

Understanding Numerical Intuition: An Analysis of Junior High School Students' Innate Mathematical Abilities and Number Sense Competencies

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Abstract

This systematic literature review examines the intricate dynamics of numerical intuition and number sense competencies among junior high school students. Through an analysis of key themes, including the cognitive development of numerical intuition, the influence of educational practices, socio-cultural factors and individual differences, as well as the challenges and opportunities for enhancing students' mathematical cognition, this study highlights the critical role of tailored educational interventions in fostering students' conceptual understanding of numerical concepts and promoting a positive learning environment. The findings underscore the significance of interactive and adaptive instructional strategies in facilitating students' engagement with mathematics and deepening their comprehension of numerical relationships. Moreover, the study emphasizes the importance of acknowledging and addressing the impact of socio-cultural factors and individual differences on students' mathematical learning experiences, advocating for inclusive educational practices that cater to diverse learning styles and foster an

equitable learning environment. This study calls for a comprehensive approach to mathematical education in junior high schools, emphasizing the need for holistic educational interventions that nurture students' numerical intuition and prepare them for future academic success.

Keywords: numerical intuition, number sense, junior high school students, cognitive development, educational practices

Introduction

Numerical intuition, often regarded as an inherent cognitive skill, plays a crucial role in the development of mathematical reasoning and problem-solving abilities (Hawes & Ansari, 2020). Research in cognitive psychology and education has highlighted the significance of number sense in shaping students' mathematical proficiency, conceptual understanding, and overall academic achievement (Nelwan, et al., 2022). Consequently, investigating the extent and nature of numerical intuition in junior high school students has emerged as a central focus in contemporary educational research.

Recent studies have emphasized the importance of nurturing and harnessing students' intuitive grasp of numbers and mathematical concepts during their formative years (Payadnya, et al., 2023). The exploration of numerical intuition in the context of junior high school education becomes particularly pertinent as it is a critical period when students transition from elementary to more complex mathematical concepts. Understanding the underlying cognitive processes and innate mathematical abilities of students at this juncture is essential for designing effective instructional strategies and interventions that can enhance their mathematical learning experiences.

This research aims to delve into the nature of numerical intuition and number sense competencies in junior high school students, with a focus on exploring the factors influencing the development of these skills. By analyzing students' inherent mathematical abilities and their understanding of numerical concepts, this study seeks to contribute to the existing literature on the cognitive mechanisms underlying mathematical learning in adolescence. Additionally, this research intends to provide insights into the potential implications for curriculum development and instructional practices that can better cater to the diverse learning needs of junior high school students in the realm of mathematics.

Through a comprehensive investigation of students' numerical intuition and number sense, this study aspires to illuminate the significance of fostering a solid foundation in mathematical reasoning and problem-solving skills during the critical years of junior high school education. By shedding light on the underlying cognitive processes and competencies that contribute to students' mathematical development, this research endeavors to pave the way for more effective pedagogical approaches that can support and enhance students' mathematical learning experiences during this crucial phase of their academic journey.

Literature Review

Numerical intuition, an integral aspect of mathematical cognition, has garnered significant attention in the educational psychology literature due to its profound impact on students' mathematical learning and problem-solving abilities. The literature review on numerical intuition and number sense competencies among junior high school students provides valuable insights into the underlying cognitive processes, developmental trajectories, and educational implications of these crucial skills.

Conceptualizing Numerical Intuition

The conceptual framework of numerical intuition involves the innate ability to comprehend numerical quantities, recognize patterns, and apply mathematical reasoning in various contexts. According to Thompson, et al. (2023), numerical intuition encompasses a multifaceted understanding of numbers, numerical relationships, and operations, which allows individuals to develop a deeper conceptual understanding of mathematical principles. This intuitive grasp of numerical concepts serves as a foundation for more advanced mathematical reasoning and problem-solving skills in later academic stages (Kilag, et al., 2023).

Studies have highlighted the developmental trajectory of number sense during adolescence, emphasizing the importance of early exposure to meaningful and contextualized mathematical experiences (Nketia, et al., 2021). During the junior high school years, students undergo significant cognitive and neurological changes, which influence their cognitive processing of numerical information. Guhn, et al. (2020) suggest that the enhancement of number sense competencies during this critical period is closely linked to students' overall academic achievement and readiness for more complex mathematical concepts in high school and beyond.

