction and assessment for learning (Wolterinck-Broekhuis, 2022). This problem became even more serious in general education classes with learners who had interpersonal behavior difficulties, because weak assessment skills made it harder to choose the right support and teaching approach (Sayson-Sumugat, 2025). Teachers also showed limited skill in assessing self-regulated learning, especially in online settings, which reduced their ability to tailor teaching to individual learners (Karlen et al., 2024). To improve this, teachers needed ongoing training, mentoring, and regular reflection so they could use assessment results better when choosing teaching strategies (Surtini & Muhtar, 2024).

Table 4

Teachers Technological Knowledge Competence

Statement	Mean	SD	Interpretation
I can learn technology easily.	3.14	0.606	Competent
I can easily solve some of the technical problems I encounter.	2.96	0.727	Competent
I know how to seek technology help.	3.20	0.535	Competent
I have sufficient knowledge and experience with the most recent technologies.	2.92	0.601	Competent
I can help my friends in their use of different technologies.	2.88	0.718	Competent
I use different technologies regularly for different purposes (i.e., communication, typing, internet).	3.08	0.634	Competent
I try different technologies in my free time.	3.00	0.700	Competent
Average	3.03	0.542	Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

The findings showed that teachers had a practical and dependable level of technology skill. They were resourceful and consistently sought help when needed, which enabled them to solve technical problems and use digital tools strategically for their own learning, independent work, and classroom tasks, reflecting readiness to learn and routine application rather than mere procedural use. However, although they used technology for their own tasks, they lacked the confidence and capacity to mentor colleagues, and their only moderate effort to explore new technologies in their free time indicated that continuous learning habits were not yet strong. As a result, their ability to support, guide, and train others remained underdeveloped, which may be linked to limited exposure to more advanced tools and fewer opportunities for collaborative, peer-supported learning. These findings suggested that technology training should go beyond basic skills and focus on strengthening teachers' confidence, sustained practice, and their ability to assist others in using technology effectively.

The results showed that teachers could improve their own technology skills, but they were not confident in guiding their co-teachers to use technology in teaching. This matched Loisulie and Kondo (2025), where teachers rated their ICT skills only as "Average," suggesting they may have felt their skills were still not strong enough to train others. This also supported the need to continue building skills for teaching with technology, especially during remote teaching situations (Hodges et al., 2020). Teachers could build confidence through regular training and practice, such as learning from expert teachers, joining workshops or online courses, using adaptive and assistive equipment, and applying TPACK in inclusive classrooms (Jaeni & Ghufron, 2024). However, helping others also depended on school support because teachers' technology leadership became stronger when the school culture supported technology use and teachers developed self-leadership (Samsudin & Ghani, 2020). Likewise, when schools introduced new tools or embraced AI, teachers might still have hesitated to promote them if they were unsure how to use them responsibly and ethically (Peddi

& Manoharan, 2025).

Table 5
Teachers in Pedagogical Content Knowledge Competence

Statement	Mean	SD	Interpretation
I can select teachable content of the subject matter appropriate to students' level.	3.28	0.536	Highly Competent
I can teach the same subject matter to students at different levels.	3.32	0.551	Highly Competent
I can adjust my teaching according to level of ease and difficulties with learning of specific subject matter.	3.36	0.563	Highly Competent
I can use different methods and approaches to represent specific content.	3.28	0.536	Highly Competent
I can generate alternative teaching approaches according to students' levels.	3.22	0.545	Competent
I have sufficient knowledge in transforming students' misconceptions.	3.14	0.535	Competent
I can use analogies, examples, and demonstrations to support students' learning.	3.24	0.555	Competent
Average	3.26	0.487	Highly Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

Two indicators had the same mean score of 3.28: choosing content appropriate to learners' levels and using different methods to present subject matter. Both were interpreted as Highly Competent. The indicator "I could use analogies, examples, and demonstrations to help learners learn" had a mean of 3.24 (SD = 0.555) and was interpreted as Competent. The lowest mean scores were found in "I could use alternative teaching approaches based on learners' levels" (3.22, SD = 0.545) and "I had enough knowledge to correct learners' misconceptions" (3.14, SD = 0.535), which were also interpreted as Competent.

The findings showed that teachers adjusted their teaching based on the difficulty of the lesson and the learners' levels and were confident in selecting appropriate content, controlling the pace of instruction, and teaching the same lesson to learners with different abilities, which indicated strength in basic instructional adjustments. However, they were less confident in using deeper strategies such as analogies, demonstrations, varied methods, and multiple representations of ideas, and they had difficulty identifying and correcting misconceptions, recognizing prior knowledge, diagnosing misunderstandings, and giving clear feedback, which affected learners' understanding. These weaknesses were linked to limited practice-based training in dynamic and multidisciplinary assessment and learner profiling that resulted in weak pedagogical content knowledge, as teacher preparation in actual practice focused more on content delivery than on interpreting learners' present level of performance, understanding how they think, activating prior knowledge, using multiple representations, and providing responsive feedback. The results indicated the need for targeted professional development that went beyond lesson adjustment and focused on how learners think and learn, particularly on eliciting prior knowledge, addressing misconceptions, and strengthening explanation and feedback skills.

Cosgun and Basaran (2025) underscore the need to strengthen teachers' awareness and competence in metacognitive learning strategies. Although many teachers adjust lessons in response to classroom demands, they often report limited confidence in the specific instructional moves required to surface and correct learners' misconceptions. Addressing this gap requires deliberate use of adaptive teaching practices that identify misconceptions early, provide targeted feedback, and sustain an inclusive learning climate that recognizes variability in learners' profiles and preferred ways of learning (V, 2025). This direction is further supported by personalized learning approaches that align instruction with individual needs and leverage adaptive technologies and flexible learning models to help learners navigate content

difficulties (Idowu, 2024).

