

## NAVIGATING CHANGES IN THE SCIENCE CURRICULUM: TEACHERS' RESILIENCE AND SYSTEMIC GAPS

### NAVEGANDO MUDANÇAS NO CURRÍCULO DE CIÊNCIAS: RESILIÊNCIA DOS PROFESSORES E LACUNAS SISTÊMICAS

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#### Abstract

Science teachers play an important role as implementers of curricula, transforming the curriculum design into meaningful learning experiences for learners. This paper presents multiple case studies of science teachers' understanding of the implementation of different science curricula in basic education, their experiences, and the strategies they use as they implement these changes. Drawing on thematic analysis of interview transcripts from five informant teachers, the study employed the procedure prescribed by Braun and Clarke to uncover recurring patterns and unique experiences. The findings reveal a complex landscape in which significant systemic and contextual barriers often confront the latest curriculum's progressive design. Key observations highlight a pervasive sense of curriculum fatigue among educators, critical resource and infrastructure deficits, and profound challenges in student readiness influenced by socioeconomic factors. Despite these obstacles, teachers consistently demonstrate remarkable resilience and innovation, frequently resorting to personal sacrifice to bridge implementation gaps.

**Keywords:** Case Study. Philippines. Revised K To 12. Science Curriculum Implementation.

#### Resumo

Os professores de ciências desempenham um papel importante como implementadores de currículos porque transformam o design em experiências de aprendizagem significativas para os alunos. Este artigo apresenta múltiplos estudos de caso sobre a compreensão dos professores de ciências em relação à implementação de diferentes currículos de ciências na educação básica e suas experiências, bem como as estratégias que utilizam ao implementar essas mudanças. Baseando-se na análise temática das transcrições das entrevistas com cinco professores informantes, o estudo empregou o procedimento prescrito por Braun e Clarke para descobrir padrões recorrentes e experiências únicas. Os achados revelam um cenário complexo onde barreiras sistêmicas e contextuais significativas frequentemente confrontam o design progressivo do currículo mais recente. Observações-chave destacam uma sensação generalizada de fadiga curricular entre os educadores, déficits críticos em recursos e infraestrutura, e desafios profundos relacionados à prontidão dos alunos influenciados por fatores socioeconômicos. Apesar desses obstáculos, os professores demonstram consistentemente uma resiliência e inovação notáveis, frequentemente recorrendo a sacrifícios pessoais para preencher as lacunas na implementação.

**Palavra-chave:** Estudo de Caso. Filipinas. Implementação do Currículo de Ciências. K To 12 Revisado.



## 1 INTRODUCTION

Science education is continuously evolving and requires frequent updates to the curriculum to keep up with the rapid changes that occur in the field (Ishemo & Hamidu, 2024). Revamping science education curriculum is a daunting task that takes into account the ever-evolving and complex nature of the field, the importance of relevance to both students and society, and the incorporation of a range of educational methodologies in multicultural perspectives (Huang & Liu, 2016; Stuckey *et al.*, 2013). Curriculum revision is not only a response to changes in scientific knowledge but also a strategic endeavor to enhance students' educational experiences and outcomes (Nugroho *et al.*, 2021).

In the Philippines, there are frequent curriculum revisions, as the Department of Education (DepEd) has continually sought to refine its educational framework, with the Revised K to 12 curriculum (introduced as the MATATAG curriculum) emerging as a pivotal reform initiative and introducing new frameworks in pursuit of improved educational outcomes, inadvertently leading to challenges at the grassroots level.

The Revised K to 12 Curriculum aims to fill in the gaps in the previous curricula and help students develop the skills they need to succeed in the 21st century. It emphasizes holistic, inclusive, and culturally relevant teaching practices integrated into peace, values education, and reading enhancement (Aquino, 2024), emphasizing a comprehensive educational approach, which includes other curricular methods like spiral progression and context-based teaching (Kostøl & Remmen, 2022). These strategies could potentially intersect with the new curriculum goals and affect science educators' experiences. A central tenet of the new science curriculum is its emphasis on fostering scientific, environmental, technological, and engineering literacy, alongside a robust integration of values education.