Factors Influencing Numerical Intuition

Various factors contribute to the development of numerical intuition and number sense competencies in junior high school students. Pan, et al. (2022) emphasize the role of instructional strategies, curriculum design, and educational interventions in fostering students' intuitive understanding of numbers and mathematical operations. Additionally, the socio-cultural context and individual differences in cognitive processing styles significantly influence students' acquisition of numerical intuition (Ho and Kozhevnikov, 2023). These factors highlight the need for tailored educational approaches that accommodate diverse learning styles and promote the holistic development of students' mathematical abilities.

The implications of understanding numerical intuition and number sense competencies in junior high school students are far-reaching in terms of educational practices and curriculum development. Abdul-Karim, et al. (2023) suggest that incorporating interactive and hands-on learning activities, such as manipulatives and real-world problem-solving tasks, can enhance students' conceptual understanding of mathematical concepts and foster their numerical intuition. Furthermore, the integration of technology-based learning tools and adaptive instructional approaches can facilitate personalized learning experiences that cater to students' individual learning needs and promote the development of robust number sense competencies (Alda, et al., 2020).

While the existing literature underscores the significance of nurturing numerical intuition and number sense competencies among junior high school students, several challenges and areas for further research remain. One critical challenge involves addressing the potential barriers to fostering students' numerical intuition, such as math anxiety, negative attitudes towards mathematics, and insufficient teacher training in implementing effective instructional practices (Anero & Tamayo, 2023). Future research endeavors should focus on designing comprehensive intervention programs that target these challenges and promote a positive learning environment conducive to the development of students' mathematical abilities and numerical intuition (Kilag, et al., 2023).

The literature review underscores the pivotal role of numerical intuition and number sense competencies in shaping students' mathematical learning experiences during the crucial phase of junior high school education. By elucidating the conceptual underpinnings, developmental trajectories, and educational implications of these innate mathematical abilities, the literature highlights the significance of implementing tailored instructional practices and interventions that foster a deeper understanding of numerical concepts and promote the holistic development of students' mathematical reasoning and problem-solving skills.

Methodology

A systematic literature review was conducted to investigate the nature of numerical intuition and number sense competencies among junior high school students. The review process followed a predefined protocol to ensure a comprehensive and unbiased examination of relevant scholarly articles and empirical studies. The methodology encompassed the following key steps:

A comprehensive search strategy was developed to identify pertinent scholarly articles and research studies from reputable academic databases, including Google Scholar, JSTOR, PubMed, and PsycINFO. The search strategy encompassed a combination of keywords and controlled vocabulary terms, such as "numerical intuition," "number sense," "adolescents," and "junior high school students," to ensure the inclusion of relevant studies in the field of mathematical cognition and education.

In accordance with the predefined research question, specific inclusion and exclusion criteria were established to ensure the selection of high-quality and pertinent literature. The inclusion criteria encompassed studies published in peer-reviewed journals, empirical research papers, and scholarly articles that focused on numerical intuition, number sense competencies, and mathematical cognition among junior high school students. Studies with a clear focus on the cognitive processes and developmental aspects of numerical intuition were prioritized. Conversely, literature that did not align with the research question or lacked empirical evidence was excluded from the review.

The selected studies were critically evaluated, and relevant data were systematically extracted to identify key themes, theoretical frameworks, and empirical findings related to the nature of numerical intuition and number sense competencies in junior high school students. The synthesized data were organized and analyzed using thematic analysis and qualitative synthesis

techniques to identify recurring patterns, trends, and significant insights pertaining to students' innate mathematical abilities and their understanding of numerical concepts.

The quality and rigor of the included studies were assessed using established criteria, including the validity of research methods, reliability of findings, and the coherence of theoretical frameworks. Studies that met the predefined quality standards were accorded higher significance in the analysis, while studies with methodological limitations were critically appraised to ensure the integrity of the review process.

Findings and Discussion

Theme 1: Cognitive Development of Numerical Intuition

The systematic literature review on the cognitive development of numerical intuition among junior high school students has unveiled the pivotal role played by both inherent cognitive processes and educational experiences in shaping students' mathematical cognition. Notably, the findings emphasized the significant evolution of students' intuitive grasp of numerical concepts during this developmental phase, enabling them to discern complex numerical patterns, establish interconnections within mathematical concepts, and apply sophisticated reasoning strategies across diverse problem-solving contexts. This enhancement in their numerical intuition lays a critical foundation for fostering a deeper conceptual understanding of fundamental mathematical principles and nurturing a more comprehensive mathematical competence (Bhatia, 2021).

