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Pedagogical Empathy of Secondary Mathematics Teachers: Measurement, Antecedents, and Consequences

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Pedagogical Empathy of Secondary Mathematics Teachers: Measurement, Antecedents, and Consequences

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Chapter 1:

The Problem and Literature Review

This chapter presents the background of the study and the literature review. The rationale of this study is discussed in the background section, which answers the what's and whys of this dissertation. The review of related literature section discusses concepts related to pedagogical empathy, scale development and validation, and investigation of the identified antecedents and consequences. This chapter also includes a conceptual framework, research questions, research hypotheses, and a definition of terms.

Background of the Study

In the rapidly evolving educational landscape, empathy's role has proven to be an essential pedagogical force. It is not just an optional disposition but an important tool in education, yet it is seldom highlighted. Specifically, the presence or absence of empathy in the mathematics classroom has insightful consequences for student learning outcomes and student experiences. Empathy, in its truest educational sense, allows teachers to be attuned to the students' emotional states, feelings, thoughts, and perspectives. Meyers et al. (2019) posit that empathic teachers understand their students' personal and social situations as a compassionate response to students' emotions, whether positive or negative, which increases students' self-confidence in educational settings (Zhang et al., 2024). Teachers use empathy to understand the context of learners through their lens and make strategic decisions to transform their students into well-rounded individuals. Stojiljković

et al. (2012) posit that empathy is pivotal for effective teacher-learner communication, which leads to successful educational undertakings. With empathy, teachers are able to know students' interests, how they learn, how they want to learn, and what motivates them to learn. This extrinsic motivation transforms into the learner's intrinsic motivation, which puts learning at a higher level (Bardach & Murayama, 2025).

Empathic teachers connect with the learners and facilitate connections between learners, resulting in an inclusive learning environment through collaboration. In that sense, strategic learning situations are being implemented to attain authentic learning. On the other hand, Mitina (2018) underscores that empathy plays an important role in elevating a teacher's professional competence. Teachers also benefit when they employ empathy in the classroom. They can adapt to different situations, considering the different contexts of each learner. Consequently, teachers who can adapt to different situations become master planners (Granziera et al., 2019). They become self-aware, intrinsically motivated, and self-efficacious (Quinn et al., 2014). Thus, empathy is one of the necessary interpersonal skills that teachers need to develop through different platforms, such as teachers' training or teacher education, to gain constant pedagogical success (Güngör et al., 2020; Posokhova et al., 2020; Efimova & Belolipetsky, 2010).

While empathy, as used in education, has been viewed as a necessary skill, some educators are not aware of a definite term for it. Hence, a concrete definition of empathy as used in education is crucial to make educators more aware and understand the scope of this construct. Fortunately, some researchers explored this construct and coined the term "pedagogical empathy" to describe empathy as a pedagogical phenomenon. Lindquist

(2004) defines pedagogical empathy as an important tool for teachers to better facilitate learning. In addition, some researchers deem pedagogical empathy as teachers' embodiment of emotional and pedagogical connection with the learners towards an educational commitment (Posokhova et al., 2020). Also, Uhing (2020) defined pedagogical empathy as a process of understanding the emotional attributes and experiences of the learners and making use of these experiences as a guide for an effective teaching-learning endeavor.

During the educational process, teachers exemplify pedagogical empathy through engendering an environment with a symbiotic relationship between the teacher and learners, where collaboration is celebrated (Posokhova et al., 2020). Additionally, pedagogical empathy provides a channel for interaction with students, understanding their difficulties with education, boosting their spirits, and developing a real-time strategy for an effective teaching-learning process (Mitina, 2018). Furthermore, pedagogical empathy is at the core of teachers' abilities to develop an appropriate and welcoming learning environment through comprehending students' situations (Meyers et al., 2019). Therefore, it encompasses how teachers establish emotional connections with their students, build their self-esteem and motivation, make educational decisions to address students' challenges, and motivate students to work together to achieve a common objective.

Additionally, it is crucial for various reasons to have a scale of empathy designed expressly for secondary mathematics teachers. Studies have demonstrated that teacher empathy is a critical component of student engagement and academic accomplishment, and this is probably true for secondary mathematics students as well (Meyers et al., 2019; Wang et al., 2022; Zhang et al., 2024). Also, secondary math teachers may encounter dif-

ficulties cultivating strong bonds with their students, such as the belief that math is a challenging or monotonous topic (Gafoor & Kurukkan, 2015; Thommen et al., 2022). To develop closer relationships with their students, secondary mathematics teachers may require additional support or training in certain areas. This is where an empathy scale designed for their particular needs could be helpful (Bouton, 2014). Hence, the promotion of a culture of empathy and understanding in mathematics education may also be aided by using an empathy scale for secondary mathematics teachers (Stojiljković et al., 2012; Swan & Riley, 2015). This could improve students' attitudes toward the subject and their general academic success.

The significance of pedagogical empathy as a skill towards authentic learning is outstanding. However, before the enhancement of pedagogical empathy of teachers, it is deemed necessary to develop a scale for pedagogical empathy to understand its dimensions and to what extent it can be measured. In recent years, some researchers have explored pedagogical empathy, but few have ventured to measure it. In 2020, Posokhova et al. used a general psychometric scale to measure the pedagogical empathy among teachers from some secondary schools in St. Petersburg, Russia. However, using a general psychometric scale for empathy is insufficient in describing the level of empathy of teachers because it does not fit their context. In that sense, they fail to authentically measure pedagogical empathy in the context of the teachers. It must be underscored that there is a fine line between empathy as used in education and empathy in general. Shkitina et al. (2019) posit that measuring the level of empathy of teachers should be contextualized and should highlight the difference between empathy as a pedagogical phenome-

non and a mere psychological phenomenon. Similarly, Mitina (2018) attempted to measure the level of pedagogical empathy of some Higher Education instructors in Ukraine using “Boyko’s Diagnostic of the Level of Empathic Abilities” scale. However, akin to Posokhova’s study, Mitina (2018) also used a scale deviating from the context of the teachers. Mitina (2018) failed to show substantial manifestation of teachers’ level of pedagogical empathy. Meanwhile, Bouton developed a 21-item Teacher Empathy Scale (TES) in 2014, but emphasized that it requires further validation because the study only included pre-service teachers. Bouton (2014) failed to include teachers who have been in the profession for more than ten years and are more knowledgeable about students' perceived difficulties.

In the Philippine context, several studies have explored empathy in general. However, research is scarce in terms of teachers’ empathy and its impact on the classroom. In the study conducted by Santiago (2023), she found that teacher participants reported above-average levels of affective, cognitive, and overall empathy. However, just like some of the research from other countries, she used a generalized instrument of empathy. In that sense, it reduces the contextual understanding of teachers’ empathy in the classroom. Hence, the existing empathy framework in education is typically drawn from psychological models, which fragment the construct into affective, cognitive, and behavioral dimensions. The vital role of empathy within pedagogy, especially in mathematics teaching, needs to be more practice-based and contextualized understanding. The corollary being that instruments or scales must be able to measure and see the true classroom climate, considering teacher empathy. The scale must be able to capture the unique expression of

empathy in the classroom, the way teachers foster empathy, and the way teachers' empathy shapes students' outcomes. Taking it all into consideration, a pedagogical empathy scale within the context of teachers is crucial and far-reaching to authentically measure their level of empathy (Meyers et al., 2019, p. 165). Hence, a customized scale for mathematics teachers facilitates a more precise and appropriate evaluation of pedagogical empathy's role in subject-specific instructional situations. Furthermore, it offers a solid foundation for recognizing deficiencies and strengths in pedagogical routines. Eventually, it allows focused interventions targeting teachers' efficacy in teaching and improved students' learning outcomes in mathematics.

Complementary to scale development and validation of pedagogical empathy, it is also important to investigate its antecedents and consequences. Looking into the variables that influence and are influenced by pedagogical empathy is necessary to understand the construct from a different perspective. For that matter, this study also aims to understand the variables that contribute to teachers' higher pedagogical empathy and what positive or negative outcomes they bring. Teachers can better develop and improve these essential skills by being aware of the components that go into pedagogical empathy (Ampofo et al., 2025; Zhang et al., 2024). Additionally, through investigating the effects of pedagogical empathy, researchers and educators can determine how it affects different learning outcomes. Understanding how pedagogical empathy influences these results can inform the development of effective teaching strategies and interventions (Ampofo et al., 2025; Ge et al., 2021; Zhang et al., 2024; Zhou, 2022). A coherent and dependable way for assessing this construct is with the use of a contextual scale for pedagogical empathy of

secondary mathematics teachers, yielding comparisons of different concepts across different situations that influence and are influenced by it. Hence, a deeper understanding of the antecedents and consequences of pedagogical empathy ushers explorations on the mechanisms to improve the teaching and learning process, along with the improvement of teachers' pedagogical empathy, which will eventually contribute to the body of knowledge in educational psychology (Martinsone & Žydžiūnaite, 2023). Consequently, this study is lucrative in education because of its potential connection to teachers' improvement of pedagogical empathy through training programs, teaching-learning interventions via instructional strategies, and the development of educational policy grounded on pedagogical empathy.

Review of Related Literature

The review of related literature discusses the variables related to the objectives of the study. This section includes empathy, related phenomena to empathy, dimensions of empathy, pedagogical empathy, classification of pedagogical empathy, pedagogical empathy in teaching mathematics, antecedents of pedagogical empathy, consequences of pedagogical empathy, empathy as a pedagogical phenomenon, and the basic empathy scale versus the pedagogical empathy scale.

Various investigations have analyzed empathy, resulting in multiple understandings of its essence. Empathy's significance has fluctuated throughout the ages. Over 40 distinct interpretations of empathy have been documented by Cuff and colleagues (2016) across time. The variations between diverse definitions of empathy arise from their con-

nections to other notions. Examining the diverse definitions of empathy as delineated by the literature is essential (Decety & Ickes, 2011). Empirical studies by diverse academics provided insights that informed our examination.