Science educators have a crucial function as implementers of curricula since they are essential in transforming curriculum design into significant learning experiences for students (Gulo, 2024). Teachers also possess the skills to develop engaging and pertinent learning activities that cater to students' needs and interests (Sipayung & Hsu, 2023). The execution of context-based science instruction, for one, showcases the significance of teachers in making science applicable to students' lives and society as a whole. However,

it poses obstacles to harmonizing with conventional assessments and demands the authentic involvement of teachers in the planning process (Kostøl & Remmen, 2022). The adoption of instructional strategies for argumentation in science teaching further exemplifies the nuanced role of teachers in implementing curricula that foster critical thinking and dialogue among students (Özdem Yilmaz *et al.*, 2017). Science teachers act as a bridge between curriculum expectations and student learning, adapting and developing curricula to fit the classroom context and contributing to their own professional growth (Gulo, 2024; Kostøl & Remmen, 2022; Özdem Yilmaz *et al.*, 2017; Parke & Coble, 1997). Their role is multifaceted and encompasses the adaptation of teaching practices to engage students effectively, as well as the integration of innovative pedagogical strategies to meet educational standards and goals amid obstacles (Alek *et al.*, 2021).

This study bolstered the existing knowledge base by exploring the unique experiences of science educators in relation to the implementation of various science curricula. The results will be crucial for curriculum developers, policymakers, and educators who aim to enhance and optimize the curriculum reforms in science education.

### **1.1 Objective of the study**

This study explored the understanding of science teachers regarding the implementation of different science curricula in basic education and their experiences, as well as the strategies they utilize as they implement it.

## **2 METHODOLOGY**

A qualitative multiple case study design (Creswell & Creswell, 2023; Creswell & Poth, 2025) was used to investigate science teachers' perspectives and experiences with the implementation of the different curricula. This approach was chosen because it provided an in-depth exploration of individual experiences within their real-life contexts. Its strength resides in its capacity to encapsulate the intricacies of authentic educational environments and the personal narratives of educators, which are crucial for thoroughly addressing the pertinent research question (Alpuerto, 2022; Sipe *et al.*, 2024).

The study focused on a specific group of science teachers in a province in the central Philippines. The science supervisor served as the gatekeeper, choosing conversation partners according to the following inclusion criteria: (1) must be a Grade 4 or Grade 7 science teacher; (2) must have taught in the last three curriculums (Revised Basic Education Curriculum, K–12, and the revised K–12); (3) must have taught in regular curriculum classes.

The conversation partners for this study comprised five science teachers. Two were elementary-level teachers, while the rest were from the secondary level. These teachers were recommended to capture a range of experiences, including varying years of teaching service and school contexts. They come from various school locations, such as a highly urbanized city, a component city, a semi-urban village, and a rural village.

Data gathering included semi-structured interviews, focus-group discussions, and document analysis of curriculum materials, lesson plans, and teacher reflections to gather collective insights to understand science teachers' perceptions, challenges, and strategies. The main method of data collection was the semi-structured interview, chosen for its flexibility in allowing participants to share rich, detailed narratives of their understanding, challenges, and strategies related to changes in the science curriculum. Data collection was done in the schools of teacher informants. This approach facilitated the capture of nuanced perspectives and personal accounts.

The data collected were analyzed using thematic analysis following the procedure prescribed by Braun & Clarke (2021a, 2021b) to identify recurring patterns, themes, and unique experiences that emerge from the teachers' perspectives.

To ensure that the data analysis was conducted in a precise, consistent, and comprehensive way, trustworthiness of the analysis set by Lincoln & Guba (1985) was observed. To establish credibility, member checks were done. Transferability was achieved by producing thick descriptions for each theme that meaningfully contextualized the participants' experiences. Dependability and confirmability were established using an audit trail.

The researcher addressed the general principles of respect for individuals, beneficence, and justice to ensure the ethical soundness of the study. These principles include social value, informed consent, the vulnerability of the research participants, risk

and benefits, privacy and confidentiality, justice, transparency, adequacy of facilities, and community involvement.

### 3 RESULTS AND DISCUSSION

This section presents a detailed account of each teacher's experience, highlighting their unique perspectives, challenges, and coping mechanisms in implementing the various science curricula.

#### 3.1 Individual case narratives: teacher experiences on curriculum implementation

Here, individual case narratives from the five informants are presented. These case narratives serve as a backdrop for the drawn themes presented in the next section.

##### 3.1.1 *Teacher Marie Curie: the flexible veteran embracing simplified guidance*

Marie Curie, a master teacher who has taught science for many years, has a unique view on the new curriculum. She finds it simpler and less cluttered than the previous iterations, appreciating the comprehensive learning exemplars and activity sheets that streamline instruction. The new curriculum encourages student exploration and collaboration, but she admits to initial stress in preparing for the changes. She notes that the new competencies require new instructional materials, and the transition from mother tongue to English for Grade 3 Science demands extra effort to teach scientific terms. Limited access to individual devices also restricts technology integration.

