



Abstract. Curriculum reforms in the Philippines, including the MATATAG curriculum, have reduced scheduled educational time in lower secondary science, raising questions about their impact on learning and metacognition. This study examined the impact of reduced educational time, specifically the shift from 60 minutes to 45 minutes per genetic lesson, on students' performance, confidence, and metacognitive accuracy in a lower secondary science context. Using a cohort-comparison design, data were collected from Grade 9 students across two school years. Student performance was assessed through a genetics test, while confidence ratings captured metacognitive accuracy. Pearson correlations examined confidence-performance alignment, and Welch's t-tests compared cohort and gender differences. Teacher perceptions were gathered through open-ended surveys. Results showed that the students who received longer lessons achieved higher performance and demonstrated stronger confidence-performance calibration, whereas students who experienced shorter lessons achieved lower performance and exhibited overconfidence. Gender differences appeared only in the 2023 cohort, with females outperforming males. Teacher accounts confirmed that shortened lessons reduced opportunities for interaction, feedback, and reflection. The findings highlight that educational time is both an academic and metacognitive resource. Safeguarding opportunities for reflection and feedback is essential to support accurate self-monitoring and sustainable learning in science education.

Keywords: confidence-performance calibration, educational time, genetics education, metacognitive accuracy, lower secondary school

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THE IMPACT OF REDUCED EDUCATIONAL TIME ON PERFORMANCE, CONFIDENCE, AND METACOGNITIVE ACCURACY IN LOWER SECONDARY GENETICS LEARNING

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Introduction

Students' opportunities to understand complex science ideas depend greatly on the amount of time that is available for instruction and reflection. When class time is limited, teachers may struggle to provide the depth, pacing, and the necessary feedback for a meaningful learning experience. This practical concern has been supported by research showing that instructional time strongly shapes what students learn and how they monitor their understanding. (Carroll, 1963; Gettinger, 1984; Organisation for Economic Co-operation and Development [OECD], 2016).

Across education systems, the allocation of class hours varies widely. Research indicates that differences in learning outcomes are more strongly associated with how instructional time is structured and used than with the total number of hours allocated (Lavy, 2015; OECD, 2019a; Stevenson & Stigler, 1992). These patterns challenge the assumption that more time automatically produces better results and instead highlight the importance of how time is structured and which learning processes it supports (OECD, 2016; Panadero, 2017).

In the Philippines, the Department of Education (DepEd) introduced the MATATAG curriculum, a revised basic education curriculum developed under MATATAG Agenda, the Department's national education reform direction. MATATAG is an acronym that articulates four reform priorities: Make the curriculum relevant to produce competent and responsible citizens; Take steps to accelerate the delivery of basic education facilities and services; Take good care of learners by promoting well-being, inclusion, and a positive learning environment; and Give support to teachers to enhance instructional quality. As formally established through DepEd Memorandum No.054, s. 2023, the MATATAG curriculum aims to decongest learning competences and includes adjustments to instructional time, beginning with pilot implementation prior to its phased nationwide rollout. The reform established a default 45-minute period for all subjects across grade levels, although the phased rollout officially began in SY 2024–2025 with Kindergarten, Grade 1, Grade 4, and Grade

7, following pilot implementation in selected schools during SY 2023–2024 (Department of Education [DepEd], 2024b, 2024d). In practice, many secondary schools also applied the 45-minute allotment immediately, including Grade 9 science, to comply with DepEd's standard. The shift to shortened lessons raised concerns among teachers about workload pressures, limited opportunities for feedback, and the risk of superficial instruction in complex subjects. In September 2024, DepEd amended the policy to grant schools flexibility to extend lessons to 50, 55, or 60 minutes while retaining the option of 45 minutes (DepEd, 2024c). These adjustments reflect ongoing tensions between efficiency, teacher welfare, and the need for meaningful learning in science classrooms.

Viewed through the lens of global research on instructional time, the MATATAG curriculum reform represents a policy-driven reduction in educational time that is directly relevant to international debates on learning opportunity and instructional quality. Global studies have shown that instructional time shapes not only academic achievement but also metacognitive processes such as self-monitoring and confidence–performance calibration, largely through its role in enabling feedback, reflection, and iterative learning cycles (Carroll, 1963; OECD, 2016; Panadero, 2017). In this context, the MATATAG reform provides a timely and theoretically grounded case for examining how reductions in instructional time may influence both cognitive and metacognitive outcomes in science education. By situating MATATAG within this broader literature, the present study positions the Philippine reform not as a local scheduling change, but as a policy context that extends global research on instructional time and metacognition.

Reduced educational time may not only affect academic achievement but also restrict opportunities for reflective learning and the development of metacognitive skills (Alexander, 2013). Self-monitoring, a core component of metacognition, refers to students' ability to evaluate the accuracy or quality of their own knowledge or performance (Flavell, 1979; Nelson & Narens, 1990). Research has shown that opportunities for feedback and reflection are essential for developing accurate metacognitive monitoring and confidence–performance calibration (Nicol & Macfarlane-Dick, 2006). In science education, it enables learners to identify misconceptions, adjust strategies, and seek clarification when needed (Tanner, 2012). Accurate self-monitoring, often assessed through the relationship between confidence judgments and actual performance, is essential for lifelong learning (Pallier et al., 2002). Reduced educational time can constrain the feedback loops, peer discussion, and reflective activities that help students calibrate confidence with performance (Panadero, 2017).

