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Implementation of differentiated instruction in Science 8: Practices, challenges, and outcomes in public secondary schools of Legislative District 5, Isabela

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ABSTRACT

Science education plays a vital role in developing learners' scientific literacy, critical thinking, and problem-solving skills in an increasingly complex world. However, despite the recognized benefits of differentiated instruction, limited local evidence exists regarding its implementation, effectiveness, associated challenges, and contribution to the realization of Science 8 competencies in public secondary schools, particularly within Legislative District 5, Isabela. This study assessed the implementation of differentiated instruction in teaching Science 8 during the School Year 2025–2026 using a descriptive-normative research design. The respondents were 48 Science 8 teachers selected through purposive sampling. Data were gathered through a validated questionnaire, unstructured interviews, and documentary analysis, and were analyzed using frequency, percentage, and weighted mean. Findings revealed that differentiated instruction was very often utilized (WM = 4.30) and very effective (WM = 4.35). Science 8 learning competencies were fully realized (WM = 4.28), while implementation challenges were moderately serious (WM = 2.96). Strategies employed to address these challenges were found to be very effective (WM = 4.28). The study recommends sustaining differentiated instructional practices, strengthening institutional support, and enhancing professional development initiatives to further improve Science instruction and learner outcomes.

Keywords: Differentiated instruction, Science 8, MATATAG Curriculum, learning competencies, instructional effectiveness.

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INTRODUCTION

Today's classrooms are characterized by increasing diversity in learners' backgrounds, abilities, interests, and ways of processing information. Differences in cognitive development, prior knowledge, sociocultural experiences, and learning preferences significantly influence how students engage with instruction and construct understanding of academic content (Çelik, 2019). This diversity is particularly evident in secondary education, where learners are expected to master increasingly complex concepts across disciplines while demonstrating higher levels of critical thinking and problem solving. As educational systems continue to

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emphasize inclusive and equitable learning, there is a growing recognition that traditional approaches to instruction may not adequately address the varied needs of learners. Consequently, educators are increasingly challenged to adopt teaching approaches that recognize learner differences and provide meaningful opportunities for all students to succeed.

One instructional approach that has gained considerable attention in addressing learner diversity is Differentiated Instruction (DI). Differentiated instruction is a pedagogical framework that seeks to accommodate differences in learners' readiness levels, interests, and learning profiles by modifying content, process, product, and learning environment (Wibowo, Wangid, & Firdaus, 2024). Grounded in theories of constructivism, multiple intelligences, and brain-based learning, differentiated instruction recognizes that students learn in different ways and at different rates. Rather than expecting all learners to acquire knowledge through identical instructional methods, DI encourages the creation of multiple pathways to learning that maximize engagement, participation, and mastery (Gillies, 2007). Strogilos (2018) emphasized that the central goal of differentiated instruction is to ensure that all learners experience appropriately challenging and meaningful educational opportunities, thereby promoting equity and inclusion within the classroom. Through the careful consideration of students' individual needs, strengths, and motivations, differentiated instruction offers a practical framework for personalizing learning while maintaining rigorous academic standards.

The relevance of differentiated instruction becomes even more apparent in Science education, where learners are expected to understand abstract concepts, engage in inquiry-based learning, and integrate knowledge across multiple domains. Science instruction begins in the elementary grades and progressively develops learners' understanding of life, physical, and earth sciences (Saleh, Ahda, & Fitria, 2020). As students advance to secondary education, scientific concepts become increasingly sophisticated, requiring not only content mastery but also higher order thinking, experimentation, analysis, and problem solving. However, science education continues to face persistent challenges, including outdated instructional resources, inadequate laboratory facilities, overcrowded classrooms, and limited teacher preparation in learner centered pedagogies. These constraints have contributed to concerns regarding the quality and effectiveness of science instruction and have been reflected in international assessments of student performance.