The terms "en" in its assimilated form, "em," which means "in," "during," and "together," and "pathos," which means "experience," "feeling," and "to suffer," are the origin of empathy (Breyer, 2020). Thus, there are various etymological definitions of empathy, one of which is "to suffer together." However, Lipps adapted Rudolf Lotze's German term "Einfühlung" in 1903, which translates to "in feeling" and was first used in 1858, to refer to the capacity to see oneself in another person's condition (Decety & Ickes, 2011). As a result, Titchener borrowed the word "einfühlung" from the German language to coin the English word "empathy" (Breyer, 2020; Decety & Ickes, 2011). Currently, empathy is referred by some researchers and psychometricians as knowing other person’s emotional state (Preston & De Waal, 2002) and call it “cognitive empathy” (Zahn et al., 1992; both cited in Decety & Ickes, 2011) or “empathic accuracy” (Ickes, 2004 as cited in Decety & Ickes, 2011). These researchers propose that empathy arises when one individual can deeply understand another's emotional interior. Through dialogue and surrounding cues, one can determine another's emotions. Considering the fact that a teacher may come across a visibly agitated student with a neutral expression and an empty stare. The instructor queries the student about their emotions, and the student replies by conveying their unease regarding the exam results. The former has observed that the latter is anxious about their upcoming exam, causing them to appear drained of emotions.

On the other hand, some researchers define empathy as supporting another person's expression and posture and call it "motor imitation" (Decety & Ickes, 2011; Hoffman, 2012) or "imitation" (Decety & Chaminade, 2003). According to Preston and De Waal's (2002) perception-action model, since two people have similar brain pathways, it is possible for one person to mimic another person's inner feeling by seeing and understanding how he or she feels when someone conveys an emotion experiences and then tries to duplicate it in some way, for example: when a person watches a movie depicting heartbreak and the protagonist cries, the audience will inevitably experience something similar to that emotion.

Meanwhile, some neuroscientists, psychologists, and philosophers described empathy as the capacity for one individual to experience the feelings of another (Cuff et al., 2016; Darwall, 1998; Decety & Chaminade, 2003; Decety & Ickes, 2011; Eisenberg & Strayer, 1990; Preston & De Waal, 2002). Studies emphasize, nonetheless, that experiencing empathy for another person does not always mean that one will feel the same emotion, but rather a related emotion (Hoffman, 2012). According to Hatfield et al. (1993, referenced in Decety & Ickes, 2011), empathy is a combination of emotional matching and capturing in this way. This indicates that one individual displays a physiological state that is nearly equivalent to that of another individual. "Shared physiology" is the term Levenson and Ruef (1992) used to describe this idea. But it's still unclear how much one person's emotions will resemble another's (Decety & Ickes, 2011). While we cannot yet claim to fully comprehend or feel another person's internal circumstances, we can be sure that we can get a sense of it.

Similarly, other authors have stated that empathy is the ability to imagine the thoughts and feelings of another person (Decety & Ickes, 2011). Understanding the other person's thoughts and feelings depends on the person in question, his or her actions, and desires. This approach is referred to as the "imagine him" approach by Stotland (1969), the "imagine another" perspective by Batson & Shaw (1991), "projection" by Adolphs (1999), and "perspective taking" by Ruby and Decety (2004). The concept means that one person projects their idea of what another person feels and thinks based on what they perceive. However, some researchers build their definition of empathy by stating that it is the ability of a person to imagine how to think and feel in another person's place (Decety & Ickes, 2011). This concept is referred to by some researchers as changing places in fancy, role taking, decentering, imagine-self perspective (Stotland, 1969), and simulation (Darwall, 1998). According to Stotland (1969, referenced in Decety & Ickes, 2011), the imagine-him perspective is distinct from the imagine-self perspective in some subtle ways. By visualizing oneself in the other person's situation, a person who uses the imagine-self perspective might understand how another person comes to feel or think the way they do (Stotland, 1969, as cited in Decety & Ickes, 2011). To put it another way, an empathic person can imagine themselves in another person's shoes and generally comprehend the context of that person. Therefore, the empathic person's viewpoint remains more central. The imagined perspective, however, allows one to identify another's feelings and ideas based just on their perception of the situation. While everyone has a unique context, one can project into a dialogue to comprehend the context of the other person. Even so,

one may only fully comprehend a portion of another person's feelings by projecting one's own feelings onto them.

The notion of empathy is continually evolving as more researchers show an interest in providing a clear definition and identifying the connected, measurable elements that make up the world. The nuances of the empathy notion examined in this paper are crucial for a deeper understanding of the phenomenon. It is therefore vital to transversally analyze this construct, which is central to this theory. To be more precise, research on the application of empathy by teachers in the classroom is beneficial for improving the teaching-learning process.

Related Phenomena to Empathy

Empathy is a more recent idea in philosophy (Breyer, 2020). Since it has multiple dimensions, we must find comparable but more easily understood abstractions to completely understand them. These ideas were articulated without drawing a clear contrast between them; therefore, comparable ideas can occasionally be confused with empathy. In some research, these ideas have been compared to empathy, although some significant differences exist (Decety & Ickes, 2011). Consequently, understanding empathy as a construct requires examination of several linked principles.

Empathy vs. Sympathy. It seemed like some definitions of empathy had been mixed with other concepts, like sympathy (Cuff et al., 2016; Breyer, 2020). According to some researchers, sympathy and empathy are essentially the same (Darwall, 1998; Eisenberg & Strayer, 1990; Preston & De Waal, 2002). The Editors of Merriam-Webster Dictionary (2022) define sympathy as the act of one person sharing another's sentiments. For

instance, when a loved one is grieving or has lost something, one feels sad. Furthermore, the bodily resonance that is felt when yawning because someone else is yawning serves as an example of sympathy, according to Breyer (2020), who cited Plato and Aristotle. These illustrations and ideas are comparable to how some scholars, such as Decety & Ickes (2011), defined empathy and referred to the phenomenon as "imitation." Empathy, according to Decety & Ickes (2011), is the capacity to identify with another person's expression and stance. Evidently, according to some experts, empathy and sympathy share some characteristics.

However, some academics dispute the idea that sympathy and empathy are the same constructs (Cuff et al., 2016; Eisenberg et al., 1991; Hein & Singer, 2008). The Merriam-Webster Dictionary editors (2022) stated that empathy is used when a person can conceive and comprehend how another person may feel without necessarily experiencing the same emotion as that person. Sympathy is used when one person shares another's experience. From this perspective, a sympathetic person can intuitively sense the emotional experiences of another, while an empathetic person can merely observe and comprehend them. On the other hand, sympathy, according to Eisenberg et al. (1991, p. 65, cited in Cuff et al., 2016), is a type of vicarious emotional reaction based on the observation of another emotional state or situation involving feelings of sorrow or concern for the other person. In addition, Wispé (1986, cited in Uhing, 2020) defined sympathy as an increasing recognition of another person's pain as something that needs to be addressed. In other words, a person who sympathizes is aware of the challenging situations that another person faces. Wispé (1986, cited in Uhing, 2020) went on to underline that

sympathy is defined in terms of negative feelings, in contrast to empathy, which can refer to understanding both pleasant and unpleasant situations of another person. This idea directly contradicts how Merriam-Webster Dictionary editors defined empathy and sympathy in 2022. In addition, Hein and Singer (2008) backed up the latter idea, arguing that whereas sympathy comprises "feeling for," empathy involves "feeling as" the other. They expanded on this idea by stating that when observing sadness in another, an empathic person will experience the same emotion (feeling as), whereas a sympathetic person will experience feelings of concern (feeling for). This idea is important to underscore because the intensity of involvement matters. When someone "feels for" another person's position, they frequently only offer cursory comprehension. However, when a person "feels as" another person, they often promote a deeper connection. This is in line with the research done by Decety and Ickes (2011), who found that the neural mechanisms supporting the two constructs differed significantly from one another.

Numerous studies have found substantial differences between the concepts of sympathy and empathy. When referring to understanding and experiencing another person's emotional environment, it is important to establish boundaries when using the terms sympathy and empathy. Then, if not entirely eliminated, the uncertainty around these terms will be reduced. In the context of the study, empathy is the main construct to be highlighted as it is used as a tool in making educational decisions for a successful teaching-learning endeavor.

Empathy vs. Compassion. Although empathy was only recently defined, compassion was previously considered to be the same thing (Breyer, 2020; Cuff et al., 2016;

Decety & Ickes, 2011), as it relates to the same desire to feel and understand others' experiences (Singer & Klimecki, 2014). Recent research, however, emphasizes a distinct difference between the notions of these two constructs (Breyer, 2020; Cuff et al., 2016; Darwall, 1998; Decety & Ickes, 2011; Singer & Klimecki, 2014).

Compassion, according to Goetz et al. (2010, p. 351), is the emotion that occurs when one sees someone else's suffering, and that spurs the immediate intention to lend a hand. They cite studies that claim compassion exhibits immediate facial expressions and behavior that signal a desire to assist others. Additionally, define compassion as being aware of another person's suffering and wanting to help them. It is obvious that empathy and compassion are somewhat comparable based on the researchers' definition of compassion. However, compassion needs a little more effort because it frequently reflects a desire to assist and lessen another person's suffering. Furthermore, Kanov et al. (2004), who were mentioned by Strauss et al. (2016), contend that "noticing, feeling, and responding" are aspects of compassion. In his study, he emphasized that whereas "feeling" adopts empathetic concerns, which entail taking on and visualizing another person's emotional situation, "noticing" involves being conscious of yet another person's suffering. On the other hand, "responding" entails wanting to lessen someone else's suffering. According to the definition of Kanov et al. (2004) on compassion, empathy is a phase in the compassion process. Clearly, empathy precedes compassion.