In applied settings, individualized education plans (IEPs) and differentiated instruction provide a systematic framework for responding to learner differences and remediating misconceptions through planned supports, scaffolded tasks, and appropriate adjustments to content, process, and assessment (Damyanov, 2024). These strategies are most effective when embedded in positive teacher–student relationships, strengthened by targeted accommodations, and implemented through sustained collaboration among teachers, families, and allied professionals to ensure continuity of support across contexts (Ranbir, 2024). Consistent with inclusive pedagogy, teachers may operationalize these commitments by calibrating instructional pacing, providing needs-based oral feedback, and proactively responding to diverse learners to promote equitable access to meaningful learning (Putra, 2023).

Table 6
Teachers' Technological Content Knowledge Competence

Statement	Mean	SD	Interpretation
I can use technology to present the content in different ways.	3.22	0.679	Competent
I can use technology to enrich the content.	3.22	0.648	Competent
I can use technology to demonstrate unobservable facts, concepts, and principles of the content.	3.16	0.650	Competent
I can use technology to access additional resources about content that may otherwise not be available.	3.22	0.616	Competent
I can use technology to provide students with opportunities in exploring content by themselves at their own individual pace.	3.16	0.618	Competent
I can use technology to support students in deeper inquiry about the content, concepts, and relationships with other subject matters.	3.14	0.606	Competent
I can use technology in teaching to provide different forms of content.	3.18	0.661	Competent
Average	3.19	0.592	Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

Table 6 presents the teachers' competency in TCK, with an overall mean score of 3.19 (SD = 0.592), which falls within the Competent level. This indicates that respondents generally have sufficient proficiency in using technology to support and enhance content-based teaching. Among the seven indicators, three statements obtained the highest mean score of 3.22, namely: "I can use technology to present the content in different ways" (SD = 0.679), "I can use technology to enrich the content" (SD = 0.648), and "I can use technology to access additional resources about content that may otherwise not be available" (SD = 0.616). The mid-ranked indicator, "I can use technology in teaching to provide different forms of content," yielded a mean score of 3.18 (SD = 0.661), remaining within the Competent range. Two indicators followed with identical mean scores of 3.16, namely: "I can use technology to demonstrate unobservable facts, concepts, and principles of the content" (SD = 0.650) and "I can use technology to provide students with opportunities to explore content independently at their own pace" (SD = 0.618). The lowest mean score was "I can use technology to support students in deeper inquiry about the content, concepts, and relationships with other subject matters," with a mean of 3.14

(SD = 0.606) and interpreted as Competent.

The findings showed that teachers were competent in presenting lessons, providing additional learning materials, and accessing digital resources, and they used technology mainly to clarify lessons and increase learners' access to content, which reflected practical and functional use. However, they rarely used it to present abstract concepts, support self-paced learning, or promote deeper exploration, so it did not often develop higher-order thinking skills, connect ideas across subjects, or sustain inquiry-based learning, and technology integration remained mostly teacher-directed rather than learner-centered. This occurred because teachers had basic ICT skills but low techno-pedagogical competence, leading them to use technology for presentation rather than for inquiry, simulations, modeling, and problem-solving, while curriculum coverage pressure, heavy workload, large class size, and limited resources hindered learner-centered, real-life-based, personalized, and self-paced learning. The data suggested that teacher education needed to move beyond technical skills and train teachers to use technology to develop higher-order thinking, that the curriculum needed to embed technology-supported inquiry to deepen conceptual understanding and interdisciplinary learning, and that effective implementation at the policy and school levels required better access to digital tools, dedicated time for collaborative planning, and clear guidance on technology-based pedagogy.

Limited teacher competency in integrating technology weakened subject delivery. Rofi'i et al. (2023) reported that even with improvements, teachers still struggled with confidence, skills, and access to resources. These limits reduced the instructional value of digital tools in daily teaching. Likewise, Mariscal et al. (2023) emphasized that although teachers generally had positive attitudes and showed some competence in educational technology, their teaching skills for technology integration varied widely. This pointed to the need for more training to strengthen content delivery. This concern also extended to teacher preparation, as teacher educators themselves may have had limited knowledge of how to integrate technology into curriculum delivery. This may have weakened teaching–learning outcomes and showed the need for constructivist support for 21st-century instruction (Mpuangnan, 2024).

Related studies also showed that effective integration depended on both teacher and learner readiness. Faloye and Faniran (2023) highlighted that teacher competency in using technology was crucial. Without prior exposure and supportive conditions, technology use may have failed to improve subject teaching. To address these gaps, Napitupulu et al. (2024) argued that Teacher Professional Development needed to go beyond basic skills by offering hands-on training aligned with teaching methods, collaboration, and sustained support. This should have been reinforced by institutional policies that encouraged innovation and adaptability. In the same direction, Rifa'i and Koironi (2025) explained that technology helped learners visualize complex concepts and link theory to practice, but successful digital transformation depended not only on infrastructure. It also required teachers' creative ability to redesign teaching, especially in settings with limited resources. Finally, despite satisfactory basic digital literacy, gaps in designing interactive multimedia instructional materials remained a major barrier to better integration. This required targeted support for teachers across experience levels (Saili et al., 2024).

Table 7
Teachers Technological Pedagogical Knowledge Competence

Statement	Mean	SD	Interpretation
I can use technology to assess students' learning.	3.18	0.629	Competent
I can use technology to identify individual differences among students.	3.16	0.618	Competent
I can use technology to advance my teaching and students' learning.	3.22	0.582	Competent
I can use technology to bring students' individual differences (learning preferences, content background, academic level) into the classroom.	3.16	0.650	Competent

I can use technology to enrich different components (i.e., lecturing, examples, and assessment) of teaching activity.	3.26	0.600	Highly Competent
I can use technology to engage students with content.	3.20	0.606	Competent
I can use technology to generate alternative approaches to teaching components (i.e., teaching, assessment, presentation, motivation).	3.28	0.573	Highly Competent
Average	3.21	0.571	Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

Table 7 presented the teachers' competency in Technological Pedagogical Knowledge (TPK). In this domain, the overall mean score was 3.21 (SD = 0.571), which was interpreted as Competent. This indicated that, on average, the respondents demonstrated an acceptable level of technological pedagogical proficiency in integrating technology into their teaching practices. When ranked according to mean scores, the highest-rated indicator was "I can use technology to generate alternative approaches to teaching components (i.e., teaching, assessment, presentation, motivation)" with a mean score of 3.28 (SD = 0.573), which was interpreted as Highly Competent. It was followed by "I can use technology to enrich different components (i.e., lecturing, examples, and assessment) of teaching activity" with a mean score of 3.26 (SD = 0.600), also interpreted as Highly Competent. The item "I can use technology to engage students with content" obtained a mean score of 3.20 (SD = 0.606) and was interpreted as Competent. Meanwhile, the indicators "I can use technology to identify individual differences among students" (M = 3.16, SD = 0.618) and "I can use technology to bring students' individual differences (learning preferences, content background, academic level) into the classroom" (M = 3.16, SD = 0.650) recorded the lowest mean scores; however, both were still interpreted as Competent.