Beyond academic outcomes, the ability to accurately judge one's own understanding is central to self-regulated and lifelong learning, specifically in science education. Students may still feel confident despite their weakened understanding, creating a hidden risk that the traditional achievement measures fail to capture when educational time is limited or reduced. Examining confidence–performance calibration thus provides a deeper lens for understanding how time constraints shape learning quality, not just learning quantity. In policy-driven reforms such as the MATATAG curriculum, evidence on these metacognitive consequences is essential for informed decision-making. This study responds to this need by examining educational time as both an academic and a metacognitive resource.

Research Problem

Despite growing international interest in educational time, little is known about how reductions in science class hours affect both achievement and metacognitive accuracy (self-monitoring accuracy) among lower secondary students, particularly in developing-country contexts. Most prior research has focused on test scores, overlooking how shortened lessons may undermine students' ability to evaluate their own understanding (OECD, 2019b; Pieschl, 2008).

Across education systems, instructional time is recognized as a critical resource shaping the depth and the quality of learning (Carroll, 1963; Gettinger, 1984; OECD, 2016). In the Philippines, the implementation of the MATATAG curriculum reduced science teaching from 60 to 45 minutes per session (DepEd, 2024b; 2024c). Genetics is a conceptually demanding topic, which requires time for guided reasoning, explanation, and iterative feedback. (Duncan & Reiser, 2007; Lewis & Kattmann, 2004). For this reason, when the class periods are compressed, opportunities for students to check their understanding, receive corrective input and regulate their learning may be constrained, which increases the risk of miscalibration or inflated confidence.

Reductions in educational time may distort students' perceptions of learning by weakening the alignment between confidence and actual performance. This miscalibration is particularly problematic in complex science domains such as genetics, where accurate self-monitoring is essential for effective learning. By examining both achievement and confidence–performance calibration in the context of curriculum reform, this study highlights that educational time is not only an academic resource but also a critical condition for metacognitive development.

This study addresses this gap by examining the impact of reduced educational time on Grade 9 students' performance, confidence, and metacognitive accuracy in genetics learning, with additional insights from teacher perceptions. By situating the study in the Philippine context of curriculum reform, where large class sizes and limited instructional time are common constraints (Reyes & Castillo, 2017), this study contributes evidence from a Southeast Asian education system where metacognitive supports are often underexplored (Famarin & Cajala, 2024). The findings extend theoretical understanding of self-monitoring in time-constrained settings and provide practical guidance for curriculum reform and classroom practice.

Research Focus

This study focuses on how reduced educational time shapes both academic performance and metacognitive accuracy (self-monitoring accuracy measured through calibration) in secondary genetics learning. This study examines two consecutive Grade 9 cohorts who experienced different class time allotments during the implementation of the MATATAG curriculum. Genetics was selected because its abstract and multi-level nature requires extended opportunities for explanation of content, discussion, and reflection (Duncan & Reiser, 2007; Lewis & Kattmann, 2004).

Three constructs guide this focus: educational time (class time allotment), confidence-performance calibration, and teacher-reported classroom conditions. In this study, educational time refers to the class time allotment defined under DepEd policy, while the term instructional time is used only when referring to prior research that conceptualizes learning time as a resource influencing pacing, interaction, and depth of processing (Carroll, 1963; Gettinger, 1984; OECD, 2016; Panadero, 2017).

By integrating the performance data, confidence ratings, and teacher insights, the study aims to provide an evidence-based understanding of how time constraints influence both cognitive and metacognitive outcomes in Philippine science classrooms.

Research Questions

To examine the impact of reduced educational time on students' performance, confidence, and metacognitive accuracy in lower secondary genetics learning, this study addresses the following research questions:

1. What is the impact of reduced educational time on Grade 9 students' performance and confidence in a genetics assessment?
2. How does reduced educational time influence confidence-performance calibration (i.e., metacognitive accuracy) across cohorts with different class time allotments?
3. Does the impact of reduced educational time on students' performance and confidence differ by gender across cohorts with different educational time allotments?
4. How do teachers perceive the impact of reduced educational time on student learning, engagement, and opportunities for reflection during genetics education?

Research Methodology

Design

This study utilized a comparative cohort design with an embedded qualitative component to examine the impact of reduced educational time on student learning outcomes and metacognitive calibration in genetics. The primary dataset consisted of quantitative measures of performance and confidence gathered from two Grade 9 cohorts in 2023 and 2024 school years. Additionally, a supplementary teacher survey was conducted to contextualize the observed differences, which focused on perceived instructional adjustments, student engagement, and self-monitoring opportunities. The study was carried out in authentic classroom settings without researcher intervention, allowing a naturalistic comparison under stable teaching conditions. These conditions included having the same science teachers, instructional materials, curriculum content standards, assessment formats, and lesson sequences across both cohorts. The only intentional variation was the class-time allotment per session, resulting from the school's early adoption of MATATAG curriculum's time-allotment adjustment.

Participants and Context

Participants were drawn from a lower secondary public school in the Philippines. The sample included five regular classes from two full cohorts of Grade 9 students who studied genetics during two consecutive school years: the 2023 cohort ($n = 385$) and the 2024 cohort ($n = 403$). These classes were purposefully selected from among several Grade 9 sections in the school based on teacher consistency. Only classes taught by the same teachers across both school years were included to control for instructional variation related to teaching style, pacing, and classroom management. Across both cohorts, the selected classes followed the same instructional materials, curriculum content standards, assessment format, and lesson sequence, ensuring comparable educational conditions. Thus, the only planned difference between the two cohorts was the scheduled educational time per session, with the 2023 cohort receiving 60 minutes of class time and the 2024 cohort receiving 45 minutes following the school-level scheduling adjustments associated with the MATATAG curriculum (DepEd, 2024b). All students enrolled in the selected classes were included in the analysis. Although not all Grade 9 sections in the school were sampled, this selection strategy is appropriate for school-based cohort comparison studies where controlling instructional conditions is prioritized over random or school-wide sampling. The resulting samples were sufficient for the planned statistical analyses of performance, confidence, and metacognitive calibration.