Why is empathy—rather than compassion—the study's main focus? This study emphasizes empathy rather than compassion as a tool in education since it only seeks to understand the idea that teachers are placing themselves in their students' shoes in order

to make informed decisions regarding the educational endeavor. Sometimes a teacher's compassion blurs their judgment and overcomes the requirement for a prescriptive approach to achieving learning objectives. Teachers who have a strong sense of compassion often become tolerant to the point where students take advantage of them (Quin et al., 2014). To the point that students disregard the demands of the teachers and get away with it, because they are still given passing grades. Therefore, if compassion is not used appropriately, it runs the risk of becoming just another inefficient teaching tool. Instead, to be more objective in ensuring that educational goals are met, teachers must combine directive and co-creative approaches (Quin et al., 2014), which empathy as an educational tool offers.

Dimensions of Empathy

The dimensions of empathy have been the subject of numerous studies by researchers. The notion of empathy can be defined in part by these attributes. According to the author's viewpoint, the dimensions of empathy vary (Cuff et al., 2016, cited in Uhing, 2020; Stepien & Baernstein, 2006). Despite the fact that empathy can be conceptualized in many ways, finding a common ground in the conceptualization of a trans perspective definition of empathy is crucial. As a result, researchers should compare different conceptions of empathy in order to develop an understanding of empathy that is unified. Accordingly, this study will highlight the three dimensions of empathy derived from a variety of research (Wiseman, 1996; Neumann et al., 2016; Powell & Roberts, 2017; Cherewick et al., 2022) and two dimensions of pedagogical empathy (Borich, 2016; Decety & Meyer, 2008; Meyers et al., 2019; Rogers, 1957; Starcevic & Piontek, 1997).

Three Dimensions of Empathy. Empathy is pivotal in developing good relationships with others, including understanding them, creating a good rapport, and establishing social harmony (Berardi et al., 2020; Norfolk et al., 2007). This can be seen in all aspects of daily life. In education, empathy is an integral part of institutional and pedagogical decisions to foster inclusive and supportive teaching-learning environments (Makoelle, 2019). Teachers can understand, feel, and make teaching adjustments to cater to their students' needs. Hence, affective, cognitive, and behavioral dimensions of empathy are discussed in this study, as it is necessary to understand and appreciate its vital role in the teaching and learning process.

The First Dimension is Affective. The affective dimension of empathy as applied in education comprises the ability of teachers to feel and identify with the emotional state of their learners (Ampofo et al., 2025; Maximiano-Barreto et al., 2025). Affective empathy drives care, a supportive educational environment, and authentic emotions (Ampofo et al., 2025; Jia et al., 2024). It is necessary to identify with how students feel because it serves as a guide for teaching decisions.

According to Wiseman (1996), empathy is a feeling-based reaction that results from understanding how another person is feeling. People may feel similar feelings to those they see others experience when they watch them (Cherewick et al., 2022; Neumann et al., 2016). However, the degree to which people are emotionally invested in their sympathetic reactions varies. For a variety of reasons, some people find it difficult to emotionally relate to their own experiences, while others react more strongly when witnessing horrifying situations in others.

This specific form of empathy enables people to intimately connect with the emotional experiences of others. According to a 2016 investigation by Neumann and peers, empathy's emotional and cognitive elements are linked with personality characteristics. The study indicated a correlation between emotional empathy and agreeableness among the Chinese sample, while also revealing an inverse relationship between these variables and neuroticism. People with an agreeable nature were more likely to catch the emotional states of those nearby. In contrast to their counterparts, individuals with lower neuroticism showed restraint when encountering others' unpleasant feelings. These findings also show how cultural norms affect how effective empathy and personality variables relate to one another.

Research has connected affective empathy with favorable results in mental health. According to Kanske et al. (2015), greater scores on tests of trait emotional intelligence, which include components related to affective empathy, were linked to lower levels of depressive and anxiety symptoms. This shows that empathetic behavior and skill development, especially affective empathy, can support mental health outcomes (Cherewick et al., 2022). Hence, empathic teachers can help students learn more by being aware of their emotional states.

One feature of this dimension is exemplified when teachers are attuned to students' sense of fulfillment as a consequence of excelling in the classroom. A positive learning environment is co-created by teachers and students when students show satisfaction and happiness in learning. This is parallel to the ideas in the study of Könings et al. (2021), which posit that co-creation in learning is formed when there is active learner in-

volvement and teacher-student collaboration during class activities. Clearly, when teachers are able to feel the students' emotions, whether positive or negative, they can create an environment that is inclusive and liberating for learning.

Furthermore, knowing students' struggles and responding to them are as important as empathizing from an instructional perspective. Teachers who demonstrate genuine care in their students' issues can foster and preserve a supportive psychological safety in the classroom (Monteiro et al., 2021). However, teachers should avoid excessive protection to solve students' problems. In the long run, the absence of risky experience will limit the development of students' resilience and independence (McCalman et al., 2017). Also, the ability to empathize with the disappointments and loneliness of students is crucial for forming trusting relationships. McAllister and Irvine (2002) found in research that it is important for teachers to show empathy to students to prevent feelings of loneliness and to promote students' sense of belonging.

Understanding students' needs and frustrations, and having the ability to empathize with their challenges, are other forms of building an empathetic relationship with the students. In this sense, Wan et al.'s (2023) findings on the importance of teacher empathy in addressing the diverse needs of students and in facilitating their academic achievement resonated in this study. In addition, building on students' social lives and enjoying their joy will also nurture a school community. The outcomes by Dietrich et al. (2021) highlighted the role of teacher-student relationships in establishing a positive classroom that acknowledges students and offers help.

In conclusion, empathy in education must focus on the affective part of empathy, which is defined by emotional understanding and the sharing of others' feelings. It enables the development of sincere emotional bonds between teachers and students, generating an atmosphere of support and caring that is motivated by empathy. Understanding and separating the affective component of empathy can help one get insight into how people behave emotionally and how it might affect their general well-being.

The Second Dimension of Empathy is Cognitive. Understanding and recognizing other people's viewpoints and thoughts are the main objectives of the cognitive component of empathy. It entails having the capacity to mentally adopt various points of view while taking into account what others might feel or believe in particular circumstances. Cognitive empathy allows people to see beyond their own experiences and gain comprehension of those of others, promoting empathy-driven tolerance (Neumann et al., 2016).

There are various levels of cognitive engagement in empathetic responses, with some people demonstrating a stronger ability to take another person's perspective and understand their emotions, while others may struggle for a variety of reasons, according to Wiseman (1996). Empathy is an intellectual process that necessitates active listening, observation, and interpretation (Cherewick et al., 2022). Developing emotional intelligence requires recognizing and addressing social cues.

As Wang et al. (2022) noted, there is a connection between the cognitive aspect of empathy and several personality characteristics, such as openness, agreeableness, and neuroticism. High degrees of openness often coincide with enhanced cognitive empathy capabilities. The connection between innate personality characteristics and emotional un-

derstanding has been explored. Neumann et al. (2016) referred to Davis and Franzoi (1991) in stating that people with high agreeableness are more likely to demonstrate heightened empathic concern.

According to Morelli et al. (2014) study, increased empathic understanding corresponds to higher levels of internalized behaviors. Both cognitive empathy and its opposite, impaired emotional intelligence, can impact one's mental health in distinct ways. Investigations have underscored the need to differentiate the emotional and cognitive aspects of empathy when analyzing social actions. According to Shamay-Tsoory et al. (2009), those with brain damage to the emotional areas were unable to accurately decipher facial signs of emotional states. Investigating the many faces of empathy, such as cognitive empathy, offers invaluable insights into the subtle yet profound ways in which social interactions shape our mental health over time.

Teachers who have high cognitive empathy are attuned and sensitive to their students' views, feelings, thoughts, problems, and learning situations (Erlich & Gindi, 2021). Empirical findings show that there can be no positive teacher-student relationality and academic achievement without these insights (Kozina et al., 2023). As a case in point, understanding the perspective of students requires that you acknowledge and give credit to their views in the classroom. Empirical studies provide evidence of the significant impact of acknowledging different perspectives of students in enhancing their learning and development. Hence, knowing the emotions and ideas of students means that you are truly aware of their emotional life and their contributions to the intellectual life of the class-

room. It is important because it goes a long way in making students feel welcomed, validated, and respected in the classroom environment (Benner et al., 2017).

In addition, making sense of students' thinking and their mathematical and learning environment can involve critical reflection. The process of engaging in reflective practice entails thinking deeply about students and the contexts in which they learn (Suphasri, 2021). This can help teachers develop the kinds of pedagogical practices and interventions that allow students to be the best that they can be in a particular context (Zahid & Khanam, 2019). Furthermore, a strong example of cognitive empathy in teaching is the understanding of the necessity to develop relationships with students and consideration of their unique qualities (McAllister & Irvine, 2002). The creation of a collaborative, inclusive, and encouraging learning environment is mostly the responsibility of educators who recognize the importance of a strong rapport and modify their methods according to the sorts of students they work with (Zhu et al., 2019). Grasping the significance of how students feel and considering their emotional circumstances in addition expresses one's cognitive empathy (Martingano & Konrath, 2022). When teachers understand the importance of students' emotional states and can actively read student cues, appropriate interventions can be made for the student, and a climate of healthy learning can be established (Wanless & Domitrovich, 2015).

In conclusion, the ability to accept divergent views and gain insight from other people's experiences is part of the practice of cognitive empathy. The ability to tolerate empathy with compassion is essential for successful relationships between teachers and students, as well as academic success. By being aware of the thoughts and feelings of

your students, you can change interventions to help create a supportive learning environment.