The urgency of improving science education is highlighted by the results of the Programme for International Student Assessment (PISA) 2022 Creative Thinking Assessment. The Philippines obtained a mean score of 14, substantially below the Organisation for Economic Co-operation and Development (OECD) average of 33, placing the country among the lowest performing participants alongside Albania, Uzbekistan, and Morocco. In contrast, Singapore achieved the highest score of 41, followed by Korea, Canada, Australia, and New Zealand. The gap between the Philippines and high performing countries is further reflected in proficiency levels, where only 3.4% of Filipino students reached Level 5 proficiency compared with 30% of Singaporean students. Moreover, approximately one third of Filipino learners performed at Level 1, the lowest proficiency category, while no Singaporean student fell into this level. Although neighboring Southeast Asian countries such as Indonesia, Thailand, Brunei, and Malaysia also performed below the OECD average, they nevertheless outperformed the Philippines. These findings suggest significant weaknesses in foundational competencies and emphasize the need to strengthen instruction in science and other core learning areas. As Romulo, cited in Chi (2024), argued, the development of foundational competencies is essential for nurturing learners' confidence and fostering both critical and creative thinking.

The challenges revealed by these assessment results underscore the importance of adopting instructional approaches capable of responding to diverse learner needs. Differentiated instruction offers considerable promise in this regard because it enables teachers

to adjust learning experiences according to individual differences while maintaining meaningful engagement with scientific concepts. Science learning requires students to interpret abstract ideas, conduct investigations, analyze evidence, and apply knowledge to real world situations (Pellegrino, 2013). These demands necessitate instructional strategies that recognize variations in readiness, learning preferences, and prior knowledge. However, the practical implementation of differentiated instruction is often complicated by contextual factors such as limited instructional time, insufficient learning resources, large class sizes, and varying levels of teacher preparedness. Consequently, although differentiated instruction is widely recognized as beneficial, its successful application remains dependent upon the realities of specific educational contexts.

Within the Philippine public school system, the implementation of differentiated instruction varies significantly according to available resources, administrative support, and teacher expertise. Such variation is particularly relevant in secondary schools where learners face increasingly demanding curricular expectations. In Legislative District 5 of Isabela, examining how differentiated instruction is implemented in Science 8 provides an opportunity to identify effective practices, understand contextual challenges, and explore factors that influence instructional outcomes. While differentiated instruction has been widely promoted as a means of enhancing educational equity and responsiveness, there remains a need for localized evidence regarding its implementation and effectiveness within Science classrooms. Understanding how teachers adapt instruction, the difficulties they encounter, and the outcomes associated with differentiated practices can provide valuable insights for improving science education and informing policy decisions under the MATATAG Curriculum framework.

The theoretical foundation of this study is anchored primarily on Carol Ann Tomlinson's theory of differentiated instruction, which emphasizes the adaptation of content, process, product, and learning environment according to learners' readiness levels, interests, and learning profiles (Palieraki & Koutrouba, 2021). Tomlinson's framework recognizes that contemporary classrooms are characterized by diversity and that effective instruction requires responsiveness to individual learner needs. In the context of Science education, differentiated instruction enables teachers to present complex concepts through varied approaches that make learning accessible while preserving academic rigor. This theoretical perspective directly supports the study's focus on examining how differentiated instruction is implemented within Science 8 classrooms and how such practices influence teaching and learning outcomes.

Complementing Tomlinson's framework is Lev Vygotsky's Zone of Proximal Development (ZPD), which posits that learning occurs most effectively when instructional tasks are positioned slightly beyond a learner's current level of competence but remain attainable through guidance and support (Tīģere et al., 2025). The principles of differentiated instruction align closely with the ZPD because both emphasize the importance of matching learning experiences to learners' developmental readiness. Through differentiated activities and appropriate scaffolding, teachers can support students in progressing from their current understanding toward higher levels of conceptual mastery. In Science education, where conceptual development and problem solving are central objectives, the ZPD highlights the necessity of tailoring instruction to meet students where they are while facilitating continued intellectual growth.

