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Understanding the Challenges and Factors Contributing to Learning Pace Differences in Mathematics Among Grade Seven Students at Osmeña Colleges

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Abstract

This study investigated the factors affecting mathematics learning pace among Grade 7 students at Osmeña Colleges Junior High School during the academic year 2023–2024. Anchored on Cognitive Load Theory, Vygotsky's Zone of Proximal Development, and Self-Determination Theory, the study examined the demographic, psychological, instructional, and environmental influences contributing to differences in students' mathematics learning progression. A descriptive quantitative research design was employed using a structured survey questionnaire composed of closed-ended items. The respondents consisted of 28 Grade 7 students selected through purposive and random sampling procedures from a population of 30 learners. Data were analyzed using percentage distribution and weighted mean. The findings revealed that most respondents were early adolescents, with the majority aged 13 years old. Students encountered difficulties related to distractions during class, solving word problems, understanding lessons delivered too quickly, and keeping pace with classroom instruction. Emotional and motivational factors such as mathematics anxiety, low self-confidence, and fear of failure also affected learning pace, although many students remained motivated to improve their mathematics skills. Instructional strategies involving visual aids, guided problem-solving, and teacher feedback positively supported learning, while interactive and student-centered approaches were only moderately utilized. Environmental factors such as availability of study spaces, access to learning materials, family encouragement, and household responsibilities likewise influenced students' learning experiences. Respondents identified one-on-one tutoring, flexible assessment time, and technology-supported learning interventions as beneficial strategies for improving mathematics performance. The study concluded that mathematics learning pace is shaped by interconnected demographic, psychological, instructional, and environmental factors. It recommended the implementation of differentiated and scaffolded instruction, problem-based and collaborative learning approaches, social-emotional support, strengthened home–school partnerships, and Multi-Tiered System of Supports (MTSS) interventions to address diverse learner needs and promote equitable mathematics learning opportunities. The study supports Sustainable Development Goal (SDG) 4: Quality Education by promoting inclusive and learner-centered instructional practices, as well as SDG 10: Reduced Inequalities through equitable educational support for students with varying learning abilities. The findings contribute to educational sustainability by encouraging adaptive teaching practices, improved student well-being, and inclusive learning environments that strengthen long-term academic development and institutional effectiveness.

Keywords: Anxiety, Differentiated Instruction, Environmental Factors, Instructional Strategies, Mathematics Learning Pace, Motivation, Psychological Factors, Scaffolded Learning, Student Performance, Teaching Interventions

1. Introduction

Mathematics plays a crucial role in developing logical reasoning, analytical thinking, and problem-solving skills. Despite its importance, mathematics remains one of the most difficult subjects for many junior high school learners (Mazana, Montero, & Olifage, 2019). In the Philippines, disparities in mathematics learning outcomes continue despite educational reforms such as the K to 12 Curriculum and the MATATAG agenda (DepEd, 2023). Variations in students' learning pace are influenced by cognitive, psychological, instructional, and environmental factors, which affect their ability to comprehend and retain mathematical concepts. At Osmeña Colleges, differences in mathematics learning pace among Grade 7 students have become increasingly evident. Some learners demonstrate rapid comprehension of mathematical concepts, while others struggle with basic operations and problem-solving tasks. These variations highlight the need to examine the factors affecting students' learning progression in mathematics. This study investigates demographic, psychological, instructional, and environmental influences on mathematics learning pace among Grade 7 students at Osmeña Colleges Junior High School during the academic year 2023–2024. The findings are expected to support the development of adaptive, equitable, and learner-centered instructional strategies.

