



Integrating Values in Mathematics: Strategies, Challenges, and a Framework for Junior and Senior High School

Jedy Fate S. Maglasang

Saint Columban College, Philippines

E-mail: jedyfate.maglasang@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0001-3500-797X>

Aleah Rose C. Regalado

Saint Columban College, Philippines

E-mail: aleahrose.regalado@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0007-7299-6571>

Ella Maikah B. Espina

Saint Columban College, Pagadian City, Philippines

E-mail: ellamaikah.espina@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0009-2221-0504>

Hannah Jean C. Segotier

Saint Columban College, Pagadian City, Philippines

E-mail: hannahjean.segotier@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0004-9091-7695>

Marjie Ann B. Catanes

Saint Columban College, Pagadian City, Philippines

E-mail: marjieann.catanes@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0001-4011-4104>

Rovelyn E. Cerdña

Saint Columban College, Pagadian City, Philippines

E-mail: rovelyn.cerdña@sccpag.edu.ph, ORCID ID: <https://orcid.org/0009-0007-6647-8735>

Alfer Jann Tantog

Saint Columban College, Pagadian City, Philippines

E-mail: altferjantantog@lsu.edu.ph, ORCID ID: <https://orcid.org/0000-0002-3131-6660>

Genesis B. Naparan

Saint Columban College, Pagadian City, Philippines

E-mail: genesisbnaparan@gmail.com, ORCID ID: <https://orcid.org/0000-0003-2335-2757>

Received 23/04/2025

Revised 03/05/2025

Accepted 06/05/2025

Abstract

Background and Aim: Integrating values in mathematics education enhances students' cognitive, ethical, and social development, yet remains underexamined in structured curricula. Grounded in sociocultural learning theory and values-based mathematics education, this study investigates how junior and senior high school mathematics teachers integrate values, specifically perseverance, honesty, and collaboration, into their instruction. It further examines their challenges and the institutional supports available and proposes a framework to strengthen values integration.

Materials and Methods: Employing a qualitative multiple-case study design, this research engaged eight experienced mathematics teachers from Saint Columban College with values-based teaching backgrounds. Data were collected through semi-structured interviews, classroom observations, and document analysis. Thematic coding was conducted using NVivo software, with triangulation, intercoder reliability (Cohen's Kappa = 0.81), and member checking, to ensure data trustworthiness. Ethical procedures included IRB approval, informed consent, and participant confidentiality.

Results: Three major themes emerged: (1) Values Integration, the most frequently emphasized values were perseverance (88%), honesty (75%), and collaboration (62%); (2) Challenges teachers cited the lack of structured frameworks (87%), students' perceptions of mathematics as value-neutral (75%), and rigid curricula (69%) as key barriers; and (3) Strategies practical approaches included contextualized learning (69%), ethical problem-based tasks (63%), and teacher role-modeling (100%). Institutional mechanisms such as professional learning communities provided critical support.

Conclusion: The findings underscore the need for systemic reforms, particularly in teacher training, curriculum design, and institutional policy, to support values integration in mathematics. By promoting ethical reasoning and culturally responsive teaching, mathematics can be reframed as a discipline that cultivates intellectual rigor





and moral insight. Although limited by sample size and institutional scope, the study offers a foundational framework for scaling values integration across diverse educational settings.

Keywords: Values Integration, Mathematics Education, Teacher Development, Sociocultural Learning, Ethical Reasoning

Introduction

Although often perceived as objective and value-neutral, mathematics inherently transmits values that shape students' cognitive, ethical, and social development. Integrating values into mathematics instruction fosters perseverance, integrity, collaboration, and critical thinking qualities essential for holistic education but still underexplored in theory and classroom practice.

This study is grounded in Vygotsky's Sociocultural Learning Theory, which emphasizes the role of social interaction in cognitive development, and Bishop's (1996) Values-Based Mathematics Education (VBME), which underscores the presence of affective dimensions such as ethical reasoning and perseverance within mathematical learning. These frameworks advocate for embedding values in mathematics to extend learning beyond technical proficiency.