Further strengthening the conceptual foundation of the study is Albert Bandura's Social Cognitive Theory, which emphasizes the role of self-efficacy, observational learning, social interaction, and environmental influences in shaping behavior and achievement (Simply Psychology, 2025). Within differentiated classrooms, learners are exposed to varied opportunities for collaboration, peer modeling, and successful task completion that can

strengthen their confidence and motivation. As students observe peers engaging successfully with learning tasks that match their abilities, they develop stronger beliefs in their own capacity to succeed. This process is particularly important in Science education, where unfamiliar concepts and technical content may create uncertainty and reduce learner confidence. By fostering supportive learning environments and promoting positive academic experiences, differentiated instruction aligns with Bandura's emphasis on the reciprocal relationship among personal, behavioral, and environmental factors.

Taken together, the theories of Tomlinson, Vygotsky, and Bandura provide a comprehensive framework for understanding differentiated instruction as an effective approach to addressing learner diversity within Science education. These perspectives collectively emphasize that meaningful learning occurs when instruction is responsive to students' readiness levels, supported through appropriate scaffolding, and reinforced through positive social and motivational experiences. Guided by these theoretical foundations, the present study examined the extent of differentiated instruction implementation in Science 8, its perceived effects on teaching and learning, the realization of Science 8 learning competencies under the MATATAG Curriculum, the challenges encountered by teachers, and the strategies employed to address these challenges. Through this investigation, the study seeks to contribute to the development of more equitable, responsive, and learner centered science instruction that can enhance educational outcomes for diverse learners in public secondary schools.

Statement of the problem

This study sought to determine the effectiveness of differentiated instruction in teaching Science 8 in public secondary schools in Legislative District 5, Isabela, during the School Year 2025–2026.

Specifically, it sought answers to the following questions:

1. What is the profile of the respondents in terms of age, gender, civil status, highest educational attainment, present position, latest performance rating, length of service, and level of in-service training attended?
2. To what extent is differentiated instruction utilized in Science 8, and what are its perceived effects on teaching and learning?
3. To what extent are the learning competencies in the MATATAG Curriculum for Science 8 realized through differentiated instruction?
4. To what extent are the challenges encountered in implementing differentiated instruction in terms of teacher related factors, time management, student related factors, resource related factors, curriculum content, class size, and the nature of differentiated instruction?
5. What strategies do teachers employ to address the challenges encountered in implementing differentiated instruction?

METHODOLOGY

This study assessed the effectiveness of differentiated instruction in teaching Science 8 in public secondary schools within Legislative District 5, Isabela, during the School Year 2025–2026. It employed the descriptive-normative research design, which was deemed appropriate for describing and analyzing existing instructional practices and conditions. According to Habaridota (2019), the descriptive-normative method is useful in identifying relationships among variables, defining existing problems, and generating reliable information for decision-making. Likewise, Kaiser (2017) emphasized that descriptive research is particularly suitable in educational settings because it focuses on describing actual practices

and conditions rather than manipulating variables. Meanwhile, Christiani (2016) explained that normative research seeks to identify prevailing standards or typical responses within a population, while Short (2023) noted that the descriptive-normative approach combines observation and documentation of real practices to establish instructional trends and norms. These perspectives provided the methodological foundation for the study.

The study respondents comprised 48 Science 8 teachers selected through purposive sampling from public secondary schools in the municipalities of Aurora, Burgos, Luna, Mallig, Quezon, Quirino, Roxas, and San Manuel in Legislative District 5, Isabela. Each district contributed six teacher-respondents, ensuring balanced representation across the study area.

Data were collected using a researcher-made questionnaire as the primary instrument, supported by unstructured interviews and documentary analysis. The questionnaire gathered information on the respondents' profiles, the extent of use and effectiveness of differentiated instruction, the realization of Science 8 learning competencies under the MATATAG Curriculum, the challenges encountered by teachers, and the effectiveness of strategies employed to address these challenges. Before its administration, the instrument underwent pilot testing and expert validation to ensure its validity, reliability, and clarity. Unstructured interviews were conducted to verify and clarify responses, while documentary analysis of lesson plans, curriculum guides, and related instructional materials served to substantiate the data gathered from the respondents.