1.1 Background of Mathematics Learning Pace Among Grade 7 Students at Osmeña Colleges

Mathematics is universally recognized as a foundational subject that develops reasoning and analytical skills essential for academic and lifelong learning. However, mathematics learning remains challenging for many students, especially during early adolescence when abstract thinking skills are still developing (Leung, 2014). Differences in learning pace are influenced by several factors, including cognitive abilities, emotional well-being, socio-economic status, instructional strategies, age, and gender (Alonzo & Kim, 2016; Montayre et al., 2020). Vygotsky's (1978) Zone of Proximal Development explains that students learn best when concepts are aligned with their developmental readiness and supported by appropriate guidance. Studies further show that attitudes toward mathematics, motivation, parental support, and access to learning resources significantly affect students' academic progress (Mazana et al., 2019; Saeed & Zyngier, 2012). At Osmeña Colleges, teacher observations and assessments indicate noticeable differences in the mathematics learning pace of Grade 7 students. While some learners can independently solve complex arithmetic and algebraic problems, others require extensive guidance even with fundamental concepts. These disparities suggest the influence of multiple interrelated factors rather than differences in intelligence alone. Understanding these factors is necessary to support differentiated instruction, improve classroom management, and design targeted interventions for learners experiencing difficulty in mathematics.

1.2 Themes and Insights on Factors Affecting Mathematics Learning Pace of Grade 7 Students

Related literature emphasizes that effective mathematics instruction involves clear goals, reasoning, diverse representations, and support for productive struggle (NCTM, 2014). The increasing global demand for STEM-related competencies further highlights the importance of strong mathematics foundations (Grand Canyon University, 2018). Foreign studies identified several variables affecting mathematics learning pace. Zelenka et al. (2024) examined learning progress and identified factors influencing how students grasp mathematical concepts. Ozdemir and Yildiz (2021) found significant relationships between learning speed, motivation, and mathematics achievement. Almutairi (2023) emphasized the combined effects of student, teacher, and curriculum factors on mathematics performance, while Jaworski (n.d.) and Rully Charites (2021) highlighted the importance of supportive learning environments and contextualized instruction. Studies also emphasize psychological and motivational factors. Mazana et al. (2019) observed that negative attitudes toward mathematics affect learning progression, while Ma et al. (2020) identified self-efficacy and mathematics anxiety as major influences on achievement. Van Der Veen et al. (2022) highlighted cognitive and motivational variables as predictors of mathematics performance. Shahrill (2014) further noted that teacher beliefs, instructional behavior, and teacher effectiveness influence students' pacing and learning outcomes. Local studies similarly stress the importance of differentiated and learner-centered instruction. Villaluz et al. (2023) discussed challenges in Philippine mathematics education and the need for interventions. Marasigan and Abulon (2023) developed self-paced learning modules for Junior High School mathematics, while Manalo et al. (2023) examined how learning styles contribute to academic differences. De Vera et al. (2024) demonstrated the effectiveness of differentiated instruction in improving student performance. Studies by Nacion and Agbayani (2023), Beleno et al. (2023), Cardiño et al. (2020), and Magayon et al. (2016) further emphasized that instructional strategies, learning styles, and student challenges significantly influence mathematics learning pace and achievement.

1.3 Local, National, and Global Context of Mathematics Learning Pace Variations

Globally, concerns regarding disparities in mathematics achievement continue to grow due to their impact on educational and workforce readiness. STEM industries increasingly require strong quantitative and analytical competencies, making mathematics education essential for economic development and innovation (Grand Canyon University, 2018). Nationally, the Philippine educational system continues implementing reforms such as the K to 12 Curriculum and the MATATAG agenda to strengthen mathematics instruction (DepEd, 2023). Despite these reforms, variations in students' mathematics performance persist due to socio-economic conditions, instructional challenges, and unequal access to educational resources. Local studies indicate declining student interest in mathematics caused by traditional teaching methods and external factors affecting learning engagement (Villaluz et al., 2023). Within Masbate City and Osmeña Colleges, Grade 7 students exhibit varying mathematics learning paces influenced by demographic, psychological, instructional, and environmental conditions. The institution reflects broader educational realities in the Philippines, where students possess diverse academic preparedness, learning styles, and socio-economic backgrounds. These local conditions underscore the need for responsive instructional practices and targeted support systems to ensure equitable mathematics education.