Based on the data, teachers used technology effectively for lesson design, presentation, assessment, and organizing instruction, which made teaching more engaging and efficient; however, they mainly used it for efficiency and classroom management rather than for personalized or learner-centered learning. They had lower competence and confidence in using digital tools for data analysis, differentiated instruction, adaptive learning, and in addressing individual learner differences because they lacked the skills to use assessment data to select appropriate pedagogical and technological approaches for diverse learners. ICT trainings focused on operating tools and presentation skills instead of data-driven instruction, and limited institutional support and the absence of collaborative structures—such as access to appropriate tools, planning time, and instructional coaching—reduced their opportunities to implement learner-centered digital strategies. The findings showed that teachers needed professional development in digital assessment, use of learner data, and technology-supported differentiated instruction for inclusive classrooms, together with stronger institutional support.

Hofer (2022) emphasized that meaningful learning required teachers to address deep misconceptions and model effective teaching practices, suggesting that limited instructional adaptation competence might have allowed misconceptions to persist and could have hindered concept mastery. In the same way, Srinivasa et al. (2022) argued that traditional, one-size-fits-all presentations often failed to accommodate learner differences, resulting in confusion and reduced engagement; in contrast, adaptive teaching strengthened concept understanding by tailoring learning pathways to student needs (Srinivasa et al., 2022).

The result was also consistent with the position of Vargas-Hernández and Vargas-González (2022), who underscored that adaptive teaching competence was crucial for inclusive teaching and that teacher education had to further develop and innovate to improve students' meaningful understanding of concepts. Empirical evidence further supported this gap: Hardy et al. (2022) reported that teachers rarely acted adaptively, indicating that insufficient instructional adaptation could have undermined meaningful learning and pointing to the need for strengthened professional development, particularly in basic education (Hardy et al., 2022). Moreover, adaptive teaching was identified as an effective approach that enhanced learning environments and outcomes (Renapurkar et al., 2025). This was strengthened by the view that meaningful learning improved when teachers designed and implemented active didactic strategies that were responsive to context (Vargas-Hernández & Kariyev, 2022).

Li (2024) recommended using varied teaching methods, including differentiation and scaffolding, to address diverse learner needs and enhance understanding. The findings highlighted a gap between modifying the curriculum and

having the competence to implement adaptations effectively, emphasizing the need for ongoing training and support for adaptive instructional practices (Hardy et al., 2022; Renapurkar et al., 2025; Vargas-Hernández & Vargas-González, 2022).

Table 8

Teachers' Technological Pedagogical Content Knowledge Competence

Statement	Mean	SD	Interpretation
I can use technology in teaching the specific content within the defined pedagogical approach in a given context.	3.20	0.606	Competent
I can use technology in such a way that students feel it's positive impact in their learning of specific subject matter.	3.24	0.625	Competent
I can use technology to organize my teaching and students' learning specific content.	3.26	0.600	Highly Competent
I can use technology to bring real-life experiences, examples, and analogies about specific content.	3.16	0.584	Competent
I can use technology to identify learners' individual differences on understanding of the content.	3.06	0.550	Competent
I can use technology to make specific subject matter comprehensible by students from different backgrounds.	3.12	0.558	Competent
I can use technology to provide opportunities to each student in the classroom to contribute to learning activity related to specific content.	3.14	0.606	Competent
Average	3.17	0.550	Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

The results showed that teachers had basic and operational technology skills and were competent in using technology to organize teaching and learning. This reflected their confidence in lesson planning, managing instruction, and structuring activities. They recognized the value of technology in supporting student learning, but they needed support in using it for inclusive, diagnostic, and responsive instruction and had only moderate confidence in using it for meaningful tasks such as connecting lessons to real-life situations, deepening understanding, and differentiating instruction. Technology was mainly used for organizing teaching rather than for higher-order thinking, formative assessment, learning analytics, and data-driven decision-making. This gap was caused by professional development that focused on operating digital tools instead of integrating them into inclusive and differentiated teaching. Technology was mostly used for administrative tasks such as preparing slides, encoding grades, storing files, and communication rather than improving instruction. Heavy workload and time constraints forced teachers to prioritize lesson preparation, documentation, reports, and classroom management, which limited their capacity to design inclusive digital learning. Teachers had low assessment literacy and low confidence in using data for instructional decisions. One-shot trainings did not change classroom practice because there was no sustained coaching or active professional learning communities. The data indicated that professional development needed to go beyond basic technology skills and focus on advanced and meaningful classroom use, and that teacher education institutions, training providers, curriculum designers, and school leaders needed to provide continuous training on digital assessment tools, simulations, multimedia resources, problem-

based digital tasks, and data-driven instruction to strengthen teachers' capacity to use technology for inclusive, flexible, real-world learning and to support equitable learning outcomes.