The Third Dimension of Empathy is Behavioral. The capacity to comprehend and react, via actions and behaviors, to the feelings and experiences of others is known as behavioral empathy (Cherewick et al., 2022). It involves responding with love, compassion, and support for other people. Also, empathizing with others demands an acute understanding of their feelings, which can be developed through practice. Showcased by the teacher's skill to detect and adapt to nonverbal hints, including body language and facial expressions, as evident in (Eklund & Meranius, 2021). In academic settings, this component of empathy is essential as it allows educators to create an inviting and inclusive atmosphere for their learners. Empirical findings demonstrate a positive correlation between empathic behavior and enhanced social/emotional performance. As revealed by Sesso et al. (2021), there exists a positive association between heightened empathetic capacity during early adolescence and diminished incidence of psychological issues. Data reveals that educators with empathetic tendencies excel at fostering a protected academic atmosphere and bolstering students' emotional resilience. Furthermore, behavioral empathy has been connected to better academic outcomes. Preston and De Waal's (2002) study indicates that behavioral empathy is connected to superior performance on social cognition tasks. This shows that behaviorally empathic teachers are better at identifying and addressing the needs of their students, which enhances learning outcomes.

Furthermore, behavioral empathy manifests in numerous ways, which are important in creating a supportive and successful learning environment. Paying attention to

the emotional needs of the students is not only important for care and support, but also for making the students feel valued and understood (Mercader-Rubio et al., 2022). Teachers who express empathy about the fact that the students could have multiple learning styles show an understanding of the fact that not all students learn the same way, and would adjust their teaching approach accordingly (Sarkingobir et al., 2023). Not to forget that a teacher's empathic behavior towards academic difficulties would maintain rigor in teaching, without compromising student success (Wijaya & Setiawan, 2021). The setting in which mathematics is taught is also vital, and having a conducive learning environment for mathematics promotes communication and co-operation (Pu et al., 2023).

To incorporate behavioral empathy, listening to the students' worries that may or may not be related to the content (Lalor & Baird, 2006), and correcting errors gently (Hoth et al., 2022) are essential. Every student wishes for support from a patient listener and from a guide who rectifies the errors and empathizes with their feelings. Validating student attempts (Zhang et al., 2024) helps the students in developing a more positive orientation towards their own learning. Every attempt should be given a pat on the back, without causing any confusion between praising trying without learning, and praising results. Letting every student speak in the discussion, irrespective of the correctness of the response (Sayeski & Brown, 2011) and modifying the teaching to accommodate the needs of the students (Aldrup et al., 2022) would help in the line of not skipping any minor aspect of the empathy opportunities in class.

In addition, encouraging students to finish the task (G. Wang et al., 2024) stimulates a growth mindset in them, assisting them in developing resilience. According to

Ampofo et al. (2025), teachers' demonstration of behavioral empathy is a key component of the learning environment where students are likely to get engaged and experience academic success. Another relevant finding is from the study by, where the authors provide evidence of the role some teachers played in students' sense of belonging and well-being in the classroom.

In conclusion, understanding and relating to another person's actions is essential for empathy in educational settings. The instructor's skillset involves effectively recognizing and responding to the actions of students with empathy and supportiveness. According to research, behavioral empathy among students is linked to better social and emotional outcomes as well as higher academic outcomes. By recognizing and addressing nonverbal signals, teachers can foster a nurturing setting that benefits the welfare and progress of their students.

Two Dimensions of Empathy in Teaching. Empathy is the cornerstone of the educational decision-making process since it is a basic tool for determining what is needed, pertinent, and effective in instruction and development. Examining two basic elements that underlie its relevance and provide a concrete basis for knowledge on how empathy influences instructional strategies is "Empathic Understanding" and "Empathy in Teaching." It is thus not only advantageous but also necessary to totally understand how empathy promotes a positive and effective learning environment in the classroom through these components.

Empathic Understanding. Empathy theory, which emphasizes that taking on another person’s viewpoint improves one’s capacity to recognize and understand their

thoughts and emotions and makes it easier to share experiences, needs, and desires, is the foundation of empathic understanding (Riess, 2017). According to Clifton and Grushka (2022), empathic understanding also includes the deep ability to relate to and deeply connect to the experiences, viewpoints, and feelings of others in order to promote meaningful and compassionate interactions. Hence, empathic understanding requires not only feeling students' emotions or perspectives but to going beyond it by understanding how and why they feel the way they feel. Understanding students' perspectives and the reasons that drive their emotions of struggles or success helps teachers to make sound educational decisions. Therefore, empathic understanding as a dimension of pedagogical empathy is the ability of teachers to understand the feelings, emotions, points of view, thoughts, and difficulties of the students (Decety & Meyer, 2008; Rogers, 1957; Starcevic & Piontek, 1997).

Empathy in Teaching. Empathy in teaching goes beyond feeling and understanding the students' emotions and perspectives, but includes finding effective strategies that fit the students' context (Zhou, 2022). It is a pedagogical tool to make sound and actionable educational decisions (Aldrup et al., 2022). Empathy in teaching also includes creating a supportive and inclusive learning environment, which leads to improved learners' engagement and academic performance (Ampofo et al., 2025; Zhang et al., 2024; Zhou, 2022). Moreover, through sustained listening and emotional awareness, teachers can have a clear view of what learning strategies and learning styles are appropriate to students' needs (Zhou, 2022). Thus, empathy in teaching refers to the ability of teachers to adjust

their educational decisions and actions to match students' difficulties, perspectives, anxieties, and actions (Borich, 2016; Meyers et al., 2019).

Pedagogical Empathy

Building a relationship with students through empathy is essential to effective teaching in order to create an atmosphere that encourages academic achievement. Previous studies have shown that teachers who demonstrate empathy for their students are more likely to see higher levels of engagement and develop strong relationships with them (Davis, 1996; Eisenberg et al., 1991; Swan & Riley, 2015). Furthermore, developing an understanding of students can result in better academic achievement for those who are having difficulty or feel overburdened by the course material (Davis, 1996, cited in Swan & Riley, 2015). Researchers probing empathy's function in teaching developed the term "Pedagogical Empathy," though the identity of its creator remains uncertain.

The esteemed educator Uhing (2020) laid the foundation for understanding pedagogical empathy through her research. This definition highlights the significance of teachers utilizing their proficiency in recognizing the singularities of their students to construct a more gratifying and productive learning environment. This definition is in conjunction with Ampofo et al. (2025 definition of pedagogical empathy, which states that it is the ability to recognize and respond appropriately to individual student needs. As noted by Jolliffe and Farrington (2006), pedagogical empathy revolves around grasping the mental processes that influence a pupil's academic behavior to foster better academic support. Additionally, Posokhova et al. (2020) characterized pedagogical empathy as the capacity to correctly recognize and address a learner's emotional requirements, thereby

establishing an atmosphere that fosters optimal educational engagement. Like Uhing's (2020) definition, the latter concept highlights comprehension rather than purely reacting to students' emotional requirements for successful instructional practice.

Taking all this into consideration, several researchers agree that pedagogical empathy is the practice of teachers using their understanding and knowledge of students to create a more effective learning environment. Being cognizant of individual student needs and promptly addressing any difficulties or emotional burdens is crucial for optimal academic performance. The provision of aid extends to students battling issues that could impede their academic progress. In a nutshell, pedagogical empathy is defined as the practice of teachers using their understanding and knowledge to recognize, respond appropriately, and understand the cognitive processes underlying a student's behavior to create an environment that is conducive to learning.

Classification of Pedagogical Empathy

As a latent construct, pedagogical empathy may be measured in several aspects. However, to quantify pedagogical empathy using multiple factors, it is required to first comprehend its categorization. In this study, I identified four primary forms of pedagogical empathy from other relevant studies that may be combined to produce new types of empathy. Interpersonal, social, cognitive, and affective empathy are the four basic forms of pedagogical empathy (Segal, 2011; Meyers et al., 2019).

The first of the four primary classifications of pedagogical empathy is interpersonal pedagogical empathy. According to Meyers et al. (2019), interpersonal empathy refers to the mechanisms by which one person learns about another's interior condition

and is driven to respond with sensitive care. However, Meyers et al. (2019) extended Carl Rogers' (1969) notion of empathy as a function of education by applying this word to teachers. They coined the phrase "teacher empathy," which asserts that learning is far more likely to take place when a teacher is aware of how education and learning seem to the student and can decipher the student's internal response (Rogers, 1969, as cited in Meyers et al., 2019). This notion is consistent with the description of pedagogical empathy as a relationship in which a teacher empathizes with a student and uses that knowledge to guide instructional decisions (Uhing, 2020). As a result, in this study, teacher empathy also refers to pedagogical empathy. This leads to my own interpretation of interpersonal empathy as interpersonal pedagogical empathy. Consequently, interpersonal pedagogical empathy refers to the methods by which a teacher learns about a student's inner state and is motivated to respond with attentive care.

Second, by having a solid understanding of larger societal difficulties, a person may be motivated to work toward improvements that affect large groups of people, which is what social empathy exhibits (Southwick et al., 2016). Even though Meyers et al. (2019) proposed a distinct interpretation of social empathy, where it is seen as the ability to comprehend individuals via a conscious acknowledgment of their life events and experiences, thereby fostering an appreciation of societal disparities and inequalities. Clearly, Meyers et al. (2019) defined social empathy as applied to the context of teachers. This highlights the teacher's ability to grasp the social atmosphere of the learner and utilize such understanding to inform effective educational strategies.

The third and most critical form of pedagogical empathy is cognitive. As revealed by Khanjani et al. (2015), cognitive empathy pertains to a person's ability to identify and address another person's emotional state. In essence, cognitive empathy entails being able to fully understand an individual's emotional state through profound mental processing (Decety & Ickes, 2011). A rational appreciation of another's feelings can serve as a conclusive indicator of cognitive empathy. However, Swan and Riley (2015) adopt a pedagogical approach to understanding teacher empathy. Cognitive empathy involves the capacity to thoroughly understand and address the learner's thoughts and emotions. So, from a teaching perspective, I employed cognitive empathy in this investigation.