Despite these challenges, Marie Curie adapts learning materials to her students' needs. Her teaching style emphasizes hands-on, group, and inquiry-based learning. This deep expertise allows her to adapt to change with creativity and innovation.

Her extensive experience mitigates the disruptive impact of curriculum changes. For her, the core concepts remain the same, so she can focus on adapting her teaching methods rather than learning new content. This makes her transition to the new curriculum smoother than it might be for less experienced teachers.

### *3.1.2 Teacher John Alcala: resource deficits and permanent change*

John Alcala, a district science coordinator, has taught through the following curricula: Revised Basic Education Curriculum, K-12, and MATATAG. He sees the new curriculum as similar to the previous one, appreciating its focus on activity-based, learner-centered, and output-based learning. However, he finds the frequent curriculum changes frustrating, as they often require him to start over and create new teaching materials.

Teacher John faces significant classroom challenges. Overcrowded, hot classrooms and a lack of facilities make group work as a teaching strategy difficult. His school has no working science laboratory, and basic supplies like bond paper are scarce, forcing learners to share materials. Learners also struggle with literacy and numeracy, hindering skill development.

Alcala calls for more resources, including larger classrooms, functional science laboratories, and centralized printing services. He stresses that effective curriculum implementation is impossible without proper teacher training and resources. His experience highlights a significant gap between the curriculum's modern ideals and the reality of under-resourced classrooms, suggesting that a lack of investment in infrastructure and technology hinders the curriculum's full potential.

### *3.1.3 Teacher Maria Gravidad: a resilient and veteran navigates spiral curriculum pitfalls*

Maria Gravidad, a veteran teacher who has been teaching since 1991, considers the new curriculum to be an improvement on existing learner-centered ideas rather than a new framework. With her extensive experience and a battery of training in science pedagogy, she considers herself well-equipped to adapt. However, she notes significant challenges.

She points out that the spiral curriculum design makes it difficult for students to retain past topics, requiring reteaching. The learners' poor foundational mathematics skills also hinder their comprehension of topics in physics. The unexpected shift in her teaching assignment from physics to biology compelled her to rely on impromptu learning to refresh her content knowledge. She also observed an unanticipated rise in scientific

competencies, notwithstanding the curriculum's objective of alleviating congestion. Gravidad struggles to implement discovery learning with diverse student groups and finds a lack of supplies and consistent materials a major issue.

To cope, she tailors lessons to her students' needs, using student-centered methods and integrating technology like Android phones, computers, and TV sets. She collaborates with colleagues and mentors new teachers. She views her job as a calling. Gravidad advocates for small groups, hands-on training workshops, and the provision of laptops and stable internet connections for students. Her experience suggests that while the curriculum is a refinement, the changes place a heavy burden on teachers, demanding constant self-directed professional development.

### *3.1.4 Teacher Lucy Carlos: the burden of competency congestion and resource scarcity*

Teacher Lucy, a master teacher from a very large secondary school in a highly urbanized city, considers the new curriculum an evolution and an improved version of the K-12 curriculum. She values its focus on character and 21st-century skills development and finds the new learning exemplars useful for collaborative, hands-on instruction.

Despite these benefits, Lucy describes the transition as a "heavier burden." She attributes a decline in student mastery to the spiral nature of the science curriculum, which she feels is difficult for students to keep up with. A recent scheduling change forced her to teach all science disciplines without a teammate, and she also had no implementation training for Grade 8, as the training was implemented after the end of the first quarter. She finds these frequent curricular changes "tiring," noting that a new, increased number of meetings with more competencies has led to physical exhaustion, including loss of voice. A lack of classroom space, broken laboratory equipment, and unstable internet further complicate hands-on, technology-driven teaching called for by the new curriculum.

To adapt, Lucy simplifies lessons for diverse learners. She uses multimedia presentations, online platforms, and sourced materials for hands-on activities. She even purchases pre-made slide decks and physically transports her projector and TV set between classrooms to compensate for a lack of resources. Lucy stresses the need for functional laboratory equipment, dedicated laboratory rooms with assigned personnel for

maintenance and calibration, ICT tools, and smaller class sizes. Her story shows that teachers' innovation, often subsidized by their money and effort, frequently masks a systematic lack of resources. This reliance on personal sacrifice is unsustainable and risks teacher burnout.

