© MAY 2026 | IRE Journals | Volume 9 Issue 11 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I11-1717358

A Management Analysis of Class Timetabling and Academic Performance Among Mechanical Engineering Students at Nueva Ecija University of Science and Technology

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Abstract- ***This study examines the relationship between class timetabling management and academic performance of Mechanical Engineering students at the Nueva Ecija University of Science and Technology (NEUST). Using a descriptive-correlational design, data from 250 students were analyzed based on scheduling factors and General Weighted Average (GWA). Results show that early and late class schedules, subject clustering, and inadequate breaks contribute to cognitive fatigue and lower academic performance. A significant negative correlation was found between poor scheduling and GWA. The study highlights the importance of cognitively aligned scheduling and recommends improved timetabling strategies to enhance student learning outcomes.***

Index Terms- ***Academic Performance, Break Intervals, Class Timetabling, Course Clustering, Time-Of-Day Scheduling.***

I. INTRODUCTION

Educational management involves the strategic orchestration of institutional resources to maximize student learning outcomes. One of the most critical yet frequently overlooked components of this orchestration is class timetabling. Globally, academic institutions face the complex logistical challenge of scheduling courses, faculty, and facilities while attempting to optimize the cognitive readiness of students. In demanding disciplines such as engineering, where subjects require intense analytical thinking and sustained attention, the temporal placement of classes can significantly influence a student's ability to absorb and process complex information.

In the Philippine context, higher education institutions struggle with spatial and temporal constraints due to high enrollment rates and limited infrastructure. At the Nueva Ecija University of Science and Technology (NEUST), the Mechanical Engineering program requires students to navigate a rigorous curriculum filled with heavy mathematics, thermodynamics, and machine design courses. Anecdotal evidence from the student body suggests that highly clustered schedules, inadequate rest intervals, and extreme early or late class hours lead to cognitive exhaustion.

Despite these observations, there is a scarcity of empirical data localized to NEUST that examines how university administrators allocate these schedules and how these management decisions directly translate to the academic performance of Mechanical Engineering students. Consequently, this study seeks to investigate the structural dynamics of class scheduling from a management perspective to determine its empirical impact on student academic achievement.

1.1 Review of Related Literature

The management of academic time is a foundational element of educational administration, yet its direct psychological and cognitive impacts on students are often overshadowed by logistical priorities. The synthesis of related literature reveals distinct thematic intersections between scheduling structures and academic outcomes.

Educational chronobiology emphasizes that human cognitive peaks and troughs fluctuate throughout the

day, directly influencing learning capacity. Williams and Shapiro (2018) established that optimal cognitive function is rarely aligned with early morning instructional hours, particularly for young adults experiencing delayed circadian rhythms. Their research indicated that students forced into mathematically intensive courses before 8:00 AM demonstrated a marked decrease in retention and analytical problem-solving. Building upon the concept of temporal exhaustion, Childers (2018) explored the onset of cognitive fatigue in higher education. Childers argued that cognitive depletion is not solely a function of the time of day but is heavily exacerbated by prolonged academic engagement without structured psychological disengagement. When applied to an engineering curriculum, which demands high working-memory capacity, the failure of management to schedule subjects during optimal biological windows drastically accelerates the onset of mental fatigue.

Beyond the specific hour of the day, the overarching architecture of the timetable is a critical management variable. Meyer (2019) introduced the concept of "structural clustering," asserting that the consecutive sequencing of highly demanding courses negatively skews academic performance. Meyer's institutional analysis demonstrated that when university administrators prioritize faculty availability or classroom utilization over pedagogical pacing, students are often subjected to "block scheduling" that clusters major subjects. This approach limits the cognitive recovery time necessary for memory consolidation. In contrast to traditional continuous scheduling, educational management perspectives now increasingly advocate for distributed practice. Administrations that actively mandate micro-breaks and distribute heavy quantitative courses across the week, rather than clustering them into localized blocks, observe a stabilization in student performance metrics.