In this study, affective pedagogical empathy is the final category. Affective empathy was taken from a generic standpoint but is then seen via a pedagogical lens, just as the other categories of pedagogical empathy. According to Van Zonneveld et al. (2017), affective empathy is the ability of an individual to experience what another person feels while they are going through a certain emotion. In addition, Decety and Ickes (2011) posit that it is the ability to have emotional responses to the experiences of others that is being seen. It is obvious that an effectively empathetic person may share and experience other people's emotions and react to them appropriately. On the other hand, affective empathy, according to Zhu et al. (2019), helps educators to demonstrate compassion that influences their decision-making regarding what instructional strategies are most effective. In that regard, a pedagogical viewpoint is used to view affective empathy. As a result, affective pedagogical empathy in this study is operationalized as the capacity of teachers

to respond to and experience the emotions of their students in a way that affects their instructional choices.

Pedagogical Empathy in Teaching Mathematics

The concept of pedagogical empathy has been gaining popularity as an essential part of enhancing mathematics teaching. Often, mathematics is viewed as a cold and inflexible discipline because of the perception that it is commonly taught with little consideration for the emotional and psychological experiences of the learners. This leads to the alienation of learners, especially those who struggle, because of the lack of attention, which makes the learners view themselves as "not math people" (Black et al., 2011). Simms (2016) contended that students persevere through the challenges in mathematics learning when they feel that they are intellectually respected and emotionally supported. In this context, empathy is more than just showing kindness. It is also about identifying the obstacles that students must overcome and making a concerted effort to remove them.

A crucial component of pedagogical empathy is the capacity of teachers to be attuned to their students' feelings about learning practices (Lane & Smith, 2021). Eventually, making students feel that they are emotionally safe. According to Wanless and Domitrovich (2015), academic motivation is positively associated with emotionally empathetic settings. Hence, when teachers practice empathy in the classroom, students tend to feel safe and comfortable inquiring, admitting misconceptions, and making mistakes. All of which are necessary for learning difficult subjects such as mathematics, without lowering the standards of education. Zhou (2022) highlighted that empathy in education is about honing an atmosphere where students are inclined not to diminish expectations

but to satisfy them. Consequently, mistakes become a natural function of the learning process rather than a disappointment, and learning becomes collective rather than competitive. Hence, teachers build an atmosphere based on common understanding and respect that leads to a shift in classroom culture (Monteiro et al., 2021).

The students' conception of their academic beliefs is significantly shaped by teachers' empathy (Ge et al., 2021; Zhang et al., 2024). According to Rittle-Johnson et al. (2024), some students who belong to marginalized backgrounds hold unfavorable opinions of their abilities to learn mathematics. Hence, teachers need to be empathic to motivate students to persevere in learning mathematics (Zhang et al., 2024). Gallagher et al. (2022) posit that empathic teaching alleviates students' idea that only a few students can excel in math. Thus, empathic teaching helps build students' intrinsic and extrinsic motivation, confidence, and self-efficacy. Therefore, pedagogical empathy makes way for inclusivity and equity in mathematics education by recognizing individual students' strengths and weaknesses and understanding individual students' contexts. This, in a way, helps to dismantle the stereotype that mathematics is only for those few students.

Furthermore, empathy in the classroom alters teachers' professional practices (Aldrup et al., 2022). Empathic teachers tend to check how they feel during the process, apart from understanding and adjusting to students' contexts. Teachers' self-emotional cognizance results in more responsive teaching (Denston et al., 2022). To make math more inclusive and engaging, teachers modify the setting, structure, and pace of instruction. Lee & Hannafin (2016) suggested that instructional flexibility assists students who have difficulties in conceptualizing and managing disinterest in learning. These can be

done by adjusting the learning-instructional materials, letting students form their own conceptualization of how correct or incorrect their answers are, or relating students' personal experiences to mathematical ideas.

Despite all these advantages, incorporating pedagogical empathy remains a challenge in daily instruction. Systemic problems such as overcrowded classrooms (Osai et al., 2021), congested curriculum, and rigorous assessments hamper the capacity of teachers to establish meaningful connections with students. Nevertheless, studies show that empathy in teaching has an enormous impact on students' academic achievements, beliefs, and inclinations (Aldrup et al., 2022; Ampofo et al., 2025).

Antecedents of Pedagogical Empathy

Generating an inclusive and motivating learning environment that benefits teachers and students both depends on empathy-driven pedagogy as a basic idea. Different factors influence the formation of pedagogical empathy, consisting of self-efficacy in teaching mathematics, self-efficacy in mathematics, gender, and basic empathy. Similarly, it has been discovered that teachers who feel more capable in the subject area of math tend to demonstrate higher degrees of compassion toward their students. By understanding the precedents of pedagogical empathy, teachers can foster a more sympathetic and supportive learning atmosphere for every learner (Ampofo et al., 2025).

Teacher Self-Efficacy. Self-efficacy among teachers is central to quality instruction. It involves the capacity to trust their ability to provide an excellent teaching–learning process. There is a strong relationship between self-efficacy and pedagogical empathy that leads to sound teaching decisions (Aparicio-Flores et al., 2020; Graziano et

al., 2024). The findings in the study by De Ruig et al. (2024) revealed that several teachers with high self-efficacy are likely to be understanding and show concern when interacting with their students. The findings of Aparicio-Flores et al. (2020) and Graziano et al. (2024) indicated that teachers with high self-efficacy are capable of reacting in a helpful fashion and are able to handle the emotional conditions of their students. An alternate interpretation of the correlation between teacher confidence and educational empathy might be that educators with more robust self-beliefs tend to use proactive techniques to regulate their instructional settings and offer understanding responses to their students' emotional needs. Providing examples, they could illustrate how to encourage positive actions with rewards and compliments are encouraging instead of relying on reprimands and unwelcome criticism (Aparicio-Flores et al., 2020). One possible interpretation could be that teachers with increased belief in their abilities are better able to govern their own emotions, leading to a more understanding and supportive reaction towards their students' emotional needs. Studies have revealed that emotional regulation is a vital aspect of teaching, as it empowers teachers to remain serene and centered when faced with difficult situations (Brackett et al., 2011).

In addition, teachers who manifest high self-efficacy are more likely to adopt self-reflection in teaching, such as assessment of their teaching approaches and asking feedback from co-teachers and superiors. These have the propensity to increase teacher awareness of students' emotional and learning requirements, which in turn brings positive academic results. A 2014 research project carried out by Hen and Sharabi-Nov found that involving novice educators in participatory and introspective exercises increases their

emotional acuity. Teachers with high self-efficacy are apt to take part in this approach, thereby fostering greater degrees of pedagogical empathy. The connection between teachers and students might influence the building of instructional talents. A more robust sense of personal capacity among educators could translate into increased rapport with their students, resulting in improved emotional insight and bonding. Teacher self-efficacy is not an inherent trait; rather, it can be learned and perfected with proper coaching. Improving teacher self-efficacy enhances supportive teaching strategies. For instance, in the study by Klassen and Chiu (2010), they found that a teaching professional development plan that focuses on the enhancement of self-efficacy resulted in improved teacher-student connections and augmented student participation.

In conclusion, a high level of self-efficacy is vital in creating a sustained and effective teaching-learning process, which is central to pedagogical. It is therefore necessary to provide teachers with an avenue to develop their self-efficacy in teaching through training and other teaching-enhancement activities. By improving their self-efficacy, teachers can become more confident and effective in managing the emotional needs of their students, which can lead to greater levels of pedagogical empathy and ultimately, better educational outcomes for their students.

Self-Efficacy in Teaching Mathematics. Empathy in education often hinges upon an individual's belief in their own ability to teach math. As expounded by Giles et al. (2016), self-efficacy refers to the judgment teachers form regarding their skill to proficiently impart math principles and motivate student learning. However, pedagogical em-

pathy is a teacher's capacity to recognize and address the requirements of their students (Krejci et al., 2022).

Empirical evidence suggests that a teacher's confidence in their math teaching skills can directly impact their emotional support for students. The analysis conducted by Giles and his team (2016) indicated a strong connection between the degree of empathy possessed by elementary preservice teachers and their confidence in teaching mathematics. Evidence suggests that teachers with stronger self-efficacy in their teaching abilities tend to exhibit greater compassion towards their students, understand their requirements better, and offer appropriate support.

Teachers' self-assessed capabilities as educators may additionally shape how they relate with students and convey knowledge, thus impacting their ability to demonstrate empathy in their teaching approaches. The study by Perera and John (2020) suggested that teachers who adopt student-centered approaches and provide tailored support to students tend to have higher self-efficacy views regarding teaching mathematics. Research indicates that teachers with high self-efficacy are apt to foster students' self-efficacy in mathematics and create an environment where students flourish.

Ultimately, self-efficacy in mathematics teaching is a significant predictor of pedagogical empathy. Educators possessing higher confidence in their math teaching abilities tend to display greater compassion toward their students, comprehend their requirements more effectively, and offer appropriate support. By comprehending and reinforcing the sense of ability among math teachers, we can create a more personable and engaging learning environment for students.

Self-Efficacy in Mathematics. Empathy as a teaching-learning approach is deemed to be correlated with an increase in self-efficacy in mathematics. This notion involves one's confidence in solving different levels of mathematics problems, central to empathy (Yang et al., 2021). According to research, pedagogical empathy can be preceded by a teacher's level of mathematics self-efficacy because teachers who are more confident in their ability in mathematics are more likely to display empathy for their students.

The investigation led by Yang et al. (2021) found that academic self-confidence plays a critical role in connecting math performance and instructor encouragement, underscoring the vitality of this element in students' educational success. This shows that teachers may promote empathy in their teaching methods by providing students with emotional support. Proficient math teachers are more likely to offer emotional support to their students, fostering an environment of empathetic instruction.

Evidence suggests that a teacher's belief in their own math capabilities significantly impacts their capability for empathetic instruction. According to a study conducted by Küçükalioğlu and Tuluk (2021), teachers with high confidence in their abilities had a positive effect on their students' math performance. The findings show that mathematics teachers with high self-efficacy in mathematics are more likely to motivate learners, which leads to improved mathematics learning achievement.