### *3.1.5 Teacher Sierra del Mundo: socioeconomic barriers and the ideal learning environment*

Master Teacher Sierra del Mundo teaches at a rural secondary school. At 58 years old, she experienced several curriculum revisions. She is handling seven classes at the time of the interview. She is positive about the new curriculum's focus on decongestion, 21st-century skills, literacy, and numeracy. However, she faces significant challenges, particularly students' poor reading and comprehension skills. Such proficiency requires extensive vocabulary drills and reteaching of previous topics, wasting valuable time. She also feels students are not developmentally ready for some of the complex topics introduced at lower grade levels.

Student absenteeism is a major issue, driven by socioeconomic factors like families pulling children out during harvest time. Overcrowded and hot classrooms also make it difficult to manage student behavior and focus. Teachers lack sufficient learning guides, relying on printing their materials. Limited ICT resources and laboratory supplies hinder effective instruction.

To adapt, Sierra uses peer teaching, collaborative groups, and contextualizes lessons with local examples. She provides food for her students and creates her own teaching materials, including films and slide decks. She also provides emergency learning kits for use when classes are cancelled. Sierra believes that no matter how effective the curriculum is, it will not succeed without addressing students' basic needs, such as food and well-ventilated classrooms. She advocates for smaller class sizes, air-conditioned classrooms (especially those that are facing the afternoon sun), better ICT access, and continuous, pedagogy-focused teacher training.

### 3.2 Cross-case thematic analysis: recurring patterns and overarching themes

This section provides a comprehensive analysis of the recurring patterns and predominant themes identified from the experiences of science teachers implementing the basic education science curricula. Four themes emerged, to wit: Curriculum Perceptions and Adaptability Amidst Constant Change; Systemic Resource Deficits and Infrastructure Gaps; Student Readiness and Socioeconomic Impact on Learning; and Teacher Resilience, Innovation, and Personal Sacrifice. Each theme is detailed, incorporating specific findings to offer a thorough understanding of the practical realities and their consequences.

#### 3.2.1 Curriculum perceptions and adaptability amidst constant change

Curriculum changes are not new among seasoned science teachers in the Philippines. This leads to a complex range of responses like acceptance, stress, and continuous adaptation. Although some teachers perceive the revised K to 12 curriculum as simpler and well-supported by the issued lesson exemplars, a significant number consider it just an “enhancement” that, illogically, adds up to an increased workload. As shared by John, “...they would revise the sequence of the topics, the competencies to be covered. After you have created your materials, you may discover that the competencies are no longer covered and that a new set has been introduced, requiring you to prepare another set of materials for those competencies. A frequently debated aspect that arises is the spiral progression design, which teachers have noted significantly affects learner mastery and necessitates extensive re-teaching.

There is an apparent inconsistency between the stated aims of the new curriculum, such as simplicity, decongestion, and a learner-centered focus, and the actual experiences of the teachers in the field. This notable disconnect often leads to a profound sense of teacher “fatigue” and a feeling of continuous adjustment. The fact that there are several curriculum changes further aggravates this exhaustion, as teachers are incessantly compelled to adjust to new frameworks rather than being able to build upon strong, established foundations.

Despite its progressive and decongestion-oriented aims, the revised curriculum faces significant practical implementation challenges, underscoring a policy-practice gap. The spiral progression approach necessitated reteaching concepts due to difficulties in student mastery. Lucy pointed out that “the spiral progression scheme is a challenge.” Maria added that “in the spiraled curriculum, students encounter difficulty learning new concepts. They cannot even remember the lessons from yesterday; how much more difficult would it be to recall the topics from last year? This testimony supports the information that the design, which was supposed to build concepts incrementally, became a point of contention due to its practical implications for student learning and teacher workload.