In the Philippine context, while values education has long been prioritized in the national curriculum (DepEd, 2023), explicit strategies for integrating values into mathematics remain limited. Teachers often face structural and pedagogical barriers, including the traditional compartmentalization of subjects, rigid curricula, and the prevailing notion of mathematics as a purely procedural field.

This study investigates how mathematics teachers at Saint Columban College integrate values into their instruction, their challenges, and the institutional mechanisms that support or hinder these efforts. It also considers the ethical dimensions of mathematics, from economic equity to environmental responsibility, and the impact of teacher beliefs and culturally responsive teaching on student engagement and achievement (Seah, 2016; Schoenfeld, 2019).

The study contributes to a broader discourse on humanizing STEM education by examining value integration in a real-world institutional setting. It argues that mathematics, when taught with ethical purpose and cultural relevance, can empower students to become responsible, critically aware individuals equipped to confront contemporary societal challenges.

Objectives

This study aimed to 1) identify the five most frequently integrated values in mathematics instruction, categorized by frequency of implementation; 2) analyze the teaching strategies used to embed values in mathematics education; 3) investigate the primary challenges teachers encounter in values integration; 4) assess coping mechanisms and institutional support structures for teachers; and 5) propose a framework for professional development focused on values integration in mathematics education.

Literature review

Integration of Values in Mathematics Education

Mathematics education transmits cognitive skills and moral and cultural values such as precision, perseverance, honesty, and responsibility. Bishop (1996) emphasized that values are unavoidable in mathematics, classifying them into mathematical, educational, and ethical domains. These values shape students' attitudes, motivation, and decision-making processes. Later, Seah and Andersson (2019) reinforced that both teachers and students bring personal and cultural values such as pakikipagkapwa-tao and Bayanihan in the Filipino context into the classroom, whether consciously or not.

Values integration in mathematics can enhance student engagement, critical thinking, and social responsibility. Kilag et al. (2023) and Clarke and Roche (2018) demonstrated that inquiry-based learning and real-world problem-solving help nurture values such as perseverance, fairness, and ethical reasoning. For instance, analyzing manipulated statistics fosters integrity and critical thinking. Moreover, Malangtupthong et al. (2022) found that values-rich environments improve academic achievement and moral development, proving that affective and values-driven factors influence mathematical performance.



Despite these benefits, practical integration faces significant challenges. Teachers often deal with time constraints, rigid curricula, and the common perception that mathematics is value-neutral or purely technical (Sirigy et al., 2021). Institutional limitations, such as high-stakes testing and lack of systemic support, hinder reflective, values-centered pedagogy. Additionally, cultural contexts may interpret values differently, especially in multilingual, multiethnic classrooms. Seah (2019) thus advocates for culturally responsive instruction that respects students' lived experiences.

Teaching Strategies for Values Integration

Effective values integration in mathematics occurs through both explicit and implicit approaches. Explicit strategies include structured reflections and ethical discussions embedded in mathematical tasks, such as debates on fairness in taxation or decision-making in budgeting problems (De Guzman & Uy, 2022). Implicit integration, on the other hand, involves teacher role-modeling, respectful classroom interactions, and fostering perseverance during challenging problem-solving tasks (Frey et al., 2019).

Cooperative learning and real-life applications are especially effective. Clarke and Roche (2018) argue that using culturally relevant scenarios deepens mathematical understanding while promoting ethical reflection. Inquiry-based learning also encourages autonomy, resilience, and responsibility. Tasks like evaluating the accuracy of statistical graphs help students build integrity and analytical skills.

Scholars commonly organize values in mathematics education into three domains (Fan, 2021; Kilag et al., 2023):

- **Mathematical Values** – Accuracy, logical reasoning, problem-solving
- **Educational Values** – Perseverance, collaboration, engagement
- **Ethical Values** – Honesty, fairness, responsibility
- These classifications provide a practical framework for targeting specific values through pedagogy.