On the contrary, there is a lack of focus on the direct relationship between teacher self-efficacy in mathematics and pedagogical empathy. While there is research that connects self-efficacy and empathy, there is no research that directly suggests that self-

efficacy in mathematics predicts pedagogical empathy. Hence, there is a need to put this in the light for further research investigations.

In the end, being capable of math is vital to developing empathy towards students. High levels of self-confidence in math abilities are essential for educators to understand and address the individual requirements of their students. Gaining comprehension of and boosting math educators' confidence in their abilities can facilitate the development of educational empathy, which, in turn, fortifies the teaching and learning experience in math education. However, research investigation that sheds light on the direct relationship between self-efficacy in mathematics and pedagogical empathy must be delved into.

Gender. Recent studies investigated the influence of teachers' gender on empathy as a tool in teaching (Olson et al., 2019; Samavi et al., 2022). The notion of gender of teachers opens discussions on the parameters of its effect on teaching with empathy. The mutuality of gender and empathy in teaching is important in the investigation of the influence of gender on empathy.

Various studies have explored how teacher gender influences pedagogical empathy. According to the investigation led by, there is a remarkable difference in empathy between male and female teachers in the classroom. This idea is supported by the findings of Graziano et al. (2024), who noticed that female teachers exemplified a higher level of empathy and are more empathic communicators during student interactions. The data imply that, naturally, female teachers tend to show a higher level of empathy in their teaching decisions.

Studies on the link between gender to teachers' display of empathy in the classroom have recently on focus. For instance, in the study by Jugović et al. (2023), findings revealed that female teachers tend to manifest empathy in the classroom than male teachers. The underlying cause of this trend might be traced back to traditional beliefs emphasizing emotional expression as a feminine trait. This also applies to how teachers show empathy more frequently to female students than to males. According to Lei et al. (2018), other investigations have discovered that male students tend to receive less empathy from educators due to their more impetuous or nonconformist conduct.

Despite its seemingly straightforward nature, the relationship between gender and pedagogical empathy is rather intricate. To illustrate, a 2025 study led by Zhao et al. found that the connection between teacher gender and empathy was indirectly affected by emotional intelligence, implying that emotional intelligence plays a key role in understanding gender discrepancies in teaching empathy. Cultural elements could potentially shape the link between gender and pedagogical empathy. The findings of Qin and Zhang (2024) suggested that there are relatively fewer gender-based differences in educational empathy within Chinese cultural contexts when compared to Western societies. Cultural traditions emphasizing concord and collaboration among students contribute to this phenomenon.

In summary, studies revealed that gender predicts empathy in the classroom more from female teachers than male teachers. However, though female teachers more frequently manifest empathy in teaching than male teachers, it is not the case that enhancement of empathy in teaching should focus only on male teachers, but on all teachers. This

will only mean that gender stereotypes are disregarded since the goal is to improve the use of empathy in the classroom. Further, there is more to gender that influences the development of higher levels of pedagogical empathy, such as emotional intelligence and cultural factors. Hence, teachers must take all these things into consideration to understand the elements to establish a compassionate and inclusive educational setting for every student, regardless of gender identity (Lei et al., 2018).

Empathy. By placing empathy as an initial step, we can better facilitate productive teacher-student connections and improve student achievement. As highlighted by Conyers and Wilson (2017), empathy involves being able to deeply understand and feel what another person feels. It entails both affective empathy (emotional sensitivity to the states of others) and cognitive empathy (the ability to understand and take the perspective of others) (Eklund & Meranius, 2021). Scientific studies demonstrate that empathy can be deliberately fostered and honed, rendering it a crucial asset for teachers.

Studies stress the importance of empathetic interactions in a classroom setting. For instance, a thorough research project spearheaded by Aldrup et al. (2022) emphasized the essential value of empathy in instruction, along with its association with productive teacher-student communication and remarkable academic successes. Inclusive educators design an atmosphere that enables students to feel supported and thrive academically. Investigations have been conducted regarding the direct, firsthand encounter with empathy in elementary school settings. Empathetic teachers are more likely to create an engaging learning environment that supports the academic success of their pupils, as revealed by

Swan (2021). This demonstrates the value of empathy in creating enduring teacher-student relationships and improving the learning environment as a whole.

A variety of suggested approaches aim to enhance empathetic development in educational environments. A productive approach involves modeling, where educators demonstrate empathetic behavior toward students through their interactions (Wilson & Conyers, 2017). Displaying understanding and concern can foster an atmosphere conducive to growth and motivation among students. A different approach that can improve empathy is a teaching point of view. Through this method, Conyers and Wilson (2017) discovered that encouraging students to consider diverse perspectives can help foster empathy and its associated capabilities. Practices such as viewpoint-oriented activities, literary circles, and joint issue-solving exercises can facilitate attaining this goal.

In conclusion, empathy influences teacher-student interactions and student outcomes as an antecedent to pedagogical empathy. Teachers may establish a welcoming and inclusive learning atmosphere by being sensitive to and expressing the feelings of others. In learning settings, approaches such as student-centered modeling and teaching can foster empathy. Teachers must learn to understand their peers to establish a setting conducive to improved student involvement and welfare.

Consequences of Pedagogical Empathy

Pedagogical empathy facilitates a lucrative learning environment that is driven by understanding, feeling, and making educational decisions based on students' emotions and viewpoints. Empathy as a teaching tool ushers in a reduction in students' mathematics anxiety and improves students’ mathematics academic achievement. Research sug-

gests that empathic teachers help learners to alleviate the students' lack of confidence in mathematics, which in turn lessens their mathematics anxiety, increases their self-efficacy, and improves their academic performance (Rozgonjuk et al., 2020). Through empathy, teachers can see students' context and academic needs. Hence, teachers can infer the appropriate learning strategies that fit the students' context. Additionally, passionate teachers who give efficient math instruction may alleviate students' fears by fostering their enthusiasm and interest in the subject through positive and interactive learning settings that are empathy-driven. Overall, pedagogical empathy is found to be an effective technique for developing students' capacity for problem-solving and academic accomplishment, as well as having a favorable effect on instructors' well-being and sense of fulfillment in their work (Uhing, 2020; Zhang et al., 2024).

Students' Mathematics Anxiety. One of the factors that hinders students' development in mathematics learning, which affects their well-being, is mathematics anxiety. In the study conducted by Mendoza et al. (2024), anxiety is found to be negatively correlated with psychological well-being. Furthermore, Mendoza et al. (2024) posited that mental health has two dimensions, which are positive affective experience (such as optimism and hope) and mental illness, in which anxiety is an indicator. In the context of this study, it suggests that mathematics anxiety is a negative indication of student psychological well-being. Mathematics anxiety, however, can be reduced when teachers employ empathy in the classroom as an instructional tool by being attuned to the students' emotional and intellectual states. Empathy as a tool in teaching is the ability to understand, feel, and make pedagogical decisions that induce an inclusive and supportive learning

environment that helps students build their self-efficacy and achievement in mathematics (Aldrup et al., 2022).

Research revealed that mathematics anxiety is linked to the lack of skills in basic mathematical tasks and problem-solving difficulties (Rozgonjuk et al., 2020). An increase in confidence in learning mathematics and improved mathematics learning achievement are aided when teachers display empathy as an instructional tool. For instance, a study by Yang et al. (2021) revealed that when teachers exemplified empathy in the classroom, students tend to increase self-efficacy and confidence, which alleviates mathematics anxiety, leading to an increase in students' learning engagement and improved academic achievements. Hence, emotional support shown by teachers helps build their use of empathy in the classroom, which results in lower mathematics anxiety in students.

Additionally, teachers who employ a deep approach to learning, which emphasizes comprehension and meaning making, can aid in lowering students' anxiety related to mathematics. According to a study by Rozgonjuk et al. (2020), mathematics anxiety is linked to students' superficial learning. This means that students tend to learn through rote memorization and lower-order thinking skills, which consequently results in a shallow understanding of the concepts. However, Rozgonjuk et al. (2020) also posited that through teachers' supportive learning, students improve their self-efficacy, which results in lower mathematics anxiety. Consequently, supportive teaching champions empathy in the classroom, helps students to form their confidence in learning, and alleviates students' mathematics anxiety.

Furthermore, teachers who are passionate about mathematics and deliver adequate mathematics-related instruction may help in reducing students' apprehension about math. According to a study by Jackson & Leffingwell (1999, mentioned in Rozgonjuk et al., 2020), effective mathematics-related education and teachers' enthusiasm for mathematics have a significant role in students' development of math anxiety. Students' interest and motivation in mathematics can be cultivated by teachers who show empathy for their students by establishing a positive and stimulating learning environment.

Teachers can employ a variety of techniques, including group projects and active learning, to help students who are anxious about math. According to a study by Cooper et al. (2018), collaborative tasks and other forms of active learning can help students feel less anxious. The collaborative and encouraging learning environment and active learning practices allow teachers to establish and help students develop their confidence and performance in math.

In conclusion, pedagogical empathy can significantly help students who are anxious about math. Empathetic teachers can promote deep learning, boost students' confidence in their mathematical abilities, and deliver effective mathematics-related instruction. Active learning techniques enable teachers to create a welcoming and stimulating learning atmosphere that encourages students' self-assurance and achievement in mathematics. The development of effective teaching practices that encourage positive teacher-student interactions and improve the teaching and learning experience in mathematics education can benefit from an understanding of and support for teachers' pedagogical empathy.

Students' Perceived Math Problem-Solving Skills. Comprehending students' viewpoints and feelings allows educators to create an encouraging atmosphere for effective learning. Findings suggest that a compassionate learning environment fostered by teachers leads to higher academic achievement and increased student motivation (Uhing, 2020). An understanding educator cultivates a nurturing space where students feel emboldened to interact actively. Empirical evidence confirms that implementing this strategy leads to improved academic performance and learning efficiency among students.