While some teachers generally perceive the initial implementation as effective with moderate adaptation, they also highlight a moderate extent of challenges related to time allocation and management, availability of resources, and pace of instruction (Yunting *et al.*, 2025). The reflection confirms that the curriculum, despite its goal of decongestion, can escalate workload by incorporating additional competencies (Malinao & Miano, 2025). The curriculum’s objective is to streamline learning competencies by reducing content (up to 70% removal of previous competencies is acknowledged), yet teachers still report increased demands (Kilag *et al.*, 2024). Well-documented challenges arise when teachers adapt to new curricula, often necessitating shifts in pedagogical approaches and confronting resource limitations (Malinao & Miano, 2025). Teachers often employ adaptation strategies such as improvisation, peer collaboration, self-directed learning, and time management (Saro *et al.*, 2024; Soriano, 2025). However, these efforts are often accompanied by psychological and emotional stress, burnout, anxiety over curriculum mastery, and pressure to meet DepEd standards despite inadequate training and resources (Malinao & Miano, 2025), pointing to a significant burden on individual teachers to bridge gaps in systemic support. The spiral progression design, a consistent contentious point in the thematic analysis, is a recognized challenge in Philippine K to 12 science education, concerning time constraints, pacing, and poor knowledge recall (Giray & Kim, 2023). Teachers often struggle to help students recall prior knowledge, which is critical for building upon concepts in a spiral curriculum. This struggle leads to a distracted and unorganized curriculum from the teachers’ perspectives, hindering mastery (Miñoza *et al.*, 2025). Moreover, frequent curriculum changes contribute to teacher

fatigue and increased workload (Zhao *et al.*, 2022). The need to meet international standards and address long-standing problems like content overload (Almerino *et al.*, 2020; Demate *et al.*, 2025) is what drives the larger movement for curriculum reform in the Philippines. However, adequate teacher preparedness, resources, and institutional support are crucial for the success of such reforms (Malinao & Miano, 2025). The continuous cycle of adaptation without stable foundations contributes to teacher weariness.

Teachers are dealing with a "paradox of enhancement" because they are tired of constant, untested changes to the curriculum. This disconnect between designers and implementers burdens educators and fosters distrust.

This instability directly harms science education by forcing teachers to prioritize constantly acquiring new frameworks instead of refining teaching methods or addressing the challenges of the spiral progression model. Consequently, the focus shifts from achieving deep learning and practical scientific skills to a cycle of perpetual adjustment. Sustainable reform requires integrating teacher perspectives and providing stability to ensure the effective pedagogical transformation needed for quality science instruction.

### *3.2.2 Systemic resource deficits and infrastructure gaps*

All informants consistently observed a universally important theme: the apparent lack of essential resources and infrastructure in schools, which creates significant barriers to effectively implementing the new curriculum, particularly its focus on hands-on and ICT-integrated teaching-learning processes. Some concerns include crowded classrooms; laboratories converted to classrooms and not used as intended; insufficient ICT tools; unreliable internet connection; and a lack of basic teaching materials. John remarked, "We have a special science class, but we do not have a laboratory because the room intended for it was split into two and was converted to classrooms." Sierra has this observation: "You see, every time I have a class in the afternoon, students are already uneasy. I wish I had a large room with air-conditioning units so that they would be comfortable. On the other hand, Marie confided that "Resources like tablets can be provided for learners' ICT development."

Resource and infrastructure needs reported in almost all levels and types of schools suggest a systemic failure to establish basic conditions for implementing the new curriculum. This is contrary to the intentions of a curriculum that is learner-centered as well as activity-based and puts teachers in the position of trying to make compromises in their approach to pedagogy. It also forces teachers to spend their own money and sometimes risk their health or lives to fill those gaps. According to Lucy, “Wherever I go, I would carry a projector myself. I have personally purchased a projector and TV.” The lack of simple equipment such as bond paper, working laboratories, and dependable internet connectivity are examples where there is a chasm between policy ambition and practice on the ground.

There is well-documented concern about resource-deprived and ill-equipped Philippine schools (Pacadaljen, 2024). There are frequent shortages of teaching and learning materials, classrooms, laboratories, and computer and internet facilities (Espinosa *et al.*, 2025), which are required in the new modes of pedagogy in the curriculum. These insufficiencies are mostly severe in far-flung, rural, and hard-to-reach areas, exacerbating educational inequities (Pacadaljen, 2024). The Revised K to 12 program calls for more school buildings, which is compounded by an estimated shortage of 165,000 classrooms and 56,000 teachers. As observed by Espinosa *et al.* (2025), last-mile schools do not have electricity and internet access; therefore, the digital divide emerges. They added that even if available devices exist, their alleged limited durability, absence of software, and inadequate teacher training obstruct effective usage. These observations are also true in other countries. The absence of resources leads teachers to improvise or use personal funds to buy teaching materials, resulting in job dissatisfaction and exhaustion (Segu-Essel, 2021). This dependence on the individual teacher’s effort to compensate for the perennial deficiencies is unjustifiable and creates inequalities in delivering quality education.