Professional Development for Teachers

For values integration to be meaningful, teachers require ongoing professional development. Kalogeropoulos et al. (2020) recommend sustained mentoring programs, reflective case studies, and action research. These formats allow educators to apply ethical reasoning in authentic classroom contexts and develop confidence in implementing values-based lessons. Hill et al. (2021) emphasize that reflective teaching is crucial for aligning personal beliefs with pedagogical decisions. DepEd has launched values integration training in the Philippines, though more empirical research is needed to assess its effectiveness and sustainability.

Critiques and Research Gaps

Some scholars argue that emphasizing values may dilute the technical rigor of mathematics or risk imposing subjective beliefs. However, this study maintains that ethical reasoning complements rather than competes with mathematical logic. Most existing literature treats value integration as supplemental. In contrast, this study positions it as central to holistic education. While Seah (2019) and Fan (2021) highlight the importance of values, they often overlook the implementation and professional development aspects that this research seeks to address.

Study Focus and Contribution

This study explores values integration practices among junior and senior high school mathematics teachers at Saint Columban College. Grounded in sociocultural theory and values-based education, it identifies common challenges, teaching strategies, and training needs. The findings aim to inform future professional development programs and promote a more holistic approach to mathematics education in the Philippines.

Conceptual Framework

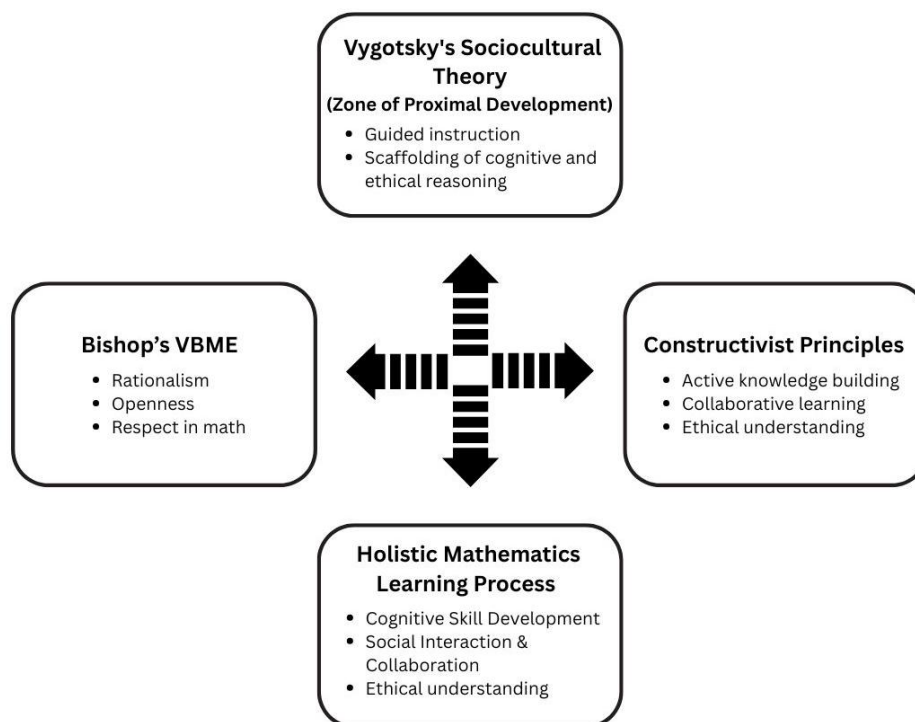
This study combines Vygotsky's Sociocultural Learning Theory, Bishop's Values-Based Mathematics Education (VBME), and constructivist principles to create a holistic view of mathematics learning that integrates cognitive development, ethical growth, and social interaction.