Ethical Considerations

This study followed all ethical considerations for conducting research with minors in a school setting. Approval to carry out the study was obtained from the school administration and from the division research committee prior to data collection. Written parental consent and student consent as well were secured for all Grade 9 participants. Students were informed that participation in the study was voluntary, their grades would not be affected by participation or non-participation, and they could withdraw at any time without penalty. For the teacher survey, participation was voluntary, and responses were collected anonymously through Google Forms. All teachers were informed that their feedback would be used solely for research purposes. All procedures complied with ethical guidelines for education research and adhered to the principles of confidentiality and informed consent.

Genetics Assessment with Confidence Scale

The primary instrument was a 30-item multiple-choice assessment on genetics, adapted from the American Association for the Advancement of Science (AAAS) Science Assessment item bank and aligned with the K to 12 curriculum standards in the Philippines. Items were selected to reflect a range of difficulty and conceptual depth across topics such as Mendelian inheritance, chromosome structure, and genetic disorders. Each item was followed by a 4-point Likert-type confidence scale (1 = Not confident, 4 = Very confident), prompting students to indicate how confident they were in their answers.

Student performance was initially calculated as the total number of correct responses (range: 0–30). For reporting and comparison purposes, raw performance scores were converted to percentages by dividing the number of correct responses by the total possible and multiplying by 100. Confidence was operationalized as the mean confidence rating across all items and was similarly transformed to a 0–100 scale. Converting both performance and confidence to a common metric allowed direct comparison between objective achievement and subjective judgments and facilitated the examination of confidence-performance calibration. This approach aligns with established metacognitive research that conceptualizes calibration as the correspondence between performance outcomes and confidence judgments and commonly relies on aligned or normalized measures for analysis (Nelson & Narens, 1990; Pallier et al., 2002; Schraw, 2009).

Data Analysis

All statistical analyses were conducted using RStudio and IBM SPSS Statistics (Version 25) with the alpha level set at .05 for determining statistical significance. Quantitative data were analysed using descriptive statistics, independent samples Welch's t -tests, and Pearson's correlation coefficients. Descriptive statistics and group comparisons for performance and confidence are summarized in Table 1, while gender-based comparisons are reported in Table 3. Welch's t -tests were selected because they are robust to violations of homogeneity of variance and unequal

sample sizes between groups. Effect sizes were calculated using Cohen's d to provide an estimate of the magnitude of differences, with benchmarks of 0.20, 0.50, and 0.80 interpreted as small, medium, and large effects, respectively.

Confidence–performance calibration was examined by computing Pearson's correlation coefficients between students' performance scores and their mean confidence ratings, disaggregated by cohort and gender; these results are presented in Table 2. Correlation coefficients were interpreted following Cohen's (1988) guidelines, where values of .10, .30, and .50 represent small, medium, and large effect sizes, respectively.

Qualitative data from teacher surveys were analysed thematically. Responses were coded inductively to identify recurring themes regarding the perceived impact of reduced educational time on student engagement, opportunities for feedback, and reflective learning. A summary of themes and representative quotes is shown in Table 4, which is used to contextualize the quantitative findings and provide a more comprehensive understanding of educational time reduction in classroom practice.

Teacher Survey on Educational Time Reduction

To support Research Question 4, a brief qualitative survey was distributed via Google Forms to the five teachers who taught both cohorts. The survey was used as a supplementary research strategy to contextualize the quantitative findings rather than as a formal measurement instrument. It included both closed- and open-ended prompts designed to capture teachers' perceptions of instructional changes associated with reduced educational time. Teachers were first asked to confirm whether a reduction in educational time had occurred and to describe specific adjustments they made to their teaching, such as the removal of group activities, reduced time for feedback, or changes in lesson pacing. The survey also inquired about perceived differences in student learning, engagement, and opportunities for reflection between the two cohorts. Teachers were asked to estimate general differences in academic preparedness, including Grade 8 GPA and prior science performance. This item was intentionally included to help determine whether performance differences could be attributed to educational time rather than baseline academic variation, thereby strengthening the validity of the analysis.

Finally, the form included an open-ended item prompting teachers to summarize how the shortened instructional period had influenced classroom dynamics during genetics instruction. The decision to use a brief online questionnaire, rather than extended interviews, was guided by both feasibility and methodological appropriateness. Online surveys are widely recognized as effective tools for efficiently capturing targeted perceptions while ensuring consistency across respondents (Cohen et al., 2018; Creswell & Creswell, 2018; Dillman et al., 2014). Moreover, integrating teacher perspectives through structured surveys provided a form of triangulation, complementing the quantitative data and enhancing the validity of interpretations (Patton, 2015). This approach was also appropriate given the heavy workload of public school teachers; short and accessible instruments minimize research burden while still yielding valuable insights (Flores & Day, 2006; Klassen & Chiu, 2010).