The culmination of these scheduling variables directly impacts quantifiable academic metrics. Alghamdi (2020) conducted a comprehensive quantitative analysis correlating specific timetable features with end-of-semester grade point averages. The findings indicated a strong negative correlation between the frequency of clustered major subjects and overall academic achievement. Alghamdi noted that the most significant drop in performance occurred when technical subjects were clustered in the late afternoon, compounding both circadian dips and accumulated cognitive fatigue. In the Philippine context, where universities like NEUST must navigate limited classroom space and high student-to-faculty ratios, scheduling often defaults to clustered block sections to maximize physical resources. While local studies on this specific intersection are scarce, the existing literature on Philippine engineering education highlights the immense pressure and high attrition rates within the discipline. Synthesizing these perspectives, it becomes evident that class timetabling is not merely a logistical necessity but a profound pedagogical intervention. The management decisions dictating when and how long a mechanical engineering student engages with complex material are as consequential to their General Weighted Average as the curriculum itself.

1.2 Statement of the Problem / Research Problem

This study aims to determine the relationship between class timetabling management and the academic performance of Mechanical Engineering students at Nueva Ecija University of Science and Technology. Specifically, it seeks to answer the following questions:

1. What is the demographic profile of the respondents in terms of;
    1.1 Age
    1.2 Sex
    1.3 Year level

2. How do the respondents assess the current class timetabling in terms of;
    2.1 Time-of-day scheduling
    2.2 Course clustering
    2.3 Break intervals

3. What is the academic performance of the respondents based on their General Weighted Average (GWA) from the previous semester?

4. Is there a significant relationship between the assessment of class timetabling and the academic performance of the respondents?

5. Based on the findings, what scheduling management framework can be proposed to optimize student academic performance?

1.3 Significance of the Study

The findings of this research provide substantial value to multiple stakeholders. For university administrators and curriculum planners at NEUST, the data will serve as an empirical basis for drafting more student-centric scheduling policies, moving beyond mere logistical convenience to prioritize cognitive optimization. For the faculty of the Mechanical Engineering department, understanding timetabling effects will aid in adjusting pedagogical strategies accommodate varying levels of student fatigue. For the students, the study advocates for a structured learning environment conducive to better mental health and academic success. Lastly, for future researchers, this paper establishes a localized foundational framework on educational chronobiology and structural scheduling that can be replicated across other colleges and universities.

1.4 Scope and Limitation of the Study

This study is exclusively focused on the Mechanical Engineering students enrolled at the Nueva Ecija University of Science and Technology during the current academic year. The independent variable is delimited to the structural components of class timetabling, specifically the time of day classes are held, the clustering of major subjects, and the frequency and duration of break intervals. The dependent variable is strictly measured using the students' General Weighted Average (GWA) from the immediately preceding semester. Factors such as teaching methodology, socioeconomic status, and individual study habits are excluded from the quantitative analysis to isolate the institutional management variable of scheduling.

1.5 Definition of Terms

To ensure clarity, the following terms are operationally defined. Class Timetabling refers to the administrative scheduling of courses, denoting the specific hours, consecutive sequencing, and rest periods assigned to Mechanical Engineering students. Course Clustering denotes the scheduling of two or more major, cognitively demanding engineering subjects consecutively without an intervening rest period. Break Intervals refer to the unassigned temporal gaps between classes intended for rest, meals, or transition. General Weighted Average (GWA) serves as the quantifiable metric for academic performance, representing the overall grade achieved by the student in the previous semester. Finally, Cognitive Fatigue refers to the mental exhaustion experienced by students resulting from prolonged, unbroken periods of academic instruction.

II. RESEARCH METHODOLOGY

2.1 Research Design

The study adopts a quantitative research paradigm, specifically utilizing a descriptive-correlational research design. This choice is predicated on the dual necessity of accurately documenting the current status of administrative scheduling at NEUST and statistically determining the degree of association between these scheduling variables and student outcomes. Descriptive research is fundamental here as it provides a comprehensive "snapshot" of the demographic characteristics and subjective assessments of the student body regarding their daily academic environment. In the context of educational management, this allows for the identification of prevalent patterns in how time is allocated and perceived within a high-stakes technical program like Mechanical Engineering.