The critical shortages of functioning science laboratories, inadequate ICT facilities, and other essential instructional materials greatly impair the ability to carry out practical experiments, demonstrations, and technology-assisted learning, which are critical for effectiveness in science teaching. This results in the science teacher being overly dependent on expository teaching, as students have too few opportunities to acquire essential practical, inquiry, and critical thinking capabilities as well as

engagement in real science. Moreover, this resource gap leads to substantial inequities in experiences with science learning across schools, where students who attend under-resourced schools are never provided with the rich, hands-on learning that is necessary for scientific literacy. Additionally, this resource gap leads to extreme inequities in science learning experiences across schools: students in under-resourced environments are denied so many of the rich, hands-on learning experiences required for scientific literacy.

### *3.2.3 Student readiness and socioeconomic impact on learning*

This theme reveals an essential “curriculum-readiness gap” that is a major factor inhibiting student learning in science. The issue is that many students lack the literacy and numeracy skills to meet the curriculum's requirements. As Sierra observed, “learners can read but cannot comprehend.” John added, “How can you teach other competencies if they cannot even read?” This feature is particularly important in a spiral curriculum, where the progression is based on what has gone before. However, when students do not possess such prior learning, spiral curriculum can serve to increase rather than to reduce pre-existing learning gaps, wasting a lot of time on remediation and review, thereby compromising the coverage and mastery of the curriculum. For science, it translates into less time devoted to deeper scientific investigation and a higher likelihood of the achievement gaps in scientific literacy getting wider. As for what John does in his classes, “If the learners find it difficult to do the activity because they cannot understand the procedure, you just have to spoon-feed’ the concepts to them.” Maria added, “I experience difficulty explaining physics lessons because some students do not even know how to add and subtract.” This observation is concurred by Lucy, saying, “Many students struggle to understand the learning tasks for hands-on activities, possibly due to lingering learning gaps from the pandemic.”

These basic knowledge gaps often compound due to underlying social and economic issues. Poverty-induced truancy and a lack of parental support create a challenging learning atmosphere. As relayed by Sierra, “In public schools, we have students who will be absent for about two to three weeks when it is harvest time.” However, we can observe that students thrive when they receive comfortable

environments and adequate nutrition. This implies that a learner's ability to learn is deeply relational to his/her life context. As Sierra opined, “No matter how effective the curriculum is, if the learners are not prepared for it physically and financially, it is useless. Understanding that the real battle in the Philippine setting takes place in the classroom is crucial. Successful learning is not only about curriculum design but also about satisfying a student’s fundamental needs through social wellbeing policies.

Recent literature strongly confirms the problems of students’ basic knowledge, being literacy and numeracy, as indicated by low PISA results in the Philippines (Miñoza *et al.*, 2025; Susanta *et al.*, 2023). Teachers affirm that they have observed a low literacy and numeracy status of the pupils, which could be influenced by various factors, including detrimental effects of the pandemic and perhaps unregulated use of gadgets (Miñoza *et al.*, 2025; Zain *et al.*, 2022). The spiral curriculum is also believed to add to this situation, causing an "unorganized and out-of-focused" curriculum that becomes a barrier to mastery (Orbe *et al.*, 2018; Usman-kaibat *et al.*, 2025). The socio-economic status (SES) is an important factor in determining student achievement (Chzhen & Leesch, 2023; Werang *et al.*, 2024). Students who come from low socioeconomic status backgrounds fare relatively poorly on standardized tests, and the performance difference increases as one goes to higher grades (Werang *et al.*, 2024). These disparities are associated with the lack of access to learning materials, less parental support, and more stress related to economic insecurity. Poverty continues to be a major challenge, where children drop out of school because they are unable to pay the indirect costs of schooling (Hirai & Hiyane, 2022; Maimad *et al.*, 2023; Parreño, 2023). Parental involvement, particularly within educational institutions, exhibits a significant negative correlation with student absenteeism (Coughenour *et al.*, 2021; Hall *et al.*, 2021; Islam & Shapla, 2021; Karlberg *et al.*, 2022; Özcan, 2022). Moreover, the physical—including seating, light, and acoustics—and social—that is, the relationships between teacher and student or peer to peer—have substantial consequences for student motivation, engagement, and academics (Hagenauer *et al.*, 2021; Tobia *et al.*, 2022). Crowded classrooms and unsuitable facilities are compromising student attention and learning (Chen *et al.*, 2024; Peng *et al.*, 2022). Meeting basic needs such as nutrition and health is similarly important because children in poor health perform poorly in school and attend school sporadically (Wei *et al.*, 2022). Finally, disjuncture between curricula demands and learners’ realities requires

considerable teacher time on catch-up, making it difficult for them to cope with engaging students and catering to various learning needs, especially if the learners' basic competencies are weak (de Bruijn *et al.*, 2025).