The consideration of students' math problem-solving abilities is vital to their academic progress. According to research, students' perceived problem-solving abilities are closely related to how well they achieve academically in mathematics. Recent findings reveal a strong correlation between empathic education and students' improved confidence in solving math problems (Uhing, 2020). Teachers' empathetic approach generates a welcoming environment, motivating students to thoroughly invest themselves in the learning adventure. A proven approach to enhancing students' skills at resolving mathematical problems and their desire to learn these subjects. Math prowess hinges on the capacity to unravel tricky issues. Aspiring students need to demonstrate problem-solving prowess in math to reach their goals. By incorporating empathy into the teaching of mathematics, Uhing (2020) finds that students benefit from improved problem-solving skills and academic attainment.

With the expectation that students will cultivate exceptionally advanced thought processes, teachers should target elaborate learning outcomes (Salmon & Barrera, 2021). For students to develop life skills like critical thinking, problem-solving, and mathemati-

cal reasoning, teachers should actively encourage this behavior in them (Mukuka et al., 2023). Supportive instructors help establish a collaborative climate conducive to active student participation. Empirical findings indicate that utilizing this methodology enhances students' appreciation of their capacity to tackle complex math issues and encourages them to pursue math learning with greater enthusiasm.

To put it simply, pedagogical empathy is all about comprehending the thoughts and feelings of students to foster an ideal academic climate. It has been shown that using this strategy enhances students' academic motivation and performance. Studies have shown that pedagogical empathy positively influences how well students gauge their aptitude to tackle mathematical challenges. The emotional support provided by teachers allows students to become invested in their education. Therefore, integrating pedagogical empathy into mathematics teaching can bolster students' perceived problem-solving skills and academic performance (Uhing, 2020).

Empathy as a Pedagogical Phenomenon

Empathy is a ubiquitous trait that finds expression in diverse areas of existence, as observed by Decety and Jackson (2004). Providing a scenario, if someone encounters a difficult day at work, they typically react with increased kindness towards their peers. Just like how someone might offer aid or assistance if they witness another individual struggling on the roadway. Therefore, this quality can also be observed in educational settings. Observers may notice similar actions between peers or individuals within a professional setting. With education being the underlying framework for this investigation, it

logically follows that the authors primarily concentrate their efforts on exploring empathy's significance in the classroom.

Empathy as a psychological concept involves comprehending and sharing the feelings and experiences of others, whereas as a pedagogical approach it entails educators utilizing their insight into individual learners to design an adaptive instructional setting that caters to distinct student requirements (Uhing, 2020). As a pedagogical phenomenon, empathy is an important concept to distinguish since it enables teachers to better understand their students, recognize their emotional needs, and provide appropriate support. Additionally, teachers can optimize their students' performance by comprehending the teaching technique known as pedagogical empathy.

Basic Empathy Scale vs Pedagogical Empathy Scale

Pedagogical empathy is a certain kind of compassion that concentrates on the capacity to comprehend as well as react suitably to students' demands in an academic setting. It stands out from basic empathy, which refers a lot more generally to understanding and reacting properly to other individuals' feelings or experiences (Konrath et al., 2011). However, Chun et al. (2018) insisted that a basic empathy scale can additionally be used in an instructional setup, given that it can be applied in various locations. It is, nevertheless, negated by Konrath et al. (2011), mentioning that while the basic empathy scale can aid educators in comprehending students' feelings as well as experiences, the pedagogical empathy scale is especially developed to analyze a teacher's capacity to recognize and also react suitably to the demands of students in an educational setting. This may involve tasks such as giving feedback or creating learning activities that cater to the individual

needs of students. They argue that having an understanding of empathy is more impactful on student outcomes compared to basic empathy. Thus, it becomes crucial to assess empathy within the context of how teachers employ it both inside and outside the classroom. To gauge the level of empathy among educators, a scale specifically designed for pedagogical empathy becomes indispensable. Supporting this notion, Konrath et al. (2011) suggested that educators can utilize pedagogical empathy scales to evaluate their abilities and effectively support students in their learning journey.

Synthesis

This research looks at the creation and validation of a Pedagogical Empathy Scale (PES) and investigates the antecedents and consequences of pedagogical empathy. It investigates different dimensions of empathy, associated phenomena, definitions, and categorizations of pedagogical empathy, and the distinction between general and pedagogical scales. The discussion of related literature encompasses definitions of empathy as applied in education. This is important to emphasize the distinction between basic empathy and empathy as a tool in teaching. This builds a clear line between measuring basic empathy and pedagogical empathy as separate phenomena. It also discussed how different types of empathic responses, such as cognitive or affective, can be classified into different types for more accurate measurement.

Following an overview of these concepts related to empathy in educational contexts, the paper discusses scale development processes that are required for developing reliable measures that accurately capture this phenomenon among teachers. In addition to covering topics directly related to the PES creation process, this study provides readers

with a comprehensive overview of the various definitions and categorizations of empathy proposed in the literature. Readers can use this as a reference to better understand how this phenomenon is conceptualized in educational contexts. Overall, this study provides a comprehensive look at the scale development and validation processes, as well as an extensive overview of different definitions and categorizations associated with empathy in educational settings. All of these concerns are crucial when it comes to developing valid measures that accurately capture teachers' pedagogical empathy.

Conceptual Framework

A conceptual framework is a visual representation of the relationships between different concepts or variables in a particular phenomenon. In this case, the conceptual framework for pedagogical empathy illustrates the relationship between the antecedents of pedagogical empathy, the consequences of pedagogical empathy, and the dimensions of pedagogical empathy. The antecedents of pedagogical empathy include teacher self-efficacy, emotional intelligence, gender, and professional development, while the consequences of pedagogical empathy include improved student-teacher relationships, teacher burnout, teacher job satisfaction, and emotional intelligence.

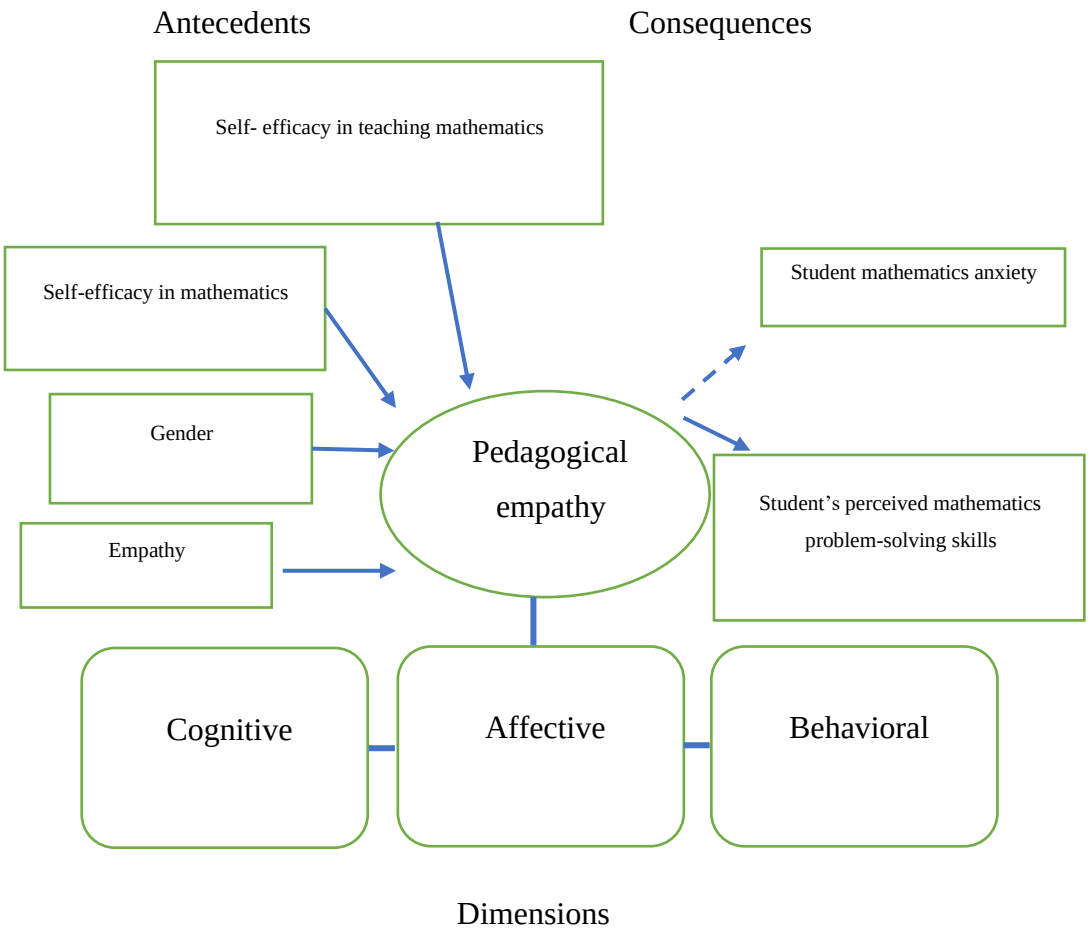
The ability to produce desired results in one's mathematics teaching practice is referred to as self-efficacy in teaching mathematics. Larger levels of teaching self-efficacy would result in larger levels of pedagogical empathy, as indicated by the arrow pointing in the direction of this variable. The belief that one can comprehend and supportively re-

spond to one's students' emotional needs is more likely to be held by teachers who have high levels of self-efficacy in teaching mathematics.

Mathematically proficient teachers can effectively communicate with students due to their in-depth knowledge of the subject. Like teacher self-efficacy, pedagogical empathy would have an arrow pointing in the direction of competence in teaching mathematics, indicating that higher levels of competence in teaching mathematics would result in higher levels of pedagogical empathy.

Figure 1

Dimensions, Antecedents, and Consequences of Pedagogical Empathy



Another key precursor of pedagogical empathy is gender. According to research, female teachers frequently exhibit better levels of empathy for their students than male teachers do (Bali, 2017). As a result, the gender variable would have an arrow pointing in

the direction of pedagogical empathy, indicating that female educators would be more likely to exhibit higher levels of pedagogical empathy.