- Vygotsky's Zone of Proximal Development (ZPD) highlights the importance of scaffolding and guided instruction. Teachers support students' learning by assisting with their current capabilities, promoting logical reasoning and ethical reflection. For example, prompting students to justify their solutions encourages critical thinking and value-based decision-making.
- Bishop's VBME introduces ethical values within mathematical contexts. Teachers who encourage diverse solution strategies and promote respectful discourse in mathematical discussions cultivate values such as rationalism, openness, and respect.
- Constructivist principles emphasize that students build their understanding through meaningful, collaborative learning experiences. Knowledge and ethics are not transmitted but co-constructed in a social environment.

These theories frame mathematics education as a dynamic interplay between intellectual growth, ethical development, and social engagement.

Conceptual Framework Illustration

Figure 1: Conceptual Framework



This framework envisions mathematics learning as more than acquiring procedural skills. It becomes a platform where learners develop as thinkers and ethical individuals within a collaborative environment.

Methodology

This qualitative multiple-case study explored mathematics teachers' strategies, challenges, and coping mechanisms in integrating values.

Research Design

This study employs a qualitative multiple-case study design to explore mathematics teachers' strategies, challenges, and professional development in integrating values into their instruction. A multiple-case study approach was chosen over other qualitative methods, such as phenomenology or grounded theory, as it enables comparative analysis of diverse teaching contexts. This design provides a richer understanding of how values integration varies across educational settings, facilitating the identification of common patterns and unique instructional challenges.

Participants

Eight mathematics teachers from Saint Columban College participated. All had at least five years of experience and prior engagement with values-based teaching. The small, purposive sample limits generalizability but provides rich, contextual insights. Future research should consider larger, more diverse samples and quantitative approaches, including power analysis.

Data Collection

Data collection involved:

- Semi-structured interviews exploring teaching practices and challenges.
- Classroom observations using structured protocols that noted ethical discussions and value-laden interactions.
- Document analysis of lesson plans and instructional materials.

Ethical approval was obtained, and participants' confidentiality was maintained.

Data Analysis

Data were analyzed thematically using NVivo. Initial codes were generated inductively and deductively based on the conceptual framework. Intercoder reliability yielded a Cohen's Kappa of 0.81, indicating strong agreement. Member checking validated the findings.

Results

1. Values Integrated into Mathematics Teaching

Table 1: Teachers emphasized:

Value	% of Teachers	Example Practice
Perseverance	88%	Solving complex, multi-step problems
Honesty	75%	Stressing academic integrity in assessments
Collaboration	62%	Group problem-solving tasks
Logical Reasoning	69%	Structured proofs and critical thinking
Responsibility	55%	Accountability in homework and projects

One Junior High School teacher said, *"We teach them that failing once isn't a failure — it's part of learning both math and life."*

However, **75%** noted that students often perceive mathematics as "value-neutral," echoing Bishop's earlier concerns.

A Senior High School teacher reflected, *"Students often ask, 'Where are the values in solving for x?' Showing them, the human side of mathematics takes deliberate effort."*

2. Strategies for Values Integration

Table 2: Teachers used:

Strategy	% of Teachers	Example Practice
Problem-Based Learning	63%	Embedding ethical dilemmas in math problems
Contextualized Learning	69%	Real-life financial literacy, environmental statistics
Teacher Modeling	100%	Demonstrating fairness, patience, and respect

A college instructor shared, *"When we calculate income disparities, students realize math can advocate for fairness, not just numbers."*

Still, **87%** noted the absence of formal frameworks guiding these practices.



3. Challenges in Values Integration

Table 3: Challenges in Values Integration

Challenge	% of Teachers	Example
Lack of Frameworks	87%	No templates for value integration
Students' Neutrality Perception	75%	Difficulty linking ethics to problem-solving
Curriculum Rigidity	69%	Overloaded syllabi restricting value discussions

A Junior High School teacher explained, *"We're pressured to finish everything for the exams — there's barely time to connect topics to real-life ethics."*

Moreover, teachers observed that some students dismissed ethical discussions as irrelevant unless explicitly assessed.