According to Montgomery (2022) reported that teachers struggled to handle diverse learners because resources and support were limited; although technology use was seen as successful, weak screening approaches and limited access to assessment tools reduced teachers' ability to give complete support to all learners. This helped explain why teachers were able to modify or present content using digital tools but still found it hard to use technology for practical inclusive tasks like identifying learner needs, planning targeted help, and tracking progress, and this gap was reinforced by the digital divide where limited training and skills constrained teachers even when student ICT access was similar (AlSadrani et al., 2020). Likewise, Nzuza (2025) emphasized that poor preparation and training often prevented teachers from using technology in inclusive ways, leading to weak competence in managing and teaching diverse learners and showing the need for fair Technology-Enhanced Learning preparation, while Farooqi et al. (2024) stressed that teachers needed broader teaching skills—along with effective technology use—to respond to learners' different backgrounds and needs, meaning technology for content delivery was not enough without strong teaching decisions in inclusive settings.

In the same way, Halder (2023) argued that teachers' skills remained inadequate for addressing diversity, especially in using technology effectively, which signaled a need to strengthen teacher education so technology use became truly inclusive rather than simply instructional. Moreover, Méndez et al. (2022) reported that teachers' digital competence was often overestimated, suggesting that perceived skill hid real limits in using technology to manage and teach diverse learners and highlighting the need for lifelong training focused on inclusion, which aligned with assistive technology research showing that lack of training and ongoing support hindered teachers' ability to provide fair learning opportunities (Chahal et al., 2024). At the institutional level, Amjad et al. (2025) called for systematic support and targeted ICT training modules, noted constraints such as limited resources and power outages, and recommended sustained support and infrastructure investment to strengthen inclusive education outcomes aligned with SDG 4.

Table 9
Teachers Overall TPACK Competence

TPACK Components	Mean	SD	Interpretation
Technological Knowledge	3.03	0.542	Competent
Content Knowledge	3.30	0.541	Highly Competent
Pedagogical Knowledge	3.24	0.533	Competent
Pedagogical Content Knowledge	3.26	0.487	Highly Competent
Technological Pedagogical Knowledge	3.21	0.571	Competent
Technological Content Knowledge	3.19	0.592	Competent
Technological Pedagogical Content Knowledge	3.17	0.550	Competent
Average	3.20	0.475	Competent

Range: 3.25 – 4.00: Highly Competent, 2.50 – 3.24: Competent, 1.75 – 2.49: Less Competent, 1.00 – 1.74: Not Competent

The results showed that teachers were strong in content knowledge and pedagogical skills. Their subject mastery helped them explain lessons clearly and accurately, select appropriate strategies, transform content into meaningful learning activities, and anticipate students' difficulties, and these strengths were developed through formal education and teaching experience. They were also able to use technology and sometimes align it with their teaching methods; however, their technological skills were only at a moderate level, which limited their confidence and prevented technology from becoming an integral part of instruction, so it was often used only as a supplementary tool rather than being fully integrated with pedagogy and content. This showed a need to strengthen teachers' capacity for meaningful technology integration, which required teacher education and professional development to move beyond teaching isolated technology

skills and instead provide structured opportunities to practice the combined use of technology, pedagogy, and content through hands-on activities, reflective practice, and exposure to emerging and flexible technologies so teachers could integrate technology more effectively and respond to diverse learner needs.

The results indicated that teachers were well-prepared in content and pedagogy but lacked confidence in using technology to adapt instruction for diverse learners, particularly LSENs in inclusive classrooms. This matched previous finding showing that strong content and pedagogical knowledge did not guarantee technology proficiency, which lowered teachers' confidence in technology use (Yulisman et al., 2020). Studies also highlighted that while teachers recognized the importance of digital tools, their low confidence and interest showed limited readiness to adapt their teaching with technology (Polly et al., 2022). Even with strong teaching skills, teachers still struggled to integrate new technologies, emphasizing the need for targeted professional development to improve technology skills (Barton & Dexter, 2019; Conan, 2022; Love et al., 2020). Sustained professional development was identified as crucial to boosting teachers' confidence in using technology effectively (Gomez et al., 2021).

VI. TEACHERS COMPETENCY IN APPLYING DIFFERENTIATED INSTRUCTION

Tables 10 to 15 showed that teachers' competency in differentiated instruction involved planning, teaching, and assessing lessons to meet diverse learner needs. They adjusted content, activities, outputs, and the learning environment to help all learners access the curriculum. Competent teachers used assessments, learner profiles, and observations to identify needs, set goals, and apply strategies like flexible grouping, tiered tasks, and accommodations for fair adaptations.

Table 10
Teachers Identification of Educational Needs Competence

Statement	Mean	SD	Interpretation
I analyze the answers on curriculum-based tests to assess a student's educational needs.	3.46	0.503	Strongly Agree
I analyze the answers on standardized tests to assess a student's educational needs.	3.44	0.541	Strongly Agree
I assess specific students' educational needs based on daily math work.	3.36	0.563	Strongly Agree
I assess specific students' educational needs based on (informal) observations during the math lesson.	3.38	0.567	Strongly Agree
If necessary, I conduct diagnostic conversations to analyze the educational needs of specific students.	3.38	0.530	Strongly Agree
Average	3.40	0.505	Strongly Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

The findings showed that teachers mainly relied on formal assessment data, particularly curriculum-based and standardized tests, to identify learners' needs and make instructional decisions, while also demonstrating competence in using functional and multiple assessment strategies by integrating qualitative data from diagnostic conversations and classroom observations to support and contextualize test results. This reflected an assessment-driven approach that provided a baseline for addressing diverse needs in inclusive settings. However, formative assessment results received less emphasis and were not used consistently in instructional decision-making, which showed a gap in the full integration of formative and informal assessment into the overall assessment process. This happened because teachers had limited assessment literacy and often viewed assessment as a grading tool rather than a means to improve instruction, and this practice was reinforced by workload demands, accountability pressures, heavy curricular requirements, and large class

sizes that reduced the time to analyze formative data and plan responsive teaching. Many teachers also lacked training in interpreting informal evidence such as observations, learning logs, and classroom interactions, which made it difficult to use these for differentiated instruction. Although formative assessment was required under the K–12 policy, teachers still prioritized summative assessment because it was directly linked to grading, reporting, and school accountability. The data suggested that targeted professional development strengthened teachers' capacity and improved the systematic use of both formal and informal data for more comprehensive and responsive instructional planning.