Literacy and numeracy limitations affect students' ability to understand scientific concepts, access information, and solve problems, which are key aspects of scientific processes. In addition, socio-economic factors such as malnutrition and poor home learning environments impede cognitive development required to comprehend complex scientific ideas. This prompts science teachers to spend more time in remediation. This prevents them from pursuing more worthwhile activities in the classroom that foster scientific inquiry or from covering more advanced science concepts. Consequently, a reduction in the depth and scope of science education leads to a widening gap in scientific literacy.

### 3.2.4 *Teacher resilience, innovation, and personal sacrifice*

Filipino science teachers never fail to show extraordinary resourcefulness, resilience, creativity, and profound commitment to their learners, usually through innovations, self-funded resources, and doing extra work. Maria shared, "...once you are a teacher, the welfare of the students is of prime importance. Not yourself. If you were really into it, things would be lighter. While this characteristic is very laudable, it is a "hidden subsidy" that masks the failings of the system and is placing unsustainable burdens on the teachers.

The reliance on a teacher's individual capacity and financial stability to bridge educational gaps leads to a fundamental erosion of educational equity. Marie beamed, "I think that my more than 30 years of experience have helped ease the impact of the implementation of the new curriculum. This is one of the factors contributing to my ability to adapt, as I have taught science for many years. The concepts remain. It is just the manner of teaching that has changed." John contradicted the claim by saying, "I have to overcome stress for a year because I am only one page ahead of the topics that will be covered, as the training for the new curriculum was implemented late." After a year, I already have the confidence to teach because the materials are already prepared, only to

find out that the administration will again change the curriculum, making us go back to square one.”

Lucy relayed, “We shell out from our own pockets so that we can realize the conduct of a laboratory activity.” While we applaud the dedication and new ideas of individual teachers as they strive to teach well against all odds, the report points out that “the effectiveness of curriculum implementation begins to rely on a teacher's personal capacity and economic position rather than institutional strength.” The report creates a direct connection: even though individual innovation is itself positive, the need for it that results from systemic deficiencies translates into unfair educational experiences for the students. Bottom-half learners may receive poorer education if teachers are weaker or less willing to take the personal hit. This contradicts a fundamental principle of educational equity, which states that all children, regardless of their geographical location or teacher's circumstances, should have equal access to a comparable education. Thereby, policy efforts need to move away from individual heroism to a more equitable and durable system of institutional support that ensures all students reach a baseline threshold of quality. This necessitates adopting a sectoral approach, rather than an individualistic one, to address problem-solving within the education system.

According to Romano *et al.* (2021), teacher resilience plays a crucial role in professional performance, empowering educators to effectively handle challenging situations. Resilient teachers are better able to maintain high instructional quality, which is a key determinant of student learning and development (Holzberger & Schiepe-Tiska, 2021; Huang *et al.*, 2023). Teacher resilience and instructional quality are influenced by teacher self-efficacy (Ahn & Bowers, 2023; Burić & Kim, 2020), teacher-student relationships, school climate, and organizational support (Holzberger & Schiepe-Tiska, 2021; Hsieh *et al.*, 2024; Mateos *et al.*, 2021). The theme of remarkable resilience in the face of challenges aligns with this finding. Teachers employ various coping mechanisms, including time management and prioritization, resourcefulness, self-care and personal reflection, perseverance, seeking support and collaboration, and faith.

On the other hand, teachers face daily challenges such as managing diverse classrooms, administrative changes, heavy workloads, time pressure, emotionally demanding situations, and balancing professional and personal lives, leading to increased stress, burnout, depression, and anxiety (Cao *et al.*, 2024; Castro *et al.*, 2023; Sohail *et*

*al.*, 2023; Stapleton *et al.*, 2020). Thus, the effectiveness of curriculum implementation should not depend on a teacher's individual capacity and financial stability but on robust institutional support.