Discussion

This study significantly contributes to the growing body of research that emphasizes the integration of values within mathematics education, particularly through a sociocultural lens. Aligning with Bishop (1999) and Seah (2019), it reinforces the notion that mathematics is not a culturally neutral discipline but rather one imbued with implicit values. By situating mathematical problem-solving within sociocultural contexts, the study reveals how value-laden content can shape learners' ethical and cognitive development, thus affirming the importance of embedding cultural and moral dimensions into mathematics curricula.

Moreover, the findings echo the conclusions of Malangtupthong et al. (2022), who demonstrated that value integration enhances students' problem-solving competencies. In this study, incorporating culturally relevant values, such as *pakikipagkapwa-tao* and *Bayanihan*, not only deepened students' understanding of mathematical concepts but also cultivated collaborative and empathetic approaches to learning. These values provided meaningful contexts for mathematical inquiry, suggesting that when learners connect abstract content to lived experiences, they demonstrate greater engagement and cognitive flexibility.

However, despite these promising outcomes, the study also identifies systemic barriers that limit the full integration of values in mathematics education. Rigid curricula and the dominance of high-stakes testing continue to prioritize procedural proficiency over holistic development. This tension, similarly observed by Seah and Andersson (2019), underscores the challenge of fostering values-based education in environments constrained by performative accountability measures. Teachers often struggle to reconcile the dual demands of content delivery and ethical cultivation, particularly when institutional frameworks offer limited support for innovative pedagogies.

Nonetheless, educators in the study navigated these complexities by adopting inquiry-based approaches to values education, thus mitigating the risks of indoctrination. By framing values through open-ended discussions and reflective practices, teachers encouraged students to develop ethical reasoning and critical thinking without imposing fixed moral codes. This approach aligns with progressive educational philosophies that advocate for the co-construction of meaning and the development of autonomous moral judgment, positioning students as active participants in both mathematical and moral discourse.

In response to these insights, several practical implications emerge. Curriculum developers should incorporate explicit, culturally grounded value outcomes to make learning more contextually meaningful. Teacher training programs must be reflective and sensitive to local values to ensure relevance and sustainability. Assessment models should evolve to include authentic tasks—such as portfolios and group projects—that measure ethical reasoning alongside computational skills. Finally, institutional support through professional learning communities can foster collaborative innovation and provide a safe space for educators to explore value-based pedagogies. Collectively, these recommendations highlight the need for systemic transformation to realize the full potential of values integration in mathematics education.





Conclusion

Values integration in mathematics education transforms it into a discipline fostering intellectual growth and ethical and civic engagement. Guided by sociocultural and constructivist theories, this study highlights how Filipino cultural values and moral reasoning can enrich mathematics instruction.

Though limited by sample size and context, the findings advocate systemic reforms at curricular, institutional, and policy levels.

Future research should explore student perspectives, long-term behavioral impacts, and cross-cultural applications to expand understanding globally.

Ultimately, mathematics should be a humanizing endeavor, preparing students to solve equations and real-world problems with empathy, responsibility, and critical insight.

Knowledge Contribution

This study bridges theoretical, practical, and cultural dimensions, offering a comprehensive framework for values integration in mathematics. It calls for a paradigm shift toward humanistic, culturally rooted mathematics education that empowers learners as responsible citizens.

The model provides a complete framework for blending values into mathematics education, starting from its Theoretical Dimension. The foundational layer derives its principles from sociocultural theory and combines elements of values-based education with a holistic learning philosophy. The model shows that learning extends beyond cognitive processes to include social interaction as well as moral and cultural elements. The theoretical framework of mathematics education becomes a tool for character development and worldview formation when values are integrated into it.

The Practical Dimension emerges from this foundational understanding by focusing on turning theoretical principles into practical applications. The Practical Dimension highlights teaching approaches that adapt to context and classroom implementation, along with ongoing teacher development. Teachers hold essential responsibilities in this area by applying educational methods that weave values into inquiry-driven learning, teamwork exercises, and ethical thought processes. Students experience theoretical insights as practical classroom experiences which enables them to participate in reflective learning activities of real meaning.