The researcher secured the necessary permissions from the Schools Division Superintendent and school administrators before conducting the study. The questionnaires were personally distributed and collected to ensure a high response rate and address participants' concerns about the instrument. The collected data were subsequently organized, tabulated, analyzed, and interpreted in accordance with the objectives of the research.

For statistical analysis, the study utilized frequency and percentage distributions to describe the profile of the respondents. In addition, the weighted mean was employed to determine the extent of use and effectiveness of differentiated instruction, the realization of Science 8 learning competencies, the challenges encountered by teachers, and the effectiveness of the strategies used to address these challenges. These statistical tools enabled the researcher to present and interpret the findings systematically and objectively.

RESULTS AND DISCUSSION

This chapter presents the results of the study on the utilization and effectiveness of differentiated instruction, the realization of Science 8 learning competencies, and the challenges encountered in implementing differentiated instruction among Science 8 teachers in public secondary schools in Legislative District 5, Isabela. A total of forty-eight (48) Science 8 teachers served as respondents of the study. Data were gathered through researcher-made instruments and analyzed using weighted means to describe the extent of utilization, perceived effectiveness, degree of competency realization, and severity of implementation challenges. The results are presented and interpreted in direct relation to the objectives of the study, and all discussions are grounded in the data gathered from the respondents.

Profile of the respondents

The demographic and professional profile of the forty-eight (48) respondents revealed several noteworthy characteristics. In terms of age, the largest group fell within the 36 to 40 age brackets, comprising 29.17% of the total, followed by those aged 46 to 50 years at 20.83%

and those aged 41 to 45 years at 18.75%. These figures indicate that the majority of respondents were in their mid-career stage and possessed substantial teaching experience. The teaching force was overwhelmingly female at 89.58% and predominantly married at 89.58%, reflecting the demographic characteristics commonly observed in the Philippine teaching profession.

In terms of educational qualifications, 93.75% of the respondents had pursued graduate studies, with 50.00% having MAEd units and 43.75% already holding a completed master's degree. The majority held the rank of Teacher III, accounting for 72.92% of respondents, while 14.58% were Master Teachers. Notably, 100% of the respondents obtained an Outstanding performance rating in their latest evaluation, reflecting a uniformly high level of professional performance across the group. The largest proportion of respondents had 11 to 15 years of teaching experience, comprising 27.08% of the total, followed by those with 16 to 20 years of experience at 22.92%, further confirming the highly experienced and professionally competent character of the respondent group. Regional-level in-service training emerged as the most frequently attended professional development activity among the respondents.

These findings suggest that the respondents possessed the professional maturity, instructional competence, and academic preparation necessary to implement differentiated instruction effectively. Their advanced qualifications and consistently strong performance ratings likely contributed to their capacity to adapt instruction to the diverse needs of their learners.

Utilization of differentiated instruction in Science 8

The overall extent of the use of differentiated instruction obtained an average weighted mean of 4.30, indicating that differentiated instruction was very often utilized in Science 8 classrooms. Among the specific practices examined, strategic student grouping obtained the highest weighted mean of 4.44, followed by assessing student readiness and interests with a weighted mean of 4.40, and varying assignments with a weighted mean of 4.27.

These findings demonstrate that teachers have moved beyond traditional one-size-fits-all instruction and have embraced learner-centered approaches that recognize differences in students' readiness, interests, and learning profiles. The prominence of strategic student grouping suggests that teachers view collaborative and flexible learning arrangements as practical means of addressing classroom diversity. Likewise, the regular assessment of readiness and interests reflects a deliberate effort to align instruction with students' individual needs, which is a core principle of differentiated instruction. Taken together, the high weighted means across these practices indicate that differentiated instruction has become an established component of Science 8 classroom practice in the district.

Effectiveness of differentiated instruction

Differentiated instruction was perceived as very effective, obtaining an overall weighted mean of 4.35. The highest-rated practices were varying assignments, strategic student grouping, and scaffolded non-verbal aids, each obtaining a weighted mean of 4.40, followed closely by peer tutoring and collaboration with a weighted mean of 4.38.