Furthermore, the reviewed studies indicated that the progression of students' cognitive development in numerical intuition is not solely reliant on innate abilities but is significantly influenced by the quality and relevance of the educational experiences provided. Effective pedagogical practices that encourage active engagement, critical thinking, and meaningful application of mathematical concepts have been found to be instrumental in fostering the refinement of students' numerical intuition (Kilag, et al., 2023). Studies have highlighted the importance of incorporating interactive learning activities, such as real-world problem-solving tasks and hands-on manipulative exercises, to stimulate students' cognitive development and promote a more profound understanding of numerical relationships (Tobe, 2023).

The reviewed literature underscores the crucial role of educators in creating a learning environment that nurtures students' cognitive development in numerical intuition through the integration of relevant and contextualized mathematical experiences. By emphasizing the significance of providing students with meaningful and engaging mathematical activities, the findings of this review underscore the importance of fostering a solid foundation in numerical intuition to promote students' overall mathematical proficiency and conceptual understanding, thereby setting the stage for their continued success in more advanced mathematical concepts and applications (Insorio & Librada, 2020).

Theme 2: Influence of Educational Practices on Number Sense Competencies

The systematic literature review highlighted the crucial role of educational practices and instructional strategies in shaping and enhancing students' number sense competencies within the

context of junior high school education. Notably, the findings emphasized the effectiveness of interactive and hands-on learning methodologies, including the utilization of manipulatives, problem-solving tasks, and technology-based learning tools, in fostering students' conceptual understanding of numerical principles and mathematical operations (del Olmo-Muñoz, et al., 2023). These pedagogical approaches have been shown to promote active engagement and provide students with practical experiences that facilitate a deeper comprehension of numerical relationships and mathematical concepts.

Furthermore, the integration of adaptive instructional approaches tailored to accommodate diverse learning styles has been identified as instrumental in nurturing students' numerical intuition and fostering a positive attitude towards mathematics. The literature review emphasized the significance of personalized learning experiences that cater to students' individual learning preferences and cognitive abilities, thereby promoting a sense of inclusivity and empowerment within the learning environment (Kilag, et al., 2023). Studies have underscored the importance of implementing flexible instructional strategies that encourage students to explore mathematical concepts through various learning modalities, fostering a deeper appreciation for the practical applications of numerical intuition in real-world scenarios (Lagura, 2022).

Moreover, the findings of the systematic literature review highlighted the need for educators to prioritize the integration of interactive and technology-driven learning tools to enhance students' engagement and promote a more holistic understanding of number sense competencies. The incorporation of digital learning platforms and educational software has been found to provide students with dynamic learning opportunities that facilitate self-directed exploration and experimentation, thereby reinforcing their conceptual understanding of numerical concepts and fostering a positive disposition towards mathematical learning (Tobe, 2023).

The findings of this review underscore the significance of integrating interactive and adaptive instructional practices that foster a deeper conceptual understanding of numerical concepts and promote students' positive engagement with mathematics. By highlighting the importance of hands-on learning experiences and technology-driven educational tools, this review emphasizes the pivotal role of educational practices in nurturing students' number sense competencies and fostering a conducive learning environment that encourages the development of robust numerical intuition among junior high school students.

Theme 3: Socio-Cultural Factors and Individual Differences in Mathematical Cognition

The systematic literature review illuminated the substantial influence of socio-cultural factors and individual differences on students' acquisition of numerical intuition and number sense competencies within the context of junior high school education. Notably, the findings underscored the profound impact of socio-cultural contexts, including family dynamics, cultural norms, and societal expectations, on students' mathematical learning experiences and their development of numerical intuition (Bernardo, et al., 2022). Studies have emphasized the significance of considering the socio-cultural background of students in the design and implementation of educational interventions aimed at nurturing their mathematical cognition and fostering a more inclusive learning environment.

Furthermore, the literature review highlighted the critical need for tailored educational interventions that address individual differences in cognitive processing styles, learning preferences, and mathematical abilities among junior high school students. The findings emphasized the importance of accommodating diverse learning modalities and providing personalized learning experiences that cater to students' unique cognitive strengths and areas of growth. Studies have emphasized the significance of implementing inclusive educational practices that acknowledge and respect the individuality of students, thereby fostering an equitable and supportive learning environment that encourages the development of robust numerical intuition and number sense competencies (Warren, 2023).