The Cultural Dimension, as the third layer, emphasizes the need to blend local cultural values and contexts into educational practices. The mathematical learning experience becomes richer by foregrounding Filipino values like *pakikipagkapwa-tao* (relational humanity) and *bayanihan* (community cooperation) which provide culturally relevant content. The dimension enhances learning engagement and authenticity through the incorporation of local examples and real-life contexts. The approach validates student identities and builds strong links between mathematical reasoning and social responsibilities.

The Integrated Framework combines the previous dimensions to achieve transformative learning results. Through this holistic model mathematics education evolves into an approach that combines humanistic principles with ethical foundations and civic accountability. The educational approach develops students into capable problem-solvers who become critical thinkers and ethical agents ready to serve their communities. The model advocates for replacing technical instruction with teaching methods that emphasize values and cultural responsiveness while creating social impact.



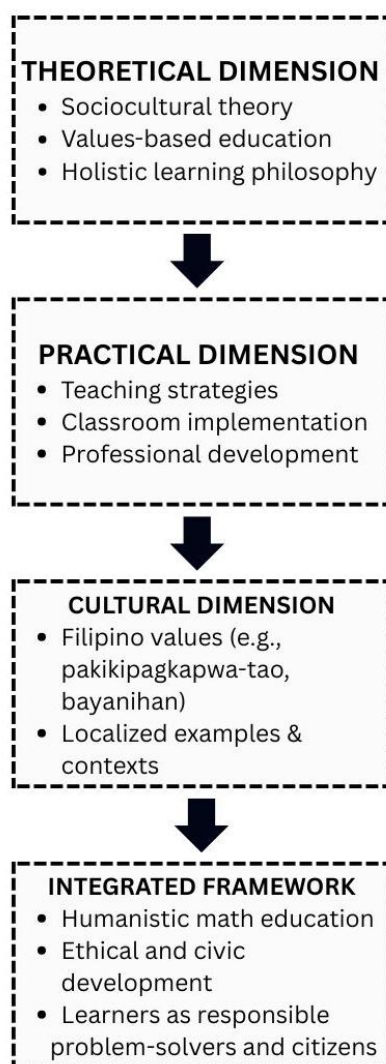


Figure 2: Knowledge Contribution Illustration

This study contributes knowledge by bridging theoretical, practical, and cultural dimensions, offering a comprehensive and dynamic framework for value integration in mathematics education. Rooted in sociocultural theory, values-based education, and holistic learning philosophy, the theoretical dimension lays the groundwork for reimagining mathematics as more than a technical discipline. It becomes a vehicle for ethical and social development.

This theoretical foundation informs the practical dimension, which focuses on effective teaching strategies, classroom implementation, and continuous professional development to support teachers in embedding values into their instruction.

The cultural dimension further strengthens the framework, emphasizing the importance of Filipino values such as *pakikipagkapwa-tao* and *Bayanihan*, and using localized examples that make mathematics relevant and meaningful to learners' lived experiences.

The integrated framework, which promotes humanistic mathematics education, lies at the convergence of these dimensions. This framework empowers students not just as competent problem-solvers but as morally grounded and socially responsible citizens who can apply mathematical thinking to real-world challenges with empathy and integrity.

Recommendation

To deepen the understanding of values integration in mathematics education, future research should: '-

1. Explore Student Perspectives – Investigate how students perceive and engage with value-based learning in math and its impact on their personal and academic growth.
2. Assess Long-Term Effects – Examine how integrated values influence students' behavior, decision-making, and ethical reasoning beyond the classroom.
3. Expand Cross-Culturally – Study how value integration varies across cultural contexts to broaden global applicability.
4. Strengthen Teacher Development – Evaluate the effectiveness of training programs in equipping teachers for values-based teaching and how this influences their practice over time.
5. Innovate Curriculum and Assessment – Develop frameworks and tools that embed and measure values through creative, performance-based assessments.