According to Rajak and Dey (2025), differentiated assessment helped teachers identify diverse learners' needs. It allowed teachers to gather information about students' readiness, strengths, interests, and abilities through varied formats, flexible timing, and constructive feedback that supported inclusion and fairness. Toshmurodova (2025) noted that this was why teachers needed assessment tools that could be adjusted to individual abilities so that results were fair and accurate. Ranbir (2024) also emphasized that results from standardized and informal assessments could guide appropriate support and accommodations, enabling teachers to adjust instruction to learners' needs and promote equity. Dada (2023) added that identifying learners' needs should not focus only on the learners; it should also consider the environment, as this provided a clearer picture of learners' strengths and difficulties. However, having tools was not enough.

Pradhan and Gochhayat (2023) reported that even when schools had varied assessment tools, teachers might lack the training to use them properly, which affected how effectively they identified and responded to learners' needs. Bakken and Dalmasso (2021) further explained that using both formal and informal methods—such as performance tasks, authentic assessments, portfolios, and self-assessment—could improve teachers' ability to identify the needs of learners with disabilities. Overall, differentiated assessment helped teachers understand learners better and supported inclusion, but limited resources and inadequate training made it difficult to implement effectively in multi-level classrooms (Appiah-Odame, 2025).

Table 11
Teachers' Differentiated Goals Competence

Statement	Mean	SD	Interpretation
I set different goals for the students, depending on their achievement level.	3.36	0.485	Strongly Agree
I set extra-challenging goals for high-achieving students.	3.32	0.471	Strongly Agree
I set well-considered minimum goals for very low-achieving students.	3.32	0.471	Strongly Agree
I know the opportunities for differentiation offered by the curriculum.	3.28	0.497	Strongly Agree
I use the opportunities the curriculum offers for differentiation for high-achieving students.	3.28	0.497	Strongly Agree
I use the opportunities the curriculum offers for differentiation for low-achieving students.	3.28	0.536	Strongly Agree
I dare to deviate from the opportunities the curriculum offers for differentiation.	3.16	0.548	Agree

I set learning goals together with the students.	3.30	0.505	Strongly Agree
Average	3.29	0.439	Strongly Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

Table 11 presented teachers' practice in goal with the overall mean of 3.29 (SD = 0.439) corresponds to a verbal interpretation of Strongly Agree. When ranked according to mean scores, the statement "I set different goals for the students, depending on their achievement level" obtained the highest mean M = 3.36 (SD = 0.485). The lowest mean score was recorded for the statement "I dare to deviate from the opportunities the curriculum offers for differentiation" 3.16 (SD = 0.548), which was interpreted as Agree.

Teachers showed strong competence in setting differentiated goals that matched learners' ability levels, developmental stages, and individual contexts by giving challenging targets to high-achieving learners, attainable goals to those who needed support, and involving learners in the goal-setting process. However, the date showed that teachers relied heavily on the prescribed curriculum, which limited their ability to modify standards based on students' contexts and constrained responsive instruction. This was because they were trained and evaluated based on compliance with prescribed standards, which promoted fidelity to the official curriculum rather than adaptive teaching, while centralized expectations prioritized coverage of required competencies instead of contextual modification. Many teachers lacked strong preparation in modifying learning competencies for diverse learners, which led to dependence on ready-made guides and reduced instructional autonomy, and their capacity to redesign lessons was further limited by heavy workload, large class size, and extensive documentation requirements. Under the K to 12 curricula, they also experienced pressure to finish all required competencies within the school year, which discouraged flexible pacing and contextual adaptation. These findings showed the need for targeted professional development to strengthen teachers' skills in designing context-based curriculum and intervention plans aligned with multidisciplinary inputs while still meeting curricular and policy requirements so they could use their existing strengths in differentiation and collaborative goal setting more consistently and flexibly for diverse learner needs.

According to Kurth et al. (2025), teachers commonly developed goals through team-based approaches that improved curricular and environmental accessibility, strengthening inclusive practice even when developmental alignment was not explicitly stated. More explicitly, teachers were encouraged to anchor goals on IEP priorities and grade-level standards while ensuring developmental and contextual fit (Alber-Morgan et al., 2022). Similarly, Malisiova et al. (2023) emphasized that aligning goals with developmental levels and individual contexts could be operationalized through differentiated instruction so that learners, including those with specific learning difficulties, could participate and achieve individualized targets.

From a systems lens, Collado (2021) explained that MTSS and UDL guided teachers in setting developmentally appropriate goals and matching these with individualized supports and interventions. Goal alignment also required that targets remained grade-aligned yet meaningful and transferable across settings, particularly to strengthen self-determination skills such as self-management, self-advocacy, and decision-making (Ruppar et al., 2022). Finally, teachers' understanding of diverse learner profiles was essential to setting goals that reflected developmental readiness and individual context, fostering inclusive learning environments where students could thrive academically, socially, and emotionally (Palei, 2024).

Table 12
Teachers' Differentiated Instruction Competence

Statement	Mean	SD	Interpretation
I adapt the level of abstraction of instruction to the needs of the students.	3.34	0.479	Strongly Agree
I adapt the modality of instruction (visual, verbal, manipulative) to the needs of the students.	3.40	0.495	Strongly Agree
I adapt the pace of instruction to the needs of the students.	3.34	0.479	Strongly Agree

I deliberately ask open-ended questions during whole-class instruction.	3.36	0.485	Strongly Agree
I deliberately ask questions at various difficulty levels during whole-class instruction.	3.34	0.479	Strongly Agree
I regularly provide low-achieving students with additional instruction (extended instruction, pre-teaching).	3.30	0.463	Strongly Agree
I regularly provide high-achieving students with additional instruction or guidance at their level, in a group or individually.	3.32	0.471	Strongly Agree
Average	3.34	0.421	Strongly Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

Table 12 presents teachers' self-reported implementation of differentiated instruction, with an overall mean of 3.34 (SD = 0.421), interpreted as Strongly Agree. The highest-rated practice was adapting the modality of instruction to students' needs, with a mean score of 3.40 (SD = 0.495). Three indicators—adapting the level of abstraction, adapting the pace of instruction, and asking questions at varying levels of difficulty—shared the overall mean of 3.34 (SD = 0.479), placing them in the middle rank and likewise interpreted as Strongly Agree. The lowest-rated practice was providing additional instruction for low-achieving students, with a mean score of 3.30 (SD = 0.463); however, this indicator was still interpreted as Strongly Agree.