Moreover, the review underscored the importance of fostering a culturally responsive and empathetic learning environment that recognizes and values students' diverse socio-cultural backgrounds and individual perspectives. Studies have highlighted the role of culturally relevant pedagogical approaches in promoting students' engagement and participation in mathematical learning activities, thereby fostering a sense of belonging and empowerment within the learning community. By acknowledging and accommodating the socio-cultural diversity of students, educators can create a more inclusive and equitable learning environment that fosters the development of students' mathematical cognition and numerical intuition, thus ensuring their academic success and personal growth (Baria & Gomez, 2022). By emphasizing the importance of tailored educational interventions and culturally responsive pedagogical practices, this review highlights the need for fostering an inclusive learning environment that values students' diverse socio-cultural backgrounds and promotes their holistic development in the realm of mathematical cognition and numerical intuition.

Theme 4: Challenges and Opportunities for Enhancing Numerical Intuition

The comprehensive review of the literature delineated various challenges and opportunities associated with enhancing students' numerical intuition and number sense competencies within the context of junior high school education. Notably, the study highlighted the detrimental impact of challenges such as math anxiety, negative attitudes towards mathematics, and insufficient teacher training on the development of students' intuitive grasp of numerical concepts (Refugio, et al., 2020). The findings underscored the critical need for addressing these challenges to create a supportive learning environment that fosters students' confidence and competence in the realm of numerical intuition and mathematical cognition.

Furthermore, the review elucidated the potential opportunities for implementing comprehensive intervention programs that promote a positive learning environment and cultivate a growth mindset towards mathematics among junior high school students. The findings emphasized the significance of integrating innovative instructional practices that cater to the diverse learning needs and cognitive abilities of students. Studies have highlighted the efficacy of adaptive teaching strategies, such as differentiated instruction, peer-assisted learning, and collaborative problem-solving tasks, in fostering a positive attitude towards mathematics and nurturing students' numerical intuition (Cherry, 2021). These opportunities serve as catalysts for creating a dynamic and engaging learning environment that fosters students' enthusiasm and motivation for exploring numerical concepts and mathematical operations.

Moreover, the review underscored the importance of providing professional development opportunities for educators to enhance their pedagogical skills and strategies in addressing the challenges associated with nurturing students' numerical intuition. Studies have emphasized the role of teacher training programs in equipping educators with the necessary tools and resources to create a supportive and inclusive learning environment that promotes students' mathematical learning experiences and fosters the development of robust numerical intuition and number sense competencies (Suguitan & Natividad, 2022). By prioritizing the professional development of educators, educational institutions can create a collaborative and nurturing learning environment that fosters students' mathematical competence and promotes their academic success and personal growth.

This review underscore the critical importance of addressing the challenges and harnessing the opportunities associated with enhancing students' numerical intuition and number sense competencies in the context of junior high school education. By emphasizing the significance of creating a supportive learning environment and providing professional development opportunities for educators, this review highlights the potential for fostering a positive attitude towards mathematics and nurturing students' numerical intuition, thereby ensuring their academic success and holistic development.

The findings of this study underscore the multifaceted nature of numerical intuition and number sense competencies among junior high school students, emphasizing the significance of tailored educational practices, inclusive pedagogical approaches, and holistic interventions that promote the development of students' mathematical reasoning, problem-solving skills, and overall numerical intuition.

Conclusion

This systematic literature review has shed light on the multifaceted nature of numerical intuition and number sense competencies among junior high school students. Through the exploration of key themes, including the cognitive development of numerical intuition, the influence of educational practices, socio-cultural factors and individual differences, as well as the challenges and opportunities for enhancing students' mathematical cognition, this study has underscored the crucial role of tailored educational interventions in fostering a deeper conceptual understanding of numerical concepts and promoting a positive learning environment.

The findings have emphasized the significance of providing students with meaningful and contextually relevant mathematical experiences that stimulate their cognitive development and nurture their numerical intuition. Additionally, the review has highlighted the effectiveness of interactive and adaptive instructional strategies in fostering students' positive engagement with mathematics and facilitating a deeper comprehension of numerical relationships.

Moreover, the study has underscored the importance of recognizing and addressing the influence of socio-cultural factors and individual differences on students' mathematical learning experiences, emphasizing the need for inclusive educational practices that accommodate diverse learning styles and foster an equitable learning environment for all students.

Furthermore, the review has identified the challenges associated with nurturing students' numerical intuition, such as math anxiety and inadequate teacher training, and has underscored the potential opportunities for implementing comprehensive intervention programs that promote a growth mindset towards mathematics and encourage the integration of innovative instructional practices.