Research Results

Cohort Differences in Performance and Confidence

An independent samples Welch's t -test was conducted to compare the performance scores of students in the 2023 cohort (60 minutes) and the 2024 cohort (45 minutes). Results showed that students in the 2023 cohort ($n=345$) performed significantly better in terms of percentage scores derived from the 30-item assessment ($M = 61.82$, $SD = 32.40$) than those in the 2024 cohort ($n=391$; $M = 29.42$, $SD = 9.81$), $t(399.60) = 17.86$, $p < .001$, Cohen's $d = 1.35$. This large effect size indicates that the reduction of educational time had a substantial negative impact on student achievement in genetics, as summarized in Table 1.

A separate Welch's t -test was performed to assess students' confidence levels. Interestingly, students in the 2024 cohort reported higher confidence ($M = 78.45$, $SD = 6.50$) compared to their 2023 counterparts ($M = 72.76$, $SD = 16.69$). The difference was statistically significant, $t(435.38) = -5.95$, $p < .001$, Cohen's $d = -0.45$, indicating a moderate effect size.

These results reveal a clear misalignment between confidence and performance in the 2024 cohort. While students in the 2023 group demonstrated higher achievement and more moderate confidence, those with less educational time (2024) exhibited lower performance but elevated self-ratings. This pattern suggests possible overconfidence and weakened metacognitive calibration under time-constrained learning conditions.



Table 1*Welch's t-test Results for Performance and Confidence Differences by Cohort*

	2023 Cohort		2024 Cohort		<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>
	<i>M</i> (%)	<i>SD</i> (%)	<i>M</i> (%)	<i>SD</i> (%)				
Performance	61.82	32.40	29.42	9.81	17.86	399.60	<.001***	1.35
Confidence	72.76	16.69	78.45	6.50	-5.95	435.38	<.001***	-0.45

Note. Performance scores were originally calculated as raw scores out of 30 and were converted to percentages (0–100) for reporting and comparison purposes. Welch's *t*-test was used to compare mean differences between cohorts. Cohen's *d* represents the effect size. $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$.

Calibration Differences Between Cohorts

To examine how confidence–performance calibration differed between cohorts, Pearson's correlation coefficients were calculated between students' performance scores and their average confidence ratings. As summarized in Table 2, for the 2023 cohort, a strong positive correlation was found for both females ($r = .61$, $p < .001$) and males ($r = .52$, $p < .001$), indicating that students who performed better also reported higher confidence levels. This alignment suggests accurate self-monitoring and well-calibrated metacognitive judgments among students with longer educational time.

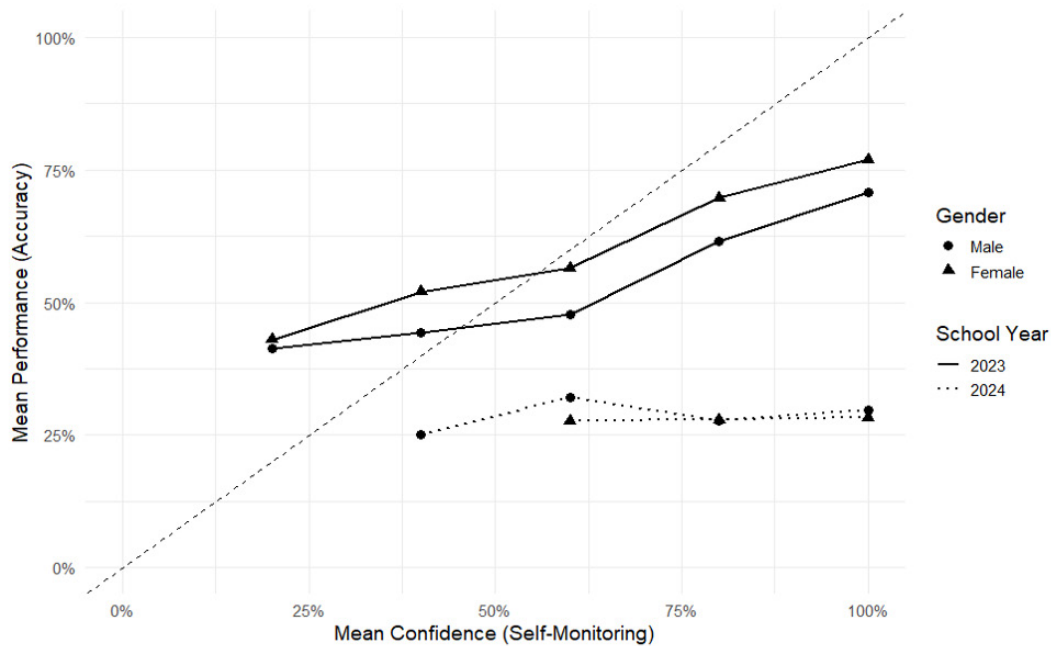
In contrast, the 2024 cohort showed no significant correlation between performance and confidence for either gender. For females, the correlation was nearly zero ($r = -0.01$, $p = .910$), while for males, it was negative but non-significant ($r = -0.07$, $p = .382$). These results are illustrated in Figure 1, which suggests a breakdown in confidence–performance alignment such as calibration among students who experienced reduced educational time. Despite low scores, confidence ratings remained consistently high across the 2024 group, indicating weakened self-monitoring accuracy and possible overconfidence. The contrast between the two cohorts shows that lesson length affects more than just test scores, it also changes how well students can judge their own understanding.