References

- Bishop, A. J. (1996). *Mathematics education and culture*. Springer.
- Bishop, A. J. (1999). *Mathematics teaching and values education – An intersection in need of research*. *Zentralblatt für Didaktik der Mathematik*, 31(1), 1–4. <https://doi.org/10.1007/s11858-999-0001-9>
- Clarke, D., & Roche, A. (2018). Using contextualized tasks to engage students in meaningful and worthwhile mathematics learning. *The Journal of Mathematical Behavior*, 51, 95–108. <https://doi.org/10.1016/j.jmathb.2017.11.006>
- De Guzman, A. B., & Uy, S. C. (2022). Cultural values in Filipino mathematics classrooms: Integrating Bayanihan and Pakikipagkapwa-tao. *Philippine Journal of Education*, 95(2), 34–45.
- DepEd. (2023). *National curriculum framework for basic education*. Department of Education, Republic of the Philippines.
- Fan, L. (2021a). Exploring issues about values in mathematics education. *ECNU Review of Education*, 4(2), 388–395. <https://doi.org/10.1177/20965311211016002>
- Fan, L. (2021b). Values in mathematics education: Understanding hidden messages in mathematics classrooms. *ZDM–Mathematics Education*, 53, 1–12. <https://doi.org/10.1007/s11858-021-01218-5>
- Frey, N., Fisher, D., & Smith, D. (2019). *All learning is social and emotional: Helping students develop essential skills for the classroom and beyond*. ASCD.
- Hill, J. L., Kern, M. L., Seah, W. T., & van Driel, J. (2021). Feeling good and functioning well in mathematics education: Exploring students' conceptions of mathematical wellbeing and values. *ECNU Review of Education*, 4(2), 349–375. <https://doi.org/10.1177/2096531121994262>
- Kalogeropoulos, P., Seah, W. T., & Wong, N. Y. (2020). Developing a framework for teachers' noticing of values in mathematics classrooms. *Educational Studies in Mathematics*, 104(1), 43–59. <https://doi.org/10.1007/s10649-020-09911-7>
- Kilag, R. B., Santos, J. A., & Dizon, R. M. (2023). Inquiry-based learning and values development in mathematics: A case study in Filipino junior high schools. *Asian Journal of Educational Research*, 11(1), 65–80.
- Malangtupthong, P., Khamwan, K., & Khaolaor, P. (2022). *Integrating values in mathematics education to enhance students' problem-solving ability*. *Journal of Education and Learning*, 11(2), 54–61. <https://doi.org/10.5539/jel.v11n2p54>
- Malangtupthong, V., Nurittamont, W., & Phayaphrom, B. (2022). The influence of value integration on students' mathematical problem-solving competency. *International Journal of Instruction*, 15(1), 347–364. <https://doi.org/10.29333/iji.2022.15120a>
- Schoenfeld, A. H. (2019). *How we think: A theory of goal-oriented decision making and its educational applications*. Routledge.



- Seah, W. T. (2019). Values in mathematics and science education: Comparing teachers' and students' views. *International Journal of Science and Mathematics Education*, 17(1), 139–153.
<https://doi.org/10.1007/s10763-017-9859-z>
- Seah, W. T. (2019). *Values in mathematics education: What is planned and what is espoused in the enacted curriculum*. In G. Hine, S. Blackley, & A. Cooke (Eds.), *Mathematics Education Research: Impacting Practice* (pp. 355–363). Mathematics Education Research Group of Australasia.
- Seah, W. T., & Andersson, A. (2019). Values alignment in mathematics classrooms: A comparative perspective. *Journal of Mathematics Teacher Education*, 22(2), 127–147.
<https://doi.org/10.1007/s10857-017-9389-3>
- Sirigy, S., Alajmi, A., & Lin, H. (2021). Perceptions of the social relevance of mathematics among high school students. *International Journal of STEM Education*, 8(1), 47.
<https://doi.org/10.1186/s40594-021-00286-6>