1.4 Theoretical and Conceptual Basis of Mathematics Learning Pace Differences Among Grade 7 Students

This study is anchored on the Cognitive Load Theory, Zone of Proximal Development, and Self-Determination Theory. Cognitive Load Theory by Sweller (1988) explains that learning becomes inefficient when instructional materials exceed students' working memory capacity. In mathematics, excessive cognitive load may hinder comprehension and slow learning pace. The theory supports the need for organized and cognitively efficient instructional strategies. Vygotsky's Zone of Proximal Development (1978) emphasizes that students learn effectively when provided with appropriate scaffolding and guidance. Learning pace differences may therefore result from variations in instructional support, peer collaboration, and developmental readiness. Self-Determination Theory by Deci & Ryan (1985) highlights the importance of autonomy, competence, and relatedness in sustaining student motivation and engagement. Students with positive emotional well-being and confidence are more likely to persist in mathematics learning, while anxiety and low self-confidence may hinder progress. The study also adopts the Input–Process–Output framework. The inputs include demographic factors, home environment, teaching strategies, and motivational influences. The process involves data gathering through surveys, rating scales, interviews, observation, and data analysis. The output focuses on identifying factors affecting mathematics learning pace and proposing adaptive and equitable instructional interventions for Grade 7 students at Osmeña Colleges.

1.5 Research Gaps and Rationale on Mathematics Learning Pace Among Grade 7 Students at Osmeña Colleges

Although numerous studies have examined mathematics achievement and instructional strategies in the Philippines (Ballado-Tan, 2014; Villanueva & Llego, 2020), limited research specifically focuses on differences in mathematics learning pace among junior high school students. Existing studies commonly emphasize academic performance, teaching strategies, or learning outcomes separately, with less attention given to the interaction of demographic, psychological, instructional, and environmental factors affecting learning progression (Anderson & Baker, 2020; Topping, 2005). Furthermore, few studies have examined mathematics learning pace within the localized context of a single institution such as Osmeña Colleges. This study addresses this gap by investigating the factors influencing mathematics learning pace among Grade 7 students using a quantitative descriptive approach. The findings are intended to support evidence-based instructional interventions and improve equitable mathematics learning opportunities.

1.6 Alignment of the Study on Mathematics Learning Pace with Relevant Sustainable Development Goals (SDGs)

This study aligns with several Sustainable Development Goals (SDGs), particularly SDG 4 – Quality Education and SDG 8 – Decent Work and Economic Growth. SDG 4 is reflected in the study's focus on inclusive, equitable, and learner-centered mathematics instruction. The research supports educational quality by identifying factors affecting learning pace and proposing differentiated instructional strategies that address diverse learner needs. UNESCO (2016) emphasized that tailored teaching based on learners' readiness is essential to quality education. The study also contributes to SDG 8 because mathematics competence is closely associated with STEM readiness, workforce development, and economic productivity. Improving mathematics learning outcomes supports the development of analytical and problem-solving skills necessary for future employment and innovation. Additionally, the study relates to SDG 10 – Reduced Inequalities by promoting equitable educational opportunities for students with varying learning abilities and socio-economic backgrounds.

1.7 Importance of the Study on Mathematics Learning Pace to Multidisciplinary Sustainability

This study contributes to educational sustainability by promoting adaptive and differentiated instructional practices that support diverse learners. By identifying factors affecting mathematics learning pace, the study encourages more inclusive and equitable classroom environments that improve long-term educational outcomes. The research also supports socio-economic sustainability because mathematics proficiency is linked to future academic achievement, employability, and participation in STEM-related careers. Enhancing mathematics instruction may help learners acquire competencies necessary for economic productivity and lifelong learning. In terms of psychological and community sustainability, the study addresses emotional well-being, mathematics anxiety, motivation, and parental support. These factors influence students' engagement and resilience in learning. The findings may guide teachers, administrators, guidance counselors, parents, and policymakers in developing collaborative support systems that strengthen mathematics education and student well-being. Institutionally, the study provides evidence-based recommendations that may improve curriculum planning, teacher training, and intervention programs at Osmeña Colleges and other educational institutions.

2. Material and methods

2.1 Research Design

This study utilized a descriptive quantitative research design to investigate the challenges and factors contributing to differences in mathematics learning pace among Grade 7 students at Osmeña Colleges. The study employed a structured survey method to describe learners' experiences, psychological influences, instructional strategies, and home-related factors affecting mathematics learning. According to Fraenkel and Wallen (2000), descriptive research systematically and factually represents existing conditions without manipulating variables. This design was considered appropriate because it enabled the researchers to examine the current status of students' learning experiences and identify factors influencing their mathematics learning pace.