Table 2*Correlations for Performance and Confidence by Gender and Cohort*

Cohort	Gender	Variable	1	2
2023	Male	1. Performance	–	.52**
		2. Confidence	.52**	–
	Female	1. Performance	–	.61**
		2. Confidence	.61**	–
2024	Male	1. Performance	–	-0.07
		2. Confidence	-0.07	–
	Female	1. Performance	–	-0.01
		2. Confidence	-0.01	–

Note. Pearson correlation coefficients (*r*) are reported. $*p < .05$, $**p < .01$, $***p < .001$. Positive correlations indicate greater alignment between performance and confidence.

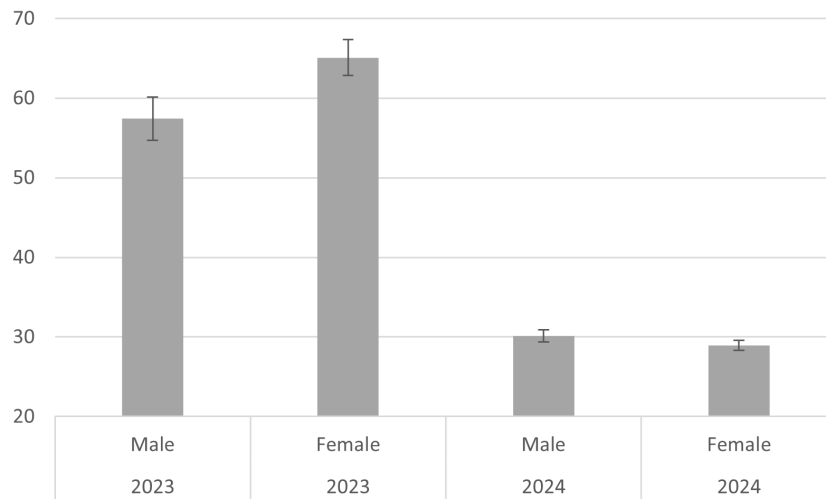
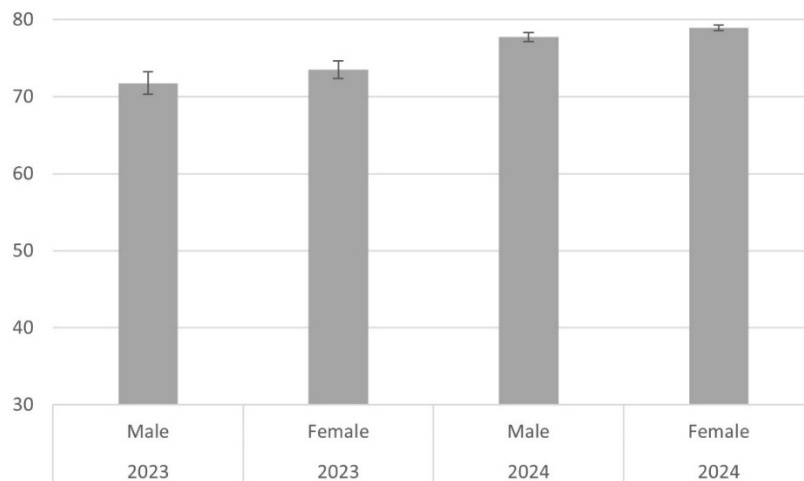


Figure 1*Calibration Curves Illustrating the Relationship between Confidence and Performance by Gender and Cohort.**Gender Differences in Performance and Confidence within Each Cohort*

To examine whether students' performance and confidence differed by gender within each cohort, Welch's t-tests were also conducted due to a violation of the homogeneity of variance assumption in 2024 confidence scores, as indicated by Levene's test ($p = .006$). Results along with descriptive statistics are summarized in Table 3. In the 2023 cohort, a significant difference in performance was found between male and female students, $t(307.71) = -2.17, p = .031$, with females ($M = 65.08, SD = 31.67$) outperforming males ($M = 57.41, SD = 32.95$). The effect size was small, $d = -0.24$. However, no significant gender difference was observed in confidence, $t(299.28) = -0.94, p = .346$, with males ($M = 71.76, SD = 17.49$) and females ($M = 73.49, SD = 16.07$) reporting comparable levels of confidence.

In the 2024 cohort, no significant gender difference was observed in performance, $t(343.50) = 1.19, p = .236$, with males ($M = 30.12, SD = 9.83$) and females ($M = 28.93, SD = 9.79$) achieving similar scores. Confidence levels were also not significantly different, $t(271.34) = -1.71, p = .089$, though females ($M = 78.95, SD = 5.50$) reported slightly higher confidence than males ($M = 77.74, SD = 7.67$). The effect sizes for both performance and confidence in 2024 were negligible ($d = 0.12$ and -0.18 , respectively).

Table 3 presents these results, and Figures 2 and 3 illustrate them. As shown in Figure 2, females outperformed males in performance in the 2023 cohort, while no gender gap was observed in 2024. Figure 3 shows that confidence levels were similar for both males and females in each cohort. Notably, in 2024, both groups expressed relatively high confidence despite low performance, suggesting weaker calibration under reduced educational time.

Figure 2*Performance by Gender and Cohort***Figure 3***Confidence by Gender and Cohort***Table 3***Welch's t-test Results and Effect Sizes for Gender Differences in Performance and Confidence by Cohort*

Cohort	Measure	Male M (SD)	Female M (SD)	t	df	p	Cohen's d
2023	Performance	57.41 (32.95)	65.08 (31.67)	-2.17	307.71	.031*	-0.24
	Confidence	71.76 (17.49)	73.49 (16.07)	-0.94	299.28	.346	-0.10
2024	Performance	30.12 (9.83)	28.93 (9.79)	1.19	343.5	.236	0.12
	Confidence	77.74 (7.67)	78.95 (5.50)	-1.71	271.34	.089	-0.18

Note. Welch's t-test results with Cohen's *d* effect sizes. Performance scores are reported as percentages (0–100) based on the 30-item assessment. $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$. Only the 2023 performance showed a significant gender difference; all other comparisons were nonsignificant.