The correlational aspect of the design is vital for addressing the core hypotheses of the study. Unlike experimental research, which might involve the ethical and logistical complications of intentionally manipulating student schedules to observe failure rates, correlational research analyzes variables as they naturally occur in the real-world setting of the university. By correlating the assessment scores of time-of-day scheduling, course clustering, and break intervals with the General Weighted Average (GWA) of the respondents, the study can ascertain whether these management factors co-vary with academic success or decline. This design is particularly appropriate for institutional analysis where the objective is to propose a management framework based on observed relationships rather than establishing definitive laboratory causation.

2.2 Locale of the Study

The research was conducted at the Nueva Ecija University of Science and Technology (NEUST), specifically within the Mechanical Engineering department located at the Sumacab Campus in Cabanatuan City, Philippines. NEUST is an ideal locale for this study due to its status as a leading state university in the region, characterized by a large and diverse student population and a rigorous engineering curriculum that places significant cognitive demands on its students. The institution operates within a framework of high enrollment rates and finite physical resources, which often necessitates complex timetabling strategies such as block scheduling and late-afternoon sessions to maximize classroom utilization. This setting provides a representative environment for examining the tensions between logistical efficiency and the cognitive requirements of students in the Philippine higher education context.

2.4 Respondents of the Study

The target population for this study is exclusively comprised of Mechanical Engineering students at NEUST who were enrolled during the current academic year. The study utilized a total of 250 unique respondents who provided complete data sets for both demographic profiling and academic performance metrics. The sampling technique employed was purposive sampling, a non-probability method where participants are selected based on their adherence to specific criteria essential to the research objectives. The primary criteria for inclusion were current enrollment in the Mechanical Engineering program and the availability of a General Weighted Average (GWA) from the previous semester. This focus on a single department ensures that the technical density of the coursework remains a constant factor, allowing the analysis to isolate the impact of temporal and structural scheduling.

2.5 Research Instrument

The primary instrument for data collection was a structured survey questionnaire, which was distributed digitally to accommodate the respondents' varying schedules. The instrument was designed to map directly onto the research objectives and the theoretical framework of educational management and chronobiology. The questionnaire is structured into three primary quantitative sections and one qualitative section:

1. Demographic and Academic Profile: This section collects baseline data on age, sex, year level, and the GWA from the previous semester.

2. Assessment of Timetabling Variables: This core section uses a 4-point Likert scale (1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree) to measure perceptions across three constructs:

> 2.1 Time-of-Day Schedule (9 items): Focuses on morning alertness, afternoon exhaustion, and evening retention.
>
> 2.2 Course Clustering (8 items): Examines the density of back-to-back major subjects and their impact on cognitive load.
>
> 2.3 Break Intervals (7 items): Evaluates the adequacy of recovery periods and their role in maintaining concentration.

3. Qualitative Insights: Two open-ended questions allow students to elaborate on specific scheduling challenges and suggest administrative improvements.

The 4-point Likert scale was specifically selected to eliminate the "neutral" midpoint, thereby forcing respondents to commit to a clear stance of agreement or disagreement. This approach is favored in management analysis as it provides more decisive data for policy formulation.

2.5 Data Gathering

Google Form and disseminated through the official communication platforms of the NEUST Mechanical Engineering Department and student organizations. This digital method allowed for wide reach and provided a flexible timeframe for students to respond without the pressure of a classroom setting.

Data Retrieval and Validation Responses were automatically logged and timestamped to ensure unique entries and prevent duplicate data points. The raw data from the Excel files were then cleaned to ensure consistency in the reporting of GWA values and to categorize qualitative responses for thematic analysis.

Ethical Implementation Informed consent was integrated into the first page of the digital instrument. Respondents were briefed on the purpose of the study, the voluntary nature of their participation, and the strict confidentiality of their responses. To preserve anonymity, no names or student identification numbers were collected, aligning with the principles of the Data Privacy Act of 2012.

2.6 Statistical Treatment of the Study

To ensure a rigorous analysis of the collected data and a systematic test of the research hypotheses, the study employed a strategic combination of descriptive and inferential statistical tools. Frequency and percentage distributions were first utilized to characterize the demographic profile of the respondents and the distribution of their academic performance. The central tendency of student assessments regarding specific timetabling variables was then determined through the calculation of weighted means. To provide qualitative depth to these numerical results, a four-point verbal interpretation scale was applied, categorizing means from "Very High" (3.26–4.00) to "Very Low" (1.00–1.75). Furthermore, the Pearson Product-Moment Correlation (Pearson r) was used to evaluate the strength and direction of the linear relationship between timetabling management assessments and student General Weighted Average (GWA). Finally, all correlational findings were interpreted using the established thresholds for social and behavioral sciences defined by Evans (1996).