2.2 Locale of the Study

The study was conducted at Osmeña Colleges, specifically within the Junior High School Department in Masbate City, during the academic year 2023–2024. The institution was selected because of the observed variations in mathematics learning pace among Grade 7 students. The setting provided an appropriate environment for examining the demographic, instructional, psychological, and environmental factors affecting students' mathematics learning experiences.

2.3 Respondents of the Study

The respondents of the study consisted of Grade 7 students enrolled in the Junior High School Department of Osmeña Colleges during the academic year 2023–2024. These students represented learners who commonly exhibit varying levels of understanding, cognitive readiness, and pace in acquiring mathematical concepts and skills. Their responses provided relevant insights into the factors influencing mathematics learning pace within the same academic institution and curriculum structure.

2.4 Sample and Sampling Procedure

The study employed purposive sampling because it focused on Grade 7 students currently enrolled in mathematics classes at Osmeña Colleges. The total population consisted of 30 students. Using Slovin's formula with a 5% margin of error, 28 students were selected as participants, resulting in a 93.3% response rate. Random sampling was also applied to provide equal opportunity for all students to be selected regardless of section, academic performance, or background. This procedure minimized sampling bias and enhanced the validity and representativeness of the study.

2.5 Research Instrument

The primary research instrument used in this study was a survey questionnaire composed of closed-ended items designed to assess students' perceptions regarding factors affecting their mathematics learning pace. The questionnaire was divided into sections corresponding to the study's specific problems. These sections included demographic profile, perceived learning challenges, psychological and emotional factors, instructional strategies used by teachers, and environmental or home-related influences on learning mathematics. The instrument was designed to gather quantitative data necessary for analyzing the factors contributing to differences in students' learning pace.

2.6 Data Gathering Procedure

The study followed a systematic and chronological procedure to ensure academic rigor, ethical compliance, and reliable data collection. The process began with the formulation and refinement of the research title, objectives, and statement of the problem in consultation with the thesis adviser. After the preliminary review of the title, survey questionnaire, and theoretical framework, the researchers proceeded to the proposal defense, where recommendations from the research panel were incorporated to improve the study. Upon approval, formal requests and informed consent forms were submitted to school authorities. Ethical considerations such as confidentiality, voluntary participation, and protection of minors were strictly observed throughout the study. The survey questionnaires were distributed to the 28 selected Grade 7 students during the data collection period, which lasted for one week. During this period, the researchers monitored survey completion, addressed respondent concerns, and checked the completeness of the responses. After collecting the questionnaires, the responses were encoded into spreadsheets and verified to minimize data entry errors and ensure consistency. The researchers then conducted statistical analyses to interpret the gathered data. Finally, the complete study, including findings and conclusions, was presented during the oral defense for evaluation and refinement by the research panel.

2.7 Data Analysis Techniques

The study used percentage distribution and weighted mean to analyze the collected data. Percentage distribution was applied to describe the demographic profile of the respondents, particularly in terms of age and gender. This statistical measure determined the frequency and proportion of responses within the study population. The weighted mean was used to interpret the respondents' levels of agreement regarding mathematical challenges, psychological factors, instructional strategies, and environmental influences affecting mathematics learning pace. Responses were interpreted using a 5-point Likert scale to identify trends and determine the most significant factors influencing students' mathematics learning pace.

3. Results and Discussion

3.1 Factors Affecting Mathematics Learning Pace Among Grade 7 Students

3.1.1 Age and Gender Distribution of the Respondents

The findings revealed that most respondents were 13 years old, comprising 71.43% of the total participants, with a larger proportion of females than males. Respondents aged 11–12 years old and 14 years old each represented 14.29% of the population, while no respondents were aged 15 and above. The results indicate that the majority of the participants belong to the early adolescent stage. The findings suggest that the respondents are at a developmental stage where learning habits, motivation, and academic interests are actively forming. This implies that instructional approaches should focus on engagement, self-regulated learning, and conceptual understanding. Interactive and age-appropriate learning experiences may help improve students' critical thinking and mathematics performance during this formative period.