This study calls for a holistic approach to mathematical education in junior high schools, one that acknowledges the significance of cognitive development, embraces diverse learning modalities, and fosters a supportive and inclusive learning environment. By prioritizing tailored educational interventions and equipping educators with the necessary tools and resources, educational institutions can create a dynamic and engaging learning environment that nurtures students' numerical intuition, fosters their mathematical competence, and prepares them for continued success in their academic journey.

References

- Abdul-Karim, H., Kasimu, O., Rahaman, A. A., Kanimam, Y. S., Imoro, M., & Dokurugu, M. E. (2023). Assessing the Impact of Algebra Tiles as Visual and Manipulative Aids on Students' Algebraic Understanding. *American Journal of Educational Research*, 11(10), 705-711.
- Alda, R., Boholano, H., & Dayagbil, F. (2020). Teacher education institutions in the philippines towards education 4.0. *International Journal of Learning, Teaching and Educational Research*, 19(8), 137-154.
- Anero, J., & Tamayo, E. (2023). Going Back to Normal: A Phenomenological Study on the Challenges and Coping Mechanisms of Junior High School Teachers in the Full Implementation of In-Person Classes in the Public Secondary Schools in the Division of Rizal. *Psych Educ*, 12, 767-808.
- Baria, K., & Gomez, D. (2022). Influence of social support to student learning and development. *International Journal of Research Studies in Education*, 11(2), 69-97.
- Bernardo, A. B., Cordel, M. O., Lapinid, M. R. C., Teves, J. M. M., Yap, S. A., & Chua, U. C. (2022). Contrasting profiles of low-performing mathematics students in public and private schools in the Philippines: insights from machine learning. *Journal of Intelligence*, 10(3), 61.
- Bhatia, P. (2021). *The neurocognitive bases of fraction processing in the learning brain* (Doctoral dissertation, Université de Lyon).
- Cherry, D. P. Del Campo (2021). Peer Life Coaching, Personal, and Reciprocal Relationship Among Junior High School Students of Looc Integrated School. *International Journal of Arts, Humanities and Social Studies*, 3(4), 80-106.
- del Olmo-Muñoz, J., González-Calero, J. A., Diago, P. D., Arnau, D., & Arevalillo-Herráez, M. (2023). Intelligent tutoring systems for word problem solving in COVID-19 days: could they have been (part of) the solution?. *ZDM—Mathematics Education*, 55(1), 35-48.

Guhn, M., Emerson, S. D., & Gouzouasis, P. (2020). A population-level analysis of associations between school music participation and academic achievement. *Journal of Educational Psychology*, 112(2), 308.

Hawes, Z., & Ansari, D. (2020). What explains the relationship between spatial and mathematical skills? A review of evidence from brain and behavior. *Psychonomic bulletin & review*, 27, 465-482.

Ho, S., & Kozhevnikov, M. (2023). Cognitive style and creativity: The role of education in shaping cognitive style profiles and creativity of adolescents. *British Journal of Educational Psychology*, e12615.

Insorio, A. O., & Librada, A. R. P. (2020). Enhancing mathematical critical thinking and problem-solving skills through emergentics® as a grouping mechanism. *Contemporary Mathematics and Science Education*, 2(1), ep21002.

Kilag, O. K. T., Bautista, J. L., Villegas, M. A. L., Bendanillo, A. A., Peñalosa, B. M., & Asentado, D. E. (2023). European Journal of Innovation in Nonformal Education (EJINE). *European Journal of Innovation in Nonformal Education (EJINE)*, 3(6).

Kilag, O. K. T., Bariquit, A. A., Glipa, C. G., Ignacio, R. A. R. A., Alvez, G. U., Guilot, R. T., & Sasan, J. M. Implication about Personalized Plan on Professional Development (IPPD) on Teachers' Professional Development and Career Advancement.

Kilag, Osias Kit T., et al. "Implication of Individual Plan for Professional Development (IPPD) on Teachers' Professional Development and Career Advancement." *Web of Semantic: Universal Journal on Innovative Education* 2.6 (2023): 43-54.

Kilag, O. K. T., Zarco, J. P., Zamora, M. B., Caballero, J. D., Yntig, C. A. L., Suba-an, J. D., & Sasan, J. M. V. (2023). How Does Philippines's Education System Compared to Finland's?. *EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION*, 3(6), 11-20.

Kilag, O. K. T., & Sasan, J. M. (2023). Unpacking the Role of Instructional Leadership in Teacher Professional Development. *Advanced Qualitative Research*, 1(1), 63-73.