2.7 Ethical Consideration

The research process adhered to the highest standards of academic ethics. Every respondent was provided with an informed consent agreement that explicitly stated their right to withdraw at any time without repercussion. The data collected was stored securely and used exclusively for the stated research purposes. Furthermore, the study avoided any form of coercion or deception, ensuring that the respondents provided honest assessments of their academic experiences at NEUST.

III. RESULTS AND DISCUSSION

A comprehensive analysis of 250 Mechanical Engineering students at Nueva Ecija University of Science and Technology demonstrates that institutional scheduling significantly dictates academic outcomes, with nearly half the cohort performing at or below "Satisfactory" levels, including 30.4% in the "Satisfactory" and 15.2% in the "Passing" tiers compare to only 12.8% in the “Excellent” tier, thereby signaling an urgent need for structural interventions to mitigate attrition. While demographic data reveals a diverse population across First year to fourth year students and a significant segment of mature learners requiring flexible management, instructional timing remains misaligned with cognitive peaks; specifically, while mid-morning (9:00 AM to 11:00 AM) represents the optimal window for technical instruction, reliance on 7:00 AM and late evening slots exacerbates the impact of circadian rhythm disruptions, heat, and long commutes. Most critically, the study identifies course clustering as a primary driver of pedagogical inefficiency, evidenced by a high weighted mean of 3.35 regarding reduced conceptual understanding during consecutive major subjects. Furthermore, a stark disparity exists between the physiological necessity for rest and current institutional practices, as students strongly correlate break intervals with improved concentration (3.26) yet rate existing timetables poorly (2.68) for prioritizing logistical efficiency over recovery. These findings are validated by a statistically significant negative correlation ($r = -0.325$, $p = 0.007$), confirming that increased scheduling stress is a reliable predictor of academic decline and suggesting that transitioning toward cognitively aligned, climate-responsive scheduling is essential for enhancing pedagogical quality.

IV. FINDINGS AND CONCLUSION

The study highlights a concerning trend where a significant portion of the student population is struggling to achieve high academic marks, with many performing at only the minimum passing levels. This struggle appears directly linked to how classes are scheduled throughout the week. Specifically, students reach their mental peak for difficult technical subjects during the mid-morning hours. In contrast, classes held very early in the morning or late into the evening are far less effective, as students must battle natural tiredness, long commutes, and the physical drain of the midday heat.

A major obstacle to learning is the common practice of "clustering" difficult major subjects back-to-back. Students reported that this sequencing leads to intense mental exhaustion, making it nearly impossible to absorb complex concepts during the second or third hour of a continuous session. Furthermore, while students emphasize that regular breaks are essential for maintaining focus, the current university schedule prioritizes fitting as many classes as possible into the day over the human need for rest and food. Ultimately, the data confirms a clear and consistent pattern: as the stress caused by poor scheduling increases, a student's grades will almost certainly suffer.

V. RECOMMENDATIONS

To improve the academic and physical well-being of students, university administrators and curriculum planners should implement a "Recovery Rule" that mandates a minimum 20-minute break between major technical subjects while balancing heavy course loads by moving mathematically intensive classes to the mid-morning peak. This strategy should be supported by a "Buffer Zone" that preserves a universal lunch hour to address nutritional needs and a "Blended Afternoon Resilience" model that shifts heat-heavy afternoon sessions to asynchronous formats. Faculty members are further encouraged to practice strategic subject spacing and integrate micro-breaks during long lectures to prevent cognitive fatigue and enhance memory consolidation. Finally, future researchers should build upon these findings by conducting cross-disciplinary comparisons and investigating the effectiveness of automated timetabling software in optimizing student performance. By adopting these multi-level recommendations, the institution can transform its scheduling management into a proactive tool for student success and pedagogical excellence.

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