3.1.2 Challenges Encountered in Learning Mathematics

The results showed that the most common challenge experienced by students was being easily distracted during mathematics class, followed by difficulty solving word problems and difficulty understanding lessons when teachers explained too quickly. Other notable challenges included difficulty understanding math problems even after discussion, insufficient examples and practice exercises, and struggles in keeping up with lesson pacing. Students also reported limited one-on-one support, difficult activities, and absenteeism affecting mathematics understanding. These findings indicate that attention, instructional pacing, comprehension, and practice opportunities significantly affect students' mathematics learning pace. Krikorian & Margolin (2020) study emphasized that attentional difficulties negatively influence mathematical performance, while Vilenius-Tuohimaa et al. (2008) highlighted the cognitive demands of solving word problems. Sweller's (2011) Cognitive Load Theory further explains that rapid delivery of information can overload working memory and hinder comprehension. The findings also support Rosenshine's (2012) Principles of Instruction, which stress the importance of guided practice and repeated exposure to learning tasks. Differentiated instruction and engagement-focused strategies (Tomlinson, 2014) may therefore help address diverse learner needs.

3.1.3 Emotional and Motivational Factors Affecting Mathematics Learning

The findings revealed that students remained motivated to improve their mathematics skills despite difficulties. Students also reported feeling proud when solving difficult math problems and enjoying mathematics when they understood the topic. However, several respondents expressed lack of confidence in solving problems independently, anxiety during tests, worry about learning slower than peers, discouragement after failure, and nervousness when solving problems in front of the class. These findings demonstrate that emotional and motivational factors significantly influence mathematics learning pace. Deci & Ryan (2000) explained that intrinsic motivation strengthens perseverance in challenging academic tasks, while Pekrun (2006) emphasized the importance of positive academic emotions in sustaining engagement. Bandura's (1997) self-efficacy theory also supports the relationship between confidence and academic achievement. Meanwhile, comparative anxiety and mathematics anxiety negatively affect students' academic self-concept and performance (Marsh & Craven, 2006; Ashcraft & Kirk, 2001). The findings highlight the importance of integrating emotional support, positive reinforcement, and growth mindset strategies into mathematics instruction (Boekaerts, 2010).

3.2 Instructional Approaches Used by Mathematics Teachers

3.2.1 Use of Visual and Guided Instructional Strategies

The results showed that the most frequently observed instructional strategy was the use of visual aids such as diagrams and drawings. Students also reported regularly solving problems on the board with teacher guidance and receiving clear feedback regarding mathematics performance. Teachers were likewise perceived to provide additional learning materials and opportunities for independent work. These findings suggest that teachers moderately apply scaffolding, formative feedback, and visual supports in mathematics instruction. Mayer (2005) emphasized that visual instruction enhances meaningful learning by reducing cognitive load, while Vygotsky's (1978) Zone of Proximal Development supports guided learning practices. Black & Wiliam (2009) further explained that constructive feedback improves learning outcomes and self-improvement. The findings indicate that structured instructional support contributes positively to mathematics comprehension and learning pace.

3.2.2 Interactive and Student-Centered Learning Practices

The results further revealed that teachers moderately used games, interactive methods, peer-assisted learning, adaptive pacing, and group activities during mathematics instruction. Although these approaches were present, they received lower ratings compared to visual aids and guided problem-solving strategies. The findings imply that while teachers employ varied instructional methods, opportunities remain to strengthen collaborative and student-centered learning approaches. Gee (2005) noted that gamified learning improves student motivation and engagement, while Bransford et al. (2000) emphasized the value of interactive learning environments in promoting deeper understanding. The results suggest that enhancing adaptive pacing, peer collaboration, and differentiated instruction may further support diverse mathematics learning needs.

3.3 Environmental and Home Factors Affecting Mathematics Learning

3.3.1 Availability of Learning Resources and Study Environment

The findings showed that students generally had access to quiet study spaces and mathematics learning materials at home. Many respondents also attended tutorials or review sessions outside school and reported encouragement from family members regarding mathematics learning. Moderate levels of regular home study habits and internet access for online learning were likewise observed. These findings suggest that environmental support moderately contributes to students' mathematics learning pace. Evans and Maxwell (1997) emphasized the importance of quiet and organized study environments for concentration and cognitive processing. Mullis et al. (2016) also found that access to educational resources positively affects mathematical proficiency, while Slavin (2013) highlighted the value of external academic reinforcement in bridging achievement gaps. Family encouragement further supports student motivation and persistence (Fan and Williams, 2010).