Kilag, O. K. T., Ignacio, R., Lumando, E. B., Alvez, G. U., Abendan, C. F. K., Quiñanola, N. A. M. P., & Sasan, J. M. (2022). ICT Integration in Primary School Classrooms in the time of Pandemic in the Light of Jean Piaget's Cognitive Development Theory. *International Journal of Emerging Issues in Early Childhood Education*, 4(2), 42-54.

Kilag, O. K. T., Manguilimotan, A. M. G., Maraño, J. C., Jordan, R. P., Columna, P. A. F., & Camaso, M. F. A. (2023). A conceptual framework: A systematic Literature Review on Educational Leadership and Management. *Science and Education*, 4(9), 262-273.

- Kilag, O. K. T., Diano Jr, F. M., Malbas, M. H., Mansueto, D. P., Villar, S. P., & Arcillo, M. T. (2023). The role of servant leadership in creating a positive school climate. *Science and Education*, 4(5), 933-942.
- Kilag, O. K., Lisao, C., Lastimoso, J., Villa, F. L., & Miñoza, C. A. (2023). Bildung-Oriented Science Education: A Critical Review of Different Visions of Scientific Literacy. *Excellencia: International Multi-disciplinary Journal of Education*, 1(4), 115-127.
- Kilag, O. K., Catacutan, A., Miñoza, M. L., Arcillo, M., Espinosa, S., & Figer-Canes, R. M. (2023). Optimizing the Teaching of Values Education Strategies for Integration and Contextualization. *Excellencia: International Multi-disciplinary Journal of Education*, 1(1), 65-76.
- Lagura, R. (2022). The Effectiveness of ICT Integration in Teaching Science Concepts. *American Journal of Multidisciplinary Research and Innovation*, 1(3), 11-20.
- Nelwan, M., Friso-van den Bos, I., Vissers, C., & Kroesbergen, E. (2022). The relation between working memory, number sense, and mathematics throughout primary education in children with and without mathematical difficulties. *Child neuropsychology*, 28(2), 143-170.
- Nketia, J., Amso, D., & Brito, N. H. (2021). Towards a more inclusive and equitable developmental cognitive neuroscience. *Developmental cognitive neuroscience*, 52, 101014.
- Pan, Y., Ke, F., & Xu, X. (2022). A systematic review of the role of learning games in fostering mathematics education in K-12 settings. *Educational Research Review*, 36, 100448.
- Payadnya, I. P. A. A., Prahmana, R. C. I., Lo, J. J., Noviyanti, P. L., & Atmaja, I. M. D. (2023). Designing area of circle learning trajectory based on “what-if” questions to support students’ higher-order thinking skills. *Journal on Mathematics Education*, 14(4), 757-778.
- Refugio, C. N., Galleto, P. G., Noblefranca, C. D., Inoferio, H. V., Macias Jr, A. O., Colina, D. G., & Dimalig, C. Y. (2020). Content Knowledge Level of Elementary Mathematics Teachers: The Case of a School District in the Philippines. *Cypriot Journal of Educational Sciences*, 15(3), 619-633.
- Sasan, J. M., & kit Kilag, O. (2023). From Teacher to School Founder: A Practicum Journal on Dr. Francisca T. Uy's Educational Journey. *Psychology and Education: A Multidisciplinary Journal*, 13(2), 159-165.
- Suguitan, L., & Natividad, E. (2022). Localized Game-Based Learning Activities in Mathematics 7 (LGBLAs). *American Journal of Multidisciplinary Research and Innovation*, 1(4), 210-227.
- Thompson, C. A., Mielicki, M. K., Rivera, F., Fitzsimmons, C. J., Scheibe, D. A., Sidney, P. G., ... & Waters, E. A. (2023). Leveraging math cognition to combat health innumeracy. *Perspectives on Psychological Science*, 18(1), 152-177.

Tobe, A. G. D. (2023). Interplay of mathematics self-efficacy, anxiety, creativity beliefs, and learning styles among college students: Implications for curriculum alignment. *Journal of Namibian Studies: History Politics Culture*, 33, 1725-1765.

Uy, Francisca, Osias Kit Kilag, and Alberto Arcilla Jr. "Empowering Education: A Learning-Goals-Centric Approach to Curriculum Development." *Excellencia: International Multi-disciplinary Journal of Education* 1, no. 4 (2023): 48-61.

Warren, I. M. (2023). *Perceptions of colorism within the K-12 learning environment as evidenced by educator response and student narrative* (Doctoral dissertation, University of Illinois at Urbana-Champaign).