The consistently high effectiveness ratings across all practices suggest that differentiated instruction enhances learning by providing multiple pathways through which students can access content, process information, and demonstrate understanding. The strong ratings for strategic grouping and peer tutoring further imply that students benefit from social interaction and cooperative learning environments facilitated by thoughtfully organized classroom structures. These findings indicate that differentiated instruction not only accommodates learner diversity but also contributes positively to classroom engagement and

overall instructional effectiveness, affirming its value as a pedagogical framework in Science 8 instruction.

Realization of Science 8 learning competencies

One of the most significant findings of the study is the consistently high realization of Science 8 learning competencies across all four quarters of the MATATAG Curriculum. The overall weighted mean for competency realization was 4.28, interpreted as Fully Realized. The highest realization ratings were obtained during the Second Quarter and the Fourth Quarter, both with a weighted mean of 4.29, followed by the First Quarter with a weighted mean of 4.28, and the Third Quarter with a weighted mean of 4.24.

Across the full scope of the curriculum, competencies related to biological systems, atomic structure, periodicity of elements, Earth science concepts, force and motion, and energy transformations were all rated as fully realized. Only a limited number of competencies involving higher-order analytical tasks, including predicting genetic ratios, understanding tidal energy applications, and conducting investigations involving light reflection and refraction, received slightly lower ratings, though these still remained within acceptable levels of realization and did not fall below the Fully Realized threshold at the overall level.

These results suggest that differentiated instruction contributes substantially to competency attainment. By adjusting content, processes, products, and learning experiences in accordance with students' needs, teachers appear capable of facilitating mastery across a wide range of scientific concepts. The findings also imply that differentiated instruction may be particularly effective in helping students understand abstract scientific ideas through varied instructional strategies, visual supports, collaborative activities, and scaffolded learning experiences that accommodate different readiness levels and learning profiles.

Challenges encountered in implementing differentiated instruction

Despite its effectiveness, teachers reported experiencing moderately serious challenges in implementing differentiated instruction, with an overall weighted mean of 2.96. The most significant challenge identified was class size, which obtained a weighted mean of 3.11, followed by time management with a weighted mean of 3.09, and the inherent complexity of differentiated instruction with a weighted mean of 3.07.

Large classes were found to limit teachers' ability to address individual learning needs, monitor student progress effectively, and organize flexible groupings within the available instructional space and time. Time-related constraints similarly hindered the preparation of differentiated lesson plans and instructional materials, particularly when teachers needed to balance comprehensive curriculum coverage with the demands of addressing diverse learner needs. Teachers further identified the complexity of planning differentiated lessons and the need to continuously modify instruction as significant concerns that added to their professional workload.

Interestingly, teacher-related factors recorded the lowest challenge rating among all identified categories, with a weighted mean of 2.61, suggesting that the respondents generally possessed sufficient confidence, knowledge, and willingness to implement differentiated instruction. The primary barriers to implementation were therefore structural and contextual in nature rather than personal, indicating that improvements in implementation may depend less on changing teacher attitudes and more on addressing systemic concerns such as class size,

professional workload, availability of instructional resources, and the flexibility of curriculum requirements.

Effectiveness of strategies used to address challenges

Teachers reported that the strategies they employed to address implementation challenges were very effective, obtaining an overall weighted mean of 4.28. The highest-rated strategies were collaboration with colleagues and the use of student interest surveys and pre-assessments, both of which obtained a weighted mean of 4.38. Other highly rated strategies included the use of rubrics and checklists, scaffolded learning experiences, reflective teaching practices, and the prioritization of essential learning competencies, all of which contributed to the overall high effectiveness rating.

The prominence of collegial collaboration in addressing implementation challenges highlights the importance of professional learning communities in sustaining differentiated instruction in the classroom. Teachers appear to benefit considerably from sharing instructional resources, exchanging pedagogical ideas, and collectively resolving instructional challenges within supportive professional networks. The high rating for the use of pre-assessments and learner profiling tools likewise indicates that these practices enable teachers to make more informed and responsive instructional decisions, thereby improving the overall quality and effectiveness of differentiated teaching.