The resilience and creativity of science teachers developing improvised experiments or personally funding laboratory supplies is laudable, but it is not a scalable model, and no one should have to sacrifice to maintain it. This “hidden subsidy” disguises systemic shortfalls in the resources made available for science education and education and effectively results in inequality of opportunity, where the ability to provide high-quality hands-on science learning experiences can depend significantly on the individual teacher’s personal means and commitment, rather than being supported by strong institutional provision. It siphons the energy of endorsers who might otherwise be focused on pedagogical innovation and meaningful scientific instruction away from creative tools to obtain the most rudimentary teaching materials, undermining the uniform quality of science education.

### **3.3 Overall discussion and multi-layered understandings**

The thematic analysis of science teachers' experiences within the Revised K to 12 Curriculum reveals a complex interaction between policy objectives and grassroots realities. While the Department of Education targets curriculum decongestion and increased learner-centeredness, teachers see the changes as an increased workload as they struggle with its implementation, citing primarily the spiral progression model. This intuition is not just anecdotal but supported by empirical evidence that reduced competencies burden the teachers, increasing their work (Jerrim & Sims, 2021; Spicksley, 2022; Sun *et al.*, 2021). The data shows that the qualitative demands of the new curriculum, rather than its content, are the main stressors of teachers, leading to a vicious cycle of adaptation and fatigue.

Pervasive systemic shortages of resources and deficiencies in infrastructure lie at the heart of not only conceptualization or materialization but also impediments to activity and technology-integrated curriculum. Overcrowded classes, non-operational laboratories, and insufficient ICT cripple, in principle, the starting points for the new curriculum, even those coming before the present one. As teachers must make trade-offs

in pedagogy and personal life, a sobering reality emerges: there is a profound chasm between policy and actual working conditions. Such a widespread absence or limited supply of basic materials is obstructing the innovative pedagogy intended by the curriculum and causing an educational mismatch between policy and practice.

Student preparedness issues deepen and expand due to a lack of foundational knowledge, literacy and numeracy weaknesses, and entrenched inequities creating a substantial disparity with curriculum expectations exacerbated by the pandemic (Bertoletti *et al.*, 2023; Darmody *et al.*, 2021). Factors such as poverty-induced absenteeism further exacerbate this issue, necessitating significant remediation and impacting curriculum coverage and accomplishment (Patiro & Budiyanti, 2022). Basic support, including a learning environment that meets the basic needs of children, is vital but often absent. This situation exposes a vicious feedback loop where external aspects of socioeconomics prevent learning, so curriculum design is meaningless unless students are ready to learn or acquire proper support.

Despite such enormous challenges, teachers show incredible resilience, creativity, and personal sacrifice. Nevertheless, the reliance on the individual's efforts to offset systems weaknesses is unsustainable, results in additional burden and exhaustion (workload, physical fatigue, emotional burnout), and perpetuates inequality in educational quality. This well-intentioned and, again, admirable resilience has the unintended consequence of obscuring systemic catastrophes and placing an unreasonable onus on educators to the extent that education quality may be compromised as well as existing inequities exacerbated.

#### 4 CONCLUSION

Although the Revised K to 12 Curriculum aspires to simplify education, it may serve to have an adverse effect, particularly in terms of teacher workload, because of the complicated content and repeated relearning of competencies. This indicates that qualitative challenges in instructional change are at least as significant as reducing the quantity of configurations and context for implementation.

The predominant absence of a minimum level of necessary resources, such as infrastructure (e.g., laboratories lacking equipment and overcrowded classrooms that

hinder effective student learning), along with ICT tools and internet connectivity, undermines the activity-based and ICT-integrated pedagogy required by the curriculum. This systemic failure to provide the foundation for learning places teachers in an unsustainable position, forcing them to make compromises.

Students arrive from a wide range of socioeconomic backgrounds with significant learning deficits in literacy and numeracy further compounded by issues with parental engagement and poverty-fueled absenteeism, leaving large proportions inadequately prepared for the demands of a curriculum. An enabling environment conducive to learning, including basic needs such as nutrition and a fitting physical space in which to learn, is a necessity for meaningful education that many do not have.

Where teachers are being asked to bridge the gap because of a lack of systemic support for all children, such an approach is not sustainable in the long term. It results in work overloads, emotional exhaustion, and burnout and is the culprit of differences in educational quality—now implementation quality comes to depend on a teacher's own resources and financial means rather than strong institutional support.

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### **Authors' Contribution**

All authors contributed equally to the development of this article.

### **Data availability**

All datasets relevant to this study's findings are fully available within the article.

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