Based on the data, teachers effectively used differentiated instruction in inclusive classrooms by adjusting instructional modalities, varying questioning techniques, and modifying abstraction, pacing, and task difficulty during whole-class teaching. This showed strong competence in immediate and embedded differentiation through real-time strategies. However, there was a gap in delivering focused supplemental instruction because practices that required additional time and resources—such as targeted support for low-achieving learners, enrichment for high-achieving learners, and sustained multi-tiered instruction—were less implemented. As a result, differentiation remained limited to what could be managed within regular class time, and individualized support beyond whole-class instruction was reduced. This gap was not due to a lack of teacher awareness but to structural and resource constraints in the school system, including large class sizes, heavy teaching loads, administrative work, pressure to cover the prescribed curriculum, competing non-teaching duties, limited learning resources, and insufficient support personnel. These factors pushed instruction to default to whole-class approaches and confined differentiation to in-class strategies. The data showed that time, resources, staffing, and school structures shaped teachers' ability to extend differentiation, and that stronger institutional support, additional personnel and materials, and allocated time for targeted interventions enabled the shift from in-the-moment differentiation to sustained and individualized support for diverse learners.

Teachers used differentiated instruction effectively in inclusive classrooms by adjusting lessons to students' abilities, interests, and learning styles (Masseru & Ishartiwi, 2025). They applied strategies like scaffolding, group work, project-based learning, flexible grouping, and tiered assignments to address diverse learning needs and improve engagement (Puspitasari et al., 2025; Pasira, 2022). These practices were more effective when teachers assessed needs and created individualized education plans for students with special needs (Taufiq et al., 2025). However, implementation was limited by a lack of resources and training (Muksalmina et al., 2024).

Effective differentiated instruction required teacher training, resource allocation, and policy support. Schools implemented strategies to improve classroom management and engagement, documenting solutions for educators and policymakers (I. Sari et al., 2025; Patel & Kim, 2024).

Table 13

Teachers' Differentiated Tasks Competence

Statement	Mean	SD	Interpretation

I vary my use of different types of tasks during the math lesson (e.g., individual or group work, solution spoken, written, or drawn).	3.32	0.471	Strongly Agree
I adjust different types of tasks to the needs of the students (e.g., a child completes exercises on the computer because this child learns more in that way).	3.26	0.487	Strongly Agree
I select the most important tasks for very low-achieving students.	3.32	0.551	Strongly Agree
I use curriculum compaction for high-achieving students.	3.24	0.476	Agree
I provide high-achieving students with enrichment tasks.	3.30	0.463	Strongly Agree
I also use computer programs or math websites in my math lessons.	3.12	0.521	Agree
I use computer programs and/or math websites to offer students focused practice in skills not sufficiently mastered.	3.06	0.620	Agree
I use computer programs and/or math websites to offer specific students additional challenge.	3.06	0.620	Agree
Average	3.21	0.436	Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

Table 13 summarized teachers' practices in terms of differentiated instruction. The overall mean score for the construct was 3.21 (SD = 0.436), corresponding to an Agree level of interpretation. The highest mean scores were obtained by two statements: varying the use of different types of tasks during the math lesson 3.32 (SD = 0.471) and selecting the most important tasks for very low-achieving students 3.32 (SD = 0.551), both interpreted as Strongly Agree. These were followed closely by providing high-achieving students with enrichment tasks 3.30 (SD = 0.463) and adjusting different types of tasks to meet students' needs 3.26 (SD = 0.487), which also fell within the Strongly Agree range. The middle-ranked item based on mean score was the use of curriculum compaction for high-achieving students 3.24 (SD = 0.476), which was interpreted as Agree. While still positively rated, this item registered a lower mean than enrichment-oriented strategies. The lowest mean scores were observed for the use of computer programs or math websites to provide (a) focused practice for skills not sufficiently mastered and (b) additional challenge for specific students, both obtaining identical mean values of 3.06 (SD = 0.620), with an Agree interpretation. These items also recorded the highest standard deviations, indicating greater variability in teachers' responses.

The data showed that teachers effectively used practical differentiated strategies in inclusive classrooms by aligning tasks with learners' needs, varying task formats, focusing on essential content for low-achieving students, and adjusting the curriculum, activities, materials, and classroom environment, which were easier to apply in daily teaching and provided immediate and workable support. However, differentiation was not applied across all approaches because teachers relied on familiar and traditional methods and rarely used curriculum compaction, structured acceleration, enrichment for high-achieving learners, and technology-based or assistive differentiation, as most had training only in general differentiation and not in advanced models. Heavy teaching loads, multiple preparations, large class sizes, and administrative and non-teaching tasks reduced the time for instructional planning and limited the use of complex strategies, while the education system's focus on minimum standards pushed teachers to prioritize low-performing learners rather than extend learning for high-performing students, and unequal ICT infrastructure with limited access to assistive technology further constrained implementation. The data indicated the need for targeted professional

development, improved access to digital and assistive tools, and stronger institutional support so teachers could implement advanced differentiation and address the needs of both struggling and high-performing learners.

Teachers used simpler task strategies because of lack of training, heavy workloads, limited resources, and pressure to cover the curriculum, creating a gap between their understanding of differentiation and expert views on task design. Misconceptions, low self-efficacy, and reduced motivation also made it hard for them to apply complex strategies, preventing them from meeting learners' diverse needs (Bardy et al., 2021; Putra, 2023). Additionally, they lacked skills in using data from adaptive learning systems, showing that key principles like goal orientation and continuous monitoring were important, no matter the technology (Keuning & Van Geel, 2021).