Taken together, the findings of this study present a coherent and substantive account of differentiated instruction as a highly utilized and highly effective pedagogical approach in Science 8 classrooms in Legislative District 5, Isabela. The respondents were predominantly experienced, academically qualified, and high-performing teachers who obtained an overall average weighted mean of 4.30 for utilization and 4.35 for effectiveness, both interpreted as very often utilized and very effective, respectively. This strong implementation corresponded with the full realization of Science 8 learning competencies across all four quarters of the MATATAG Curriculum, with an overall weighted mean of 4.28 interpreted as Fully Realized. Although challenges related to class size (WM = 3.11), time management (WM = 3.09), instructional complexity (WM = 3.07), and resource limitations persisted, these difficulties were rated as only moderately serious overall (WM = 2.96) and were effectively mitigated through collaborative planning, learner-centered assessment practices, reflective teaching, and instructional flexibility, as reflected in the overall strategies effectiveness rating of 4.28. These results collectively affirm that differentiated instruction is not merely an instructional innovation but a practical and effective pedagogical approach capable of strengthening curriculum implementation and supporting the diverse learning needs of students in Science education. The findings provide a substantive empirical basis for the conclusions, recommendations, and proposed action plans to be presented in the subsequent chapter of this manuscript.

CONCLUSION

Based on the findings of the study, it is concluded that Science 8 teachers in Legislative District 5, Isabela are generally experienced and professionally competent educators. Most are in their mid-career stage, predominantly female and married, pursuing or having completed graduate studies, and occupying higher teaching positions. Their outstanding performance ratings and active participation in professional development activities indicate a strong commitment to instructional excellence and continuous learning.

The study further concludes that differentiated instruction is widely practiced and highly effective in teaching Science 8. Teachers consistently employ strategies such as strategic

student grouping, assessment of learner readiness and interests, varied assignments, peer tutoring and collaboration, scaffolded non-verbal aids, and inclusive and tiered instructional standards. The sustained use of these learner-centered approaches contributes significantly to meeting the diverse needs of students and promoting meaningful learning experiences.

The findings also reveal that Science 8 learning competencies under the MATATAG Curriculum were fully realized across all four quarters. This suggests that differentiated instruction serves as an effective pedagogical approach for facilitating the attainment of competencies in life science, physical science, and earth and environmental science. Consequently, Science 8 teachers should continue the consistent application of differentiated instructional practices to sustain and further enhance learner achievement and competency development.

Despite these positive outcomes, the implementation of differentiated instruction was accompanied by moderately serious challenges related to teacher factors, time management, student diversity, instructional resources, curriculum demands, the inherent complexity of differentiated instruction, and class size. These findings indicate that while teachers are capable of implementing differentiated instruction effectively, contextual and organizational constraints continue to influence its full implementation. To address these concerns, school administrators should provide sustained instructional support through adequate time allocation for lesson preparation, collaborative planning, and professional reflection. Likewise, schools should improve access to instructional materials, technology resources, and learning facilities to better support differentiated teaching practices.

The study further concludes that the strategies employed by teachers to address implementation challenges were very effective. Collaborative planning, learner assessment, reflective practice, flexible instructional approaches, and learner-centered classroom management enabled teachers to mitigate many of the barriers encountered in practice. In view of this, professional development programs should be strengthened to further enhance teachers' competence in differentiated instruction, particularly in instructional planning, classroom implementation, and the management of diverse learners. Curriculum planners and school leaders may also review pacing guides and instructional supports to provide greater flexibility while maintaining alignment with Science 8 learning competencies. Moreover, strategies for managing large class sizes should be explored to improve monitoring of learners, classroom management, and the organization of flexible learning groups.

Finally, future researchers are encouraged to conduct similar investigations in other grade levels, subject areas, and educational settings to validate the findings of this study and generate additional evidence on the effectiveness, challenges, and best practices associated with differentiated instruction. Such studies may contribute to the continuous improvement of instructional practices and curriculum implementation in Philippine schools.

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