Teachers’ Perceptions of Reduced Educational Time in Genetics Learning

To complement the quantitative findings, teacher perceptions were gathered through open-ended survey prompts about the reduction of science class time shown in Table 4. Most teachers reported that the reductions of science class time from 60 to 45 minutes significantly altered their instructional routines. Four teachers (80%) indicated that they had to focus primarily on test-related content, while three teachers (60%) stated that they had to shorten discussions, reduce feedback, or skip some activities (See Table 5).

When comparing cohorts, most teachers reported that students in the 2024 cohort demonstrated noticeably weaker understanding of genetics than those in 2023. Teachers consistently described how reduced educational time limited opportunities for questioning, feedback, and reflection, which they believed hindered students’ ability to connect genetics concepts to real-life contexts. Although teachers differed in their perceptions of prior academic preparation between cohorts, all agreed that shortened educational time contributed to lower performance, reduced engagement, and weaker metacognitive calibration. Representative comments supporting these themes are summarized in Table 4.

Overall, teachers perceived that reduced class time constrained learning, engagement, and self-reflection, reinforcing the quantitative findings that the 2024 cohort performed lower and showed weaker confidence–performance alignment.

Table 4
Summary of Teacher Perceptions on Reduced Educational Time (n = 5)

Theme	Frequency	Representative teacher quote
Focus on test-related content	80% (4/5)	<i>“Almost same, just the time allotted affects learning.”</i>
Reduced opportunities for feedback and questioning	60% (3/5)	<i>“Motivation and assessment of students was limited in SY 2024.”</i>
Lower student understanding in 2024	60% much lower, 40% slightly lower	<i>“Generally, in terms of expressing idea or individual experiences ... students of 2023 is slightly better compared to students of 2024.”</i>
Reduced engagement and reflection	100% (5/5)	<i>“The reduction time has an impact on the learning process of the students.”</i>
Variation in prior academic preparation	40% 2023 stronger; 40% 2024 stronger; 20% similar	—

Note. Teacher responses were collected through a Google Form survey with both closed- and open-ended items.

Discussion

Interpreting the present findings requires attention to the realities of Philippine public secondary classrooms, where large class sizes, limited instructional resources, and substantial teacher workload shape everyday teaching practices. Under these conditions, educational time functions as a critical structural resource that determines whether teachers can provide explanation, interaction, feedback, and opportunities for reflection. Accordingly, the impact of reduced educational time observed in this study should be understood not merely as a scheduling difference, but as a constraint on core instructional and metacognitive processes in everyday classroom practice.

Cohort-Based Differences in Genetics Performance and Confidence

This study found clear differences between the 2023 and 2024 cohorts, showing that educational time affects both learning and metacognitive skills. Students in 2023 achieved higher test scores but reported lower confidence, suggesting cautious and more accurate self-monitoring. In contrast, the 2024 cohort expressed inflated confidence despite weaker test performance, a pattern of miscalibration. Together, these results indicate that reduced educational time is associated with lower performance in genetics, highlighting the critical role of educational time in supporting conceptual understanding in lower secondary science. From a time-to-learn perspective, learning outcomes depend on the balance between the time available for instruction and the time required for students



to achieve mastery (Carroll, 1963; Gettinger, 1984). When educational time is reduced without corresponding reduction in learning demands, students are more likely to leave lessons with incomplete or fragile understanding.

This relationship is particularly relevant for genetics, which is a domain characterized by abstract concepts, multi-level explanations, and unfamiliar terminology. Prior research emphasized that meaningful genetics learning requires extended opportunities for guided reasoning, explanation, and iterative feedback (Duncan & Reiser, 2007; Lewis & Kattmann, 2004). Longer lesson periods provide space for teachers to unpack their complex ideas, surface and address misconceptions, and help students to integrate new information with prior knowledge, whereas shorter lessons encourage pacing that prioritizes coverage over consolidation, increasing the likelihood that students acquire surface familiarity without deep understanding.

The Philippine classroom context further strengthens this interpretation. Large class sizes and limited instructional resources already reduce opportunities for individualized support and formative feedback, making educational time an especially scarce resource in public schools (Reyes & Castillo, 2017). Research suggests that differences in learning outcomes are shaped not only by the total time allocated but also by how time is structured and used to support interaction, explanation, and reflection (Stevenson & Stigler, 1992; Lavy, 2015; OECD, 2019a). When lesson periods are shortened under such conditions, teachers may be forced to narrow instructional goals and trim discussion and guided practice to meet curricular pacing requirements. The present results align with studies showing that reduced class time reduces learning gains and limits feedback opportunities (Jez & Wassmer, 2013; Lavy, 2015; López-Agudo & Marcenaro-Gutiérrez, 2020).

These constraints help explain why reduced educational time was associated with lower performance in the present study. The decline in achievement should not be interpreted simply as a function of less exposure to content but as a reflection of reduced opportunities for the instructional processes that support sense-making and conceptual consolidation in science learning. In this sense, educational time functions as a structural condition that enables the depth of processing required for meaningful understanding, reinforcing international evidence that instructional time matters not only in quantity but also in its capacity to sustain the learning processes essential for complex scientific reasoning (OECD, 2016).