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Table 14
Teachers' Evaluation of Progress and Process Competence

Statement	Mean	SD	Interpretation
I use scores on standardized and curriculum-based tests to evaluate whether the learning goals have been met.	3.32	0.471	Strongly Agree
I analyze the answers on curriculum-based tests to evaluate whether the learning goals of that unit have been met.	3.34	0.479	Strongly Agree
I regularly evaluate whether all students have met the learning goals based on their daily math work.	3.34	0.479	Strongly Agree
I evaluate whether all students have met the lesson goals based on (informal) observations during the math lesson.	3.34	0.479	Strongly Agree
I conduct diagnostic conversations to evaluate whether specific students have met the lesson goals.	3.30	0.463	Strongly Agree
I evaluate whether the types of instruction and tasks I chose were effective for the majority of the students.	3.32	0.471	Strongly Agree
I evaluate whether a specific type of instruction was effective for specific students.	3.30	0.463	Strongly Agree
I regularly evaluate the students' learning process.	3.44	0.501	Strongly Agree
Average	3.34	0.426	Strongly Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

Although teachers were competent in conducting classroom-based and formative assessments, they were inconsistent in evaluating the overall outcomes of their instructional decisions and had difficulty integrating and analyzing multiple data sources, including assessment results and actual learner performance, to determine the effectiveness and

appropriateness of their strategies. This happened because assessment practices were compliance-driven and focused on recording and reporting rather than on continuous inquiry for instructional improvement, heavy teaching and administrative workloads limited the time for data analysis and data-driven decision-making, assessment was done individually instead of through systematic team-based processes, and training focused more on test and rubric design than on evaluating the impact of instruction. While assessment results were collected, they were not formally linked to instructional adjustment and re-evaluation. These findings indicated the need to strengthen teachers' competence in structured evaluation and to embed it in school policies so that pre-assessment, ongoing assessment, and post-assessment results were systematically used as the basis for instructional practices that were responsive to the individual needs of the learners.

According to Aburizaizah (2021), teachers used data-driven decision-making tools and structured evaluation processes to assess progress, monitor changes in learning, and ensure reliable data collection over time. Likewise, effective routines for organizing and evaluating assessment data strengthened teachers' ability to collect dependable evidence and monitor learner development over time (Barnes & Fives, 2020). In classroom assessment, McMillan (2022) emphasized that gathering evidence through a structured evaluation process supported reliable data collection, enabling teachers to track learning trajectories and use results to inform instructional decisions. Similarly, Nurdin et al. (2025) noted that teachers demonstrated pedagogic competence when they used structured evaluation processes—both formative and summative—aligned with learning objectives, which helped monitor students' development across cognitive, affective, and psychomotor domains. At the school level, evaluation practices that supported self-evaluation also enabled teachers to access valid information, collect reliable data, and track learning and development over time (Mehisto & Kitsing, 2022). In addition, growth-focused evaluation systems allowed for reliable data collection and ongoing tracking of development, addressing limitations of traditional evaluation approaches (Pandit et al., 2025). Moreover, assessment practices had shifted toward tasks that captured significant knowledge and skills, producing richer evidence of student development that could guide instructional planning, including differentiation (Kartal, 2022).

Tab 15

Teachers Overall Competency in Applying Differentiated Instruction

Components of Differentiated Instruction	Mean	SD	Interpretation
Identification of Educational Needs	3.40	0.505	Strongly Agree
Differentiated Goals	3.29	0.439	Strongly Agree
Differentiated Instruction	3.34	0.421	Strongly Agree
Differentiated Tasks	3.21	0.436	Agree
Evaluation of Progress and Process	3.34	0.426	Strongly Agree
Average	3.32	0.401	Strongly Agree

Range: 3.25 – 4.00 Strongly Agree, 2.51 – 3.24 Agree, 1.76 – 2.49 Disagree, 1.00 – 1.74 Strongly Disagree

The results showed that teachers had strong competence in differentiated instruction, particularly in identifying learners' needs, using varied teaching strategies, and monitoring students' progress. These strengths indicated that teachers understood their learners and implemented instruction and assessment as a continuous process. However, the variations in responses revealed that some teachers needed support in conducting more systematic and standardized assessments. A clear gap was found between assessment and task design. Although teachers were able to gather and interpret assessment data and set differentiated goals, some had difficulty translating these into specific, measurable objectives and into well-designed differentiated classroom tasks. This resulted in inconsistent implementation of task-level differentiation across classrooms. These findings pointed to the need for targeted professional development that would help teachers align assessment results with individualized goals and develop functional, varied, and inclusive learning tasks.

Teachers struggled to design effective differentiated and individualized tasks because many found it difficult to use assessment results to make clear instructional decisions. Eysink and Schildkamp (2021) explained that this difficulty became greater when teachers had to integrate formative assessment with differentiation activities at the same time; they

proposed the Assessment-Informed Differentiation framework to better connect these processes and improve instructional design (Eysink & Schildkamp, 2021). Rajak and Dey (2025) also reported that inadequate teacher training and the complexity of planning hindered teachers from using assessment results effectively when creating differentiated and individualized tasks.

According to Appiah-Odame (2025) found that although differentiated assessment supported inclusivity and meaningful evaluation, implementation was hindered by limited resources, insufficient training, time constraints, and resistance to change. Park et al. (2023) noted that teachers also struggled to recognize the differentiation potential of tasks, which made it harder to design tasks suited for heterogeneous learning groups. Support strategies had been recommended, including providing training and resources (Rajak & Dey, 2025) and using flexible goal-setting, evidence-based method selection, organized content planning, and multidimensional evaluation to improve teachers' instructional proficiency (J. Li, 2025).

VII. TEST OF THE SIGNIFICANCE OF THE RELATIONSHIP BETWEEN TEACHERS' TPACK COMPETENCY AND DIFFERENTIATED INSTRUCTION COMPETENCY

Table 16 presented the results, which indicated a strong, positive, and statistically significant relationship between TPACK and overall differentiated instruction competencies ($r = 0.689$, $p < 0.001$), leading to the rejection of the null hypothesis. This finding showed that teachers with higher levels of TPACK demonstrated stronger competence in implementing differentiated instruction.