3.3.2 Family Support and Household Responsibilities

The results indicated that students received limited direct assistance from parents when encountering difficulties in mathematics. Some respondents also experienced household responsibilities that interfered with study time, while family-supported homework completion and assistance from siblings or relatives were only moderately observed. These findings reveal the dual influence of home environments on mathematics learning. Topping (2005) suggested that peer-supported learning within families can improve understanding and collaboration, while Sirin (2005) emphasized the impact of socioeconomic and household conditions on academic achievement. Desforges and Abouchaar (2003) further noted the importance of school-led interventions in supplementing limited parental instructional support. Strengthening school-home partnerships may therefore help minimize environmental barriers affecting mathematics learning pace.

3.4 Interventions Supporting Mathematics Learning Pace

3.4.1 Personalized and Flexible Learning Interventions

The findings revealed that students considered one-on-one tutoring as the most beneficial intervention for improving mathematics performance. Respondents also believed that additional time during examinations could improve performance, while games, digital learning tools, and real-life examples in lessons were viewed as moderately helpful. These findings indicate that students value personalized, flexible, and engaging learning interventions. Bloom (1984) emphasized that individualized instruction enhances learning outcomes by addressing students' specific needs and misconceptions. Lovett (2010) also explained that extended testing time reduces anxiety and improves fairness for learners with difficulties. Papastergiou (2009) highlighted the motivational benefits of gamified learning, while Means et al. (2010) noted the effectiveness of blended learning approaches integrating digital tools. The findings support the use of differentiated instruction and responsive learning environments to strengthen mathematics learning pace and promote inclusivity among learners (Tomlinson, 2014).

4. Conclusion & Recommendations

The study concluded that differences in mathematics learning pace among Grade 7 students at Osmeña Colleges are influenced by demographic, psychological, instructional, and environmental factors. Most respondents belonged to the early adolescent stage, where learning habits and academic behaviors are still developing. Students experienced difficulties in problem-solving, comprehension, instructional pacing, and retention, while emotional factors such as math anxiety, low confidence, and limited motivation also affected their learning progress. Instructional practices involving visual aids, guided activities, and feedback positively supported learning, although more differentiated and student-centered approaches remain necessary. Environmental conditions, including limited parental involvement and household responsibilities, also influenced study habits and learning consistency. The findings further revealed that students preferred individualized, interactive, and technology-supported interventions that could better accommodate diverse learning needs and improve mathematics performance.

The study recommends the implementation of differentiated and scaffolded instructional approaches that address variations in students' developmental readiness and cognitive abilities. Mathematics teachers are encouraged to use problem-based learning, contextualized activities, collaborative learning methods, and gamified strategies to strengthen comprehension, engagement, and critical thinking. Schools should also integrate social-emotional learning approaches to reduce mathematics anxiety and improve students' confidence and motivation. Strengthening home–school partnerships through consistent parent involvement and communication programs is likewise recommended to support students' learning progress. Furthermore, the development of a Multi-Tiered System of Supports (MTSS), including tutoring, flexible assessment, and technology-enhanced learning, may provide more personalized interventions for slow-paced learners and promote equitable mathematics learning opportunities.

The study was limited to Grade 7 students enrolled at Osmeña Colleges Junior High School during the academic year 2023–2024 and focused only on factors directly related to mathematics learning pace. The research utilized a descriptive quantitative design with a structured survey questionnaire, limiting the findings to the respondents' perceptions and experiences. Other variables such as peer influence, performance in other academic subjects, and policy-related factors were excluded from the investigation. The relatively small sample size and focus on a single institution may also limit the generalizability of the findings to other educational settings.

Compliance with ethical standards

The study followed a systematic procedure to ensure academic rigor, ethical compliance, and reliable data collection. Formal requests and informed consent forms were submitted to school authorities prior to data gathering. Ethical considerations such as confidentiality, voluntary participation, and protection of minors were strictly observed throughout the conduct of the study.

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