Confidence–Performance Calibration by Cohort and Gender

Calibration patterns in this study varied noticeably by both cohort and gender, highlighting the role of educational time in shaping metacognitive accuracy. In the 2023 cohort, both males and females showed a positive link between confidence and performance, with females exhibiting stronger alignment. This suggests that when instructional conditions were favourable to students, particularly females, engaged in more accurate self-monitoring. However, in the 2024 cohort, the confidence–performance link disappeared, reflecting weakened calibration under reduced educational time. This pattern is consistent with the view that time itself functions as a metacognitive resource: when a feedback and reflection are constrained, students have fewer opportunities to compare their judgments with evidence from their own performance, and their confidence judgments become less accurate (Flavell, 1979; Nelson & Narens, 1990; Winne & Azevedo, 2022).

From a metacognitive perspective, confidence–performance calibration develops through iterative cycles of monitoring and control, in which learners evaluate their understanding, receive feedback, and adjust their strategies accordingly (Flavell, 1979; Nelson & Narens, 1990). In longer lessons, these cycles can be repeated: teachers can pose diagnostic questions, provide corrective input, and give students time to reflect on discrepancies between perceived and actual performance. When lessons are shortened, teachers are more likely to prioritize content delivery over formative assessment and reflective questioning, limiting opportunities for such monitoring–control cycles. As a result, students may rely on non-diagnostic cues such as familiarity with terms or perceived ease of instruction when judging confidence, which increases the risk of miscalibration (Nicol & Macfarlane-Dick, 2006; Panadero, 2017).

This mechanism helps explain why students in the shorter-lesson cohort expressed relatively high confidence despite lower test performance. With fewer opportunities to test their understanding, receive feedback, and revise judgments, students may develop an “illusion of understanding” that is not grounded in demonstrated mastery. The inflated confidence observed in 2024 resonates with findings that lower-performing individuals tend to overestimate their ability when opportunities to check and adjust judgments are limited (Kruger & Dunning, 1999; Serra & DeMarree, 2016; Pieschl, 2008). Overall, the results indicate that calibration improves when students experience longer lessons with repeated feedback and reflection, whereas reduced educational time weakens this link for learners, even when they remain confident in their understanding.



Gender Differences in Performance and Confidence Across Cohorts

Gender differences in performance and confidence were evident only in the 2023 cohort, where females significantly outperformed males but reported comparable levels of confidence, suggesting stronger calibration. Similar findings have been reported in physics and biology education, where female students often demonstrate more accurate self-monitoring and higher academic performance (Cotner et al., 2020; Sharma & Bewes, 2011). In contrast, the absence of gender gaps in the 2024 cohort, for both performance and confidence, reflects a uniform miscalibration across genders, likely driven by reduced educational time and fewer opportunities for feedback (Wang et al., 2024; Winne & Azevedo, 2022).

This pattern suggests that time constraints may suppress gender differences by limiting opportunities for the reflective monitoring that allows individual metacognitive strategies to emerge. Previous studies indicate that both socio-cultural and instructional contexts shape gender patterns in metacognition (Eccles, 2007; Reyes et al., 2020). In the longer 2023 lessons, females likely benefited from sufficient feedback and reflection to express their performance advantage without inflating confidence. However, when 2024 lessons were shortened, both genders faced compressed instruction that prioritized content coverage, reducing opportunities for diagnostic feedback and self-evaluation.

Cross-cultural studies support this interpretation. Male often show greater overconfidence in science tasks, particularly when feedback is limited, while females demonstrate more accurate calibration under supportive conditions (Pennycook et al., 2017; Rachmatullah & Ha, 2019). The findings in the 2024 cohort align with the pattern that both genders exhibited high confidence despite low performance, suggesting that time pressure pushed students toward heuristic judgments rather than evidence-based monitoring (Golke et al., 2022). The absence of gender differences in 2024 should not be interpreted as equity. Instead, it reflects a shared reduction in metacognitive support, when feedback and reflection opportunities are curtailed, calibration accuracy declines uniformly, masking underlying differences in monitoring strategies (Daloos & Paderna, 2022; UNESCO, 2023). These results highlight the need for feedback-rich environments that enable gender-responsive metacognitive development in Philippine science classrooms.

Teacher Perceptions of Reduced Educational Time

Teacher perspectives provided valuable context for interpreting the quantitative findings, highlighting how reduced educational time reshaped classroom practice. Most teachers reported that the shift from 60 to 45 minutes of lessons forced them to narrow educational goals, prioritize test-related content, and remove interactive strategies such as group work and peer discussion. These observations are consistent with prior research showing that shorter lessons reduce opportunities for adaptive instruction and limit the quality of engagement opportunities (Cattaneo et al., 2017; Gromada & Shewbridge, 2016).

In the Philippine classroom context, these constraints are particularly salient. Large class sizes and limited instructional resources already restrict opportunities for individualized feedback and guided discussion (Reyes & Castillo, 2017). When lesson time is further reduced, teachers face intensified pressure to prioritize content delivery over formative practices. This instructional trade-off helps explain why reduced educational time in the present study was associated with weaker confidence-performance calibration. Feedback and reflection are central to metacognitive monitoring. Their reduction limits students' access to the performance cues needed to evaluate understanding accurately (Nicol & Macfarlane-Dick, 2006; Panadero, 2017).