Table 16
Relationship Between Teachers' TPACK Competency and Differentiated Instruction Competency

Variable	Computed r-value	Strength of correlation	p-value	Decision	Results
TPACK Competency Differentiated Instruction Competency	0.689	Strong Positive Correlation	<0.001	Reject H_0	Statistically significant

TPACK helped teachers adjust their teaching methods, activities, and assessments to meet diverse learner needs. The results showed that effective differentiated instruction relied on the intentional use of technology. This allowed teachers to apply varied strategies, use digital tools for learning support and assessment, and implement flexible practices for inclusive learning. Teachers with strong TPACK were better able to set diverse learning goals, choose appropriate strategies, design differentiated tasks, and assess outcomes using technology to address individual learner differences. Technology enabled them to provide flexible learning options, scaffold instruction, and adapt teaching based on students' needs.

The findings highlighted the importance of integrating digital tools into instruction, not treating technology as an extra resource. Professional development programs based on TPACK, where content knowledge, pedagogy, and technology are developed together, were essential. These programs should focus on continuous, hands-on learning rather than short-term, skill-based training. Teacher education programs must incorporate TPACK into both coursework and internships to prepare future teachers for inclusive classrooms. At the school and policy levels, investments in technologies aligned with teaching practices were necessary. Integrating TPACK standards into teacher evaluations, professional development, and resource planning could enhance differentiated instruction and improve student outcomes.

That teachers' level of TPACK competency was significantly related to their DI competency—was consistent with earlier evidence showing that stronger TPACK was linked to better differentiation practices. Utari et al. (2024) reported a strong and significant correlation between teachers' TPACK and their professional competence in designing differentiated instruction, which showed that higher TPACK was associated with a better ability to use differentiated teaching strategies. This relationship was also supported by the idea that improving teachers' TPACK helped improve the quality of teaching decisions and the use of strategies in the classroom (Patalinghug & Arnado, 2021).

Related studies also helped explain why this relationship likely happened. Phan et al. (2024) stressed that teachers who had strong TPACK were better prepared to design effective learning experiences using different ways of teaching

and learning, which suggested that their strategies could also be adjusted for differentiated instruction. However, not all settings showed high TPACK readiness. Zhakiyanova et al. (2023) found that teachers' TPACK skills were at a moderate level, while their self-confidence varied, which suggested that skills and confidence did not always grow at the same pace. In some areas, teachers' TPACK levels were low, which highlighted the need for focused training on technology to improve teaching, including differentiated instruction (Shambare & Simuja, 2024). These gaps were affected by practical factors such as access to technology training, support from the school, and teachers' personal motivation (Khaliq, 2024), which directly shaped how well teachers turned their TPACK knowledge into differentiated instruction competence.

VIII. SUMMARY

This study assessed teachers' competency in TPACK and their ability to use differentiated instruction in teaching diverse learners at Talamban Elementary School during the 2025-2026 school year. It also examined how TPACK competence influenced teachers' effectiveness in addressing the diverse needs of learners in inclusive classrooms. The findings informed a comprehensive professional development plan. The study used a quantitative research approach with a descriptive-correlational design. Fifty general education teachers from Talamban Elementary School participate, selected through purposive sampling. Data were collected using an adapted survey questionnaire with three parts. The second part measured teachers' TPACK competency, based on Valtonen et al. (2017) and adapted by Lugo and Delos Reyes (2024) for this study. This section assessed teachers' competency in applying differentiated instruction in inclusive classrooms, adapted from Van Geel et al. (2022). Data were analyzed using descriptive statistics (frequency, mean, standard deviation), and Pearson's r correlation was used to determine the relationship between TPACK competency and the ability to apply differentiated instruction in inclusive classrooms.

IX. FINDINGS

The study showed that teachers excelled in content knowledge and teaching strategies but had limited technological skills, using technology primarily as a support tool rather than integrating it fully into teaching. Teachers rated themselves highly in applying differentiated instruction, such as identifying learner needs, using varied strategies, and monitoring progress, but inconsistencies in assessment and task design indicated the need for standardized assessment practices. The study emphasized the importance of TPACK in enhancing differentiated instruction, highlighting that teachers with strong TPACK were better at aligning goals, strategies, tasks, and assessments using technology. The findings also stressed that technology should be intentionally integrated into instruction, not treated as an add-on, and recommended professional development programs based on TPACK principles, focusing on content knowledge, pedagogy, and technology. At the institutional level, aligning technology investments, teacher evaluations, and professional development with TPACK standards was deemed essential for improving differentiated instruction and student learning outcomes.

X. CONCLUSION

This study concluded that teachers were generally competent in applying TPACK and highly competent in applying differentiated instruction; however, they still needed assistance in implementing individualized tasks. Furthermore, the study found that effective differentiated instruction was strengthened through a strong integration of technology, pedagogy, and content expertise.

RECOMMENDATIONS

The study recommended implementing a development plan to improve teaching practices, support teacher growth, and enhance school support for special and inclusive education, with a focus on applying the TPACK framework and enhancing differentiated instruction, especially for LSENs. It recommended regular, classroom-based TPACK training that connected assessment results to learning goals, designed varied learning tasks, and appropriately used technology. The training provided ongoing practice in developing inclusive intervention plans based on assessment data, helping teachers set clear goals, design suitable tasks, and select appropriate assistive technologies. To ensure successful implementation, it recommended coaching, peer support, lesson studies, and providing ready-to-use materials such as assessment templates and task banks. Collaboration among ICT staff, special education experts, and teachers was emphasized to select effective strategies and materials. Teacher education and training programs integrated TPACK into both pre-service and in-service training, requiring teachers to plan, teach, and reflect on lessons using technology and differentiated instruction, with practicum experiences in inclusive classrooms. School leaders and policymakers supported inclusive education by aligning technology budgets, teacher training, and evaluations with inclusive goals, ensuring teachers were trained to use devices, internet access, and software effectively, while incorporating differentiated instruction and technology use into evaluations. A school culture promoting teamwork, innovation, and reflection was encouraged.

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