These findings have direct implications for the MATATAG curriculum. MATATAG aims to decongest learning competencies while supporting teacher well-being and meaningful learning, yet the initial implementation of a uniform 45-minute period appears to have reduced opportunities for the instructional processes that support metacognitive accuracy in complex subjects such as genetics (DepEd, 2024b; DepEd, 2024d). The subsequent policy adjustment allowing schools to extend lessons to 50, 55, or 60 minutes reflects an acknowledgment of these challenges (DepEd, 2024c). Viewed in the light of the present findings, the flexible time option is not merely a scheduling adjustment but a pedagogical safeguard. In contexts where large classes and workload already limit feedback, adopting longer lesson periods can better protect opportunities for discussion, formative assessment, and reflection. Where shorter periods remain necessary, teacher-reported strategies such as brief confidence checks, exit tickets, and focused peer discussion become critical for preserving feedback loops that support metacognition. Taken together, these findings suggest that decisions about instructional time under MATATAG have consequences not only for content coverage, but also for students' capacity to regulate and accurately evaluate their learning.



Limitations

Although this study provides valuable insights into how reduced educational time affects student performance, confidence, and metacognitive accuracy, several limitations should still be acknowledged. First, the research was conducted with Grade 9 students from a single high school and focused exclusively on genetics. As a result, the findings may not generalize across different grade levels, subject areas, or educational systems. Second, the analysis was limited to two cohorts during consecutive school years. This design captured short-term effects of the curriculum reform but did not examine whether students might adapt to reduced educational time over longer periods. A longitudinal approach could provide a more complete picture of how learning and self-monitoring evolve under sustained policy changes. Third, self-monitoring accuracy was assessed using confidence ratings linked to test performance. While this method effectively reflects calibration, it may not capture the full range of metacognitive processes such as planning, monitoring during study, or strategy use. Incorporating multiple measures of metacognition would provide a more comprehensive perspective.

Finally, teacher perceptions were gathered through self-reported surveys, which can be influenced by recall bias or individual interpretation. Direct classroom observations or additional qualitative methods could enrich the understanding of how reduced educational influences teaching practices and student engagement. Overall, these limitations suggest caution in generalizing the findings, while still emphasizing their importance for understanding how time structures shape science learning and metacognitive development.

Future Research Directions

The findings of this study point to several areas that require further investigation. First, future research should examine the impact of reduced educational time across different science subjects and grade levels. While this study focused on Grade 9 genetics, it is important to know whether similar patterns emerge in physics, chemistry, and earth science. Broadening the scope would clarify whether shortened lessons consistently influence student performance, confidence, and self-monitoring.

Second, longitudinal studies are needed to explore whether students and teachers adapt to shortened lessons over time. The present study only measured immediate effects, leaving unanswered whether extended exposure leads to the development of compensatory strategies that reduce miscalibration and performance gaps.

Third, future work should incorporate additional measures of metacognition beyond confidence ratings. Tools such as reflective journals, structured interviews, or digital learning analytics could offer a more detailed understanding of how students monitor and regulate their learning under time constraints.

Finally, intervention-based studies are necessary to identify practical strategies that help students maintain accurate self-monitoring in shortened lessons. Possible approaches include using reflection prompts, requiring justifications for confidence ratings, or integrating classroom routines that increase feedback opportunities within limited time. Such interventions would provide valuable guidance for teachers and policymakers as they adapt to curriculum changes. Overall, future research should go beyond describing the consequences of reduced educational time and begin testing concrete solutions that protect both learning outcomes and metacognitive accuracy.

Conclusions and Implications

This study shows the impact of reduced educational time on both academic performance and metacognitive accuracy in lower secondary genetics learning. By comparing two cohorts who experienced different lesson lengths, the findings show that shorter lessons not only hindered performance but also weakened the alignment between confidence and performance, a pattern clearly reflected in Table 1 and visualized in the calibration curves in Figure 1. The disappearance of confidence-performance alignment in the 2024 cohort, as shown in Table 2, emphasizes that educational time supports the cognitive and metacognitive processes needed for students to evaluate their learning accurately. This misalignment has important educational consequences, as students who are overconfident, yet underperforming, are less likely to seek feedback, regulate their learning, or correct misconceptions, thereby compounding learning difficulties over time.

Taken together with the teacher perspectives summarized in Table 4, the findings show a coherent picture wherein the shorter lessons limit discussion, feedback, and reflection, which in turn weakens calibration and deep conceptual learning. These patterns illustrate the broader impact of reduced educational time as it alters not only



how much students learn, but also how they monitor, regulate, and sustain their learning in science. By addressing performance, calibrations, gender patterns, and instructional conditions, this study provides a comprehensive picture of the impact of reduced educational time on learning quality in genetics education. In the context of curriculum reforms such as MATATAG, the results suggest that decisions about class time are closely linked not only to academic achievement but also to metacognitive processes that support effective learning. Considering both cognitive and metacognitive dimensions may help inform future efforts to balance efficiency with meaningful learning experiences in science classrooms.

The implications extend to both practice and policy. For teachers, the findings highlight the importance of embedding strategies that promote reflection and feedback even in shorter lessons. Confidence checks, quick peer discussions, exit tickets, and brief reflective pauses can help maintain accuracy in self-monitoring. For curriculum reformers and policymakers, the results caution against reducing educational time without providing complementary support. Reforms must balance content decongestion with opportunities for reflection and feedback to ensure students develop not only knowledge but also metacognitive accuracy. Overall, the study highlights that educational time is not just about covering content. It is also a resource for feedback, reflection, and metacognitive growth. Protecting time for these processes is essential if students are to become both knowledgeable and self-regulated learners.

Declaration of Interest

The authors declare no competing interest.

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