Basic empathy is a primary predictor of developing and honing pedagogical empathy. Empathic teachers are capable of understanding and feeling students' emotions and perspectives as well as making appropriate pedagogical decisions, which improve their conceptualization of teaching strategies contextual to students' situations and perspectives. This helps in the formation of stronger teacher-student interactions. The distinct arrow indicates that basic empathy predicts pedagogical empathy.

The arrows of pedagogical empathy are directed to the consequences of pedagogical empathy, such as student mathematics anxiety and students' perceived mathematics problem-solving skills. Figure 1 depicts the relationship between pedagogical empathy and student anxiety in mathematics as a broken arrow, signifying a negative correlation. Teachers' lack of pedagogical empathy produces students with a high level of mathematics anxiety, which results in mathematics learning lag. However, teachers who display empathy produce learners who are motivated and self-efficacious, which indicates a lower level of mathematics anxiety. Students tend towards increased confidence and resilience when educators acknowledge and validate their efforts in math challenges, fostering positive attitudes toward problem-solving capabilities. An instructor's empathic behavior creates a dynamic space inviting collaboration and arousing motivational energies within students, ultimately heightening educational attainment.

Pedagogical empathy's cognitive, affective, and behavioral elements are likely to correspond to different aspects of empathic teaching strategies. To instruct students effec-

tively, teachers must be aware of their cognitive processes and learning needs. To effectively recognize and address students' emotional states, one must consider the affective dimension. The behavioral dimension also includes the empathetic behaviors and expressions of teachers that support their students' growth and well-being.

In conclusion, this conceptual framework clarifies how its antecedents, consequences, and different dimensions interact. The development of pedagogical empathy is aided by teachers' self-efficacy in both teaching and mathematics, as well as their empathetic nature. The well-being of teachers and student outcomes, particularly perceived problem-solving abilities, are favorably impacted by pedagogical empathy. However, a lack of pedagogical empathy could result in increased math anxiety among students. Pedagogical empathy is further improved by taking cognitive, affective, and behavioral factors into account in instructional strategies, which promotes a welcoming and inclusive learning environment.

Aims of the Study

It takes more than simply the capacity to transfer knowledge to students to be an excellent teacher. Empathic teachers may establish stronger connections with their students, comprehend their needs, and create a safe learning environment that promotes growth and development. To gauge how empathic teachers are toward their students, a scale on pedagogical empathy is a potent tool. In addition to creating and validating a scale for pedagogical empathy, this two-phase study attempts to investigate the causes and effects of pedagogical empathy. I want to learn more through this study on how ped-

agogical empathy impacts mathematics teaching and how it may be fostered among mathematics teachers to improve the learning environment for all students. The following goals serve as a guide for this two-phase study:

1. Develop and validate a scale to gauge how empathetic mathematics teachers are to their students in a school context;
2. Utilize the scale as a measure of pedagogical empathy, analyze the variables that affect teacher pedagogical empathy (self-efficacy in teaching mathematics, self-efficacy in mathematics, gender, and empathy);
3. Examine the impact of pedagogical empathy on student mathematics anxiety and students' perceived mathematics problem-solving skills using the existing measures.

Each independent phase has a distinct goal. The purpose of developing and validating a pedagogical empathy scale is to capture the dimension of pedagogical empathy from the literature and other scales. This section of the research aims to identify variables that can be tested and scaled and are directly related to pedagogical empathy. The scale can then be used to assess teachers' pedagogical empathy in order to improve institutional and individual teaching. The second independent paper investigates how factors predict the level of pedagogical empathy and what consequences result from pedagogical empathy.

Research Problems and Hypotheses

Based on secondary teachers' assessments of the significance of empathy in education, this study seeks to develop and validate a pedagogical empathy scale. The importance of empathy in education has been recognized, especially in relation to mathematics instruction. Empathy is a key component of effective teaching because it enables teachers to recognize and respond to students' needs. The goals of the study are to examine the variables that influence secondary mathematics teachers' pedagogical empathy levels and the effects of having either high or low levels of pedagogical empathy. In order to examine data from a sample of secondary mathematics teachers and answer the study objectives, multiple regression analysis and a series of simple regression analyses were used. The results of the study provide valuable insights into the significance of empathy in mathematics education and assist in the development of interventions to increase Pedagogical Empathy in teachers. The research questions that guide this study are as follows:

1. What measure of pedagogical empathy for secondary mathematics teachers can be developed?
2. How valid and reliable is the developed measure for pedagogical empathy for secondary mathematics teachers?
3. Do mathematics teachers' self-efficacy in teaching mathematics, self-efficacy in mathematics, gender, and empathy predict pedagogical empathy?
4. Does pedagogical empathy of mathematics teachers predict student mathematics anxiety, and students’ perceived mathematics problem-solving skills?

Research Hypotheses

Seven hypotheses are put forth by this study about the antecedents and consequences of pedagogical empathy in secondary mathematics teachers:

1. In comparison to other teachers, female educators exhibit higher levels of pedagogical empathy than male teachers.
2. Teacher self-efficacy in teaching mathematics positively predicts pedagogical empathy.
3. Teacher self-efficacy in mathematics positively predicts pedagogical empathy.
4. A high level of teachers' basic empathy predicts a high level of pedagogical empathy.
5. Teachers' level of pedagogical empathy negatively predicts students' level of mathematics anxiety.
6. Pedagogical empathy positively predicts students' mathematics problem-solving skills.

Definition of Terms

The following terms are defined conceptually and operationally.

Affective Empathy. One of the initial dimensions of pedagogical empathy in mathematics scale, used as the basis for the initial development of the pedagogical empathy in mathematics scale.

Antecedents. These are independent variables in the second phase of the study in relation to the context of secondary mathematics teachers, that was measured through dif-

ferent scales to elicit their influence on pedagogical empathy. It includes teacher self-efficacy in teaching mathematics, self-efficacy in mathematics, gender, and basic empathy.

Basic Empathy. This refers to an antecedent of pedagogical empathy that is measured by the basic empathy scale in relation to the general empathy of secondary mathematics teachers, and was compared to the data of the pedagogical empathy scale to establish whether basic empathy predicts pedagogical empathy.

Cognitive Empathy. One of the initial dimensions of pedagogical empathy is used in the development of the initial pedagogical empathy in the mathematics scale of secondary mathematics teachers.

Consequences. These are dependent variables in the second phase of the study, measured via different validated instruments to establish whether they are influenced by pedagogical empathy. This includes student mathematics anxiety and students' perceived mathematics problem-solving skills.

Dimensions of Pedagogical Empathy. These refer to the initial dimensions of pedagogical empathy (affective, cognitive, behavioral) used in the second and third round of scale development, second dimensions of pedagogical empathy (Empathic Understanding, Empathy in Teaching) used in the third and fourth round of scale development, and the reframed dimensions of pedagogical empathy as a result of factor analysis (Emotional Awareness, Supportive Teaching, and Instructional Adaptability).

Emotional Awareness. One of the reframed dimensions of pedagogical empathy is based on the result of the factor analyses.

Instructional Adaptability. One of the reframed dimensions of pedagogical empathy is based on the result of the factor analyses.

Mathematics Anxiety. One of the consequences (student variable) of pedagogical empathy measured by the mathematics anxiety scale, which was compared to the data gathered from students' perception of teachers' pedagogical empathy in mathematics, to elicit the influence of pedagogical empathy on this variable.

Pedagogical Empathy. The latent construct that is measured by the pedagogical empathy in mathematics scale.

Pedagogical Empathy in Mathematics Scale (PEMS). A 21-item developed and validated scale that measures the pedagogical empathy of secondary mathematics teachers across three dimensions – Emotional Awareness, Supportive Teaching, and Instructional Adaptability.

Self-Efficacy in Teaching Mathematics. One of the antecedents of pedagogical empathy that is measured by the Mathematics Teaching Efficacy Belief Instrument (MTEBI) is to establish its influence on pedagogical empathy through multiple regression analysis.

Self-Efficacy in Mathematics. One of the identified antecedents of pedagogical empathy, which is measured by the Mathematics Self-Efficacy Scale (MSES) to elicit its influence on pedagogical empathy via multiple regression analysis.

Students' Perceived Mathematics Problem-Solving Skills. One of the consequences of pedagogical empathy, measured by the Mathematics Problem-Solving Math-

ematics Scale (MPSMS) to investigate the influence of pedagogical empathy on this student variable.

Supportive Teaching. One of the reframed dimensions of pedagogical empathy is based on the results of factor analyses.

Chapter 3:

Results and Discussion

The results are subdivided into two parts. First, this chapter presents the results of the process of development and validation of the scale for pedagogical empathy of secondary mathematics teachers. Second, it shows the result of the influence of predictor variables (antecedents) of pedagogical empathy and its influence on some outcome variables (consequences). This chapter shows the analysis and interpretation of the results based on each research question.

Results of Phase 1: Scale Development and Validation

This part discusses the results of the scale development and validation process undertaken in this study. The results on dimension identification, item construction, and content validation, and initial refinement addressed Research Question 1. Similarly, results on scale tryouts using exploratory and confirmatory factor analyses addressed research question 2.

Research Question 1: What measure of pedagogical empathy for secondary mathematics teachers can be developed?

Development Stage. This part presents the development stage, comprising the content domain and item writing sections. The process of identifying the dimensions and the development of scale items was discussed below. Also, the distribution of the scale items per dimension was presented.

Search for Content Domain. The initial dimensions based on the framework supported by several studies are shown below. These dimensions were the basis for scale-item construction. Table 7 shows the initial dimension used in this study in coherence with recent scales on basic empathy and other related literature. Table 7 below shows the initial dimensions of pedagogical empathy.

Table 7

Initial Dimensions of Pedagogical Empathy

Dimensions	Descriptions	Cited Authors
Cognitive	The ability to understand the thoughts, emotions, feelings, and points of view of others.	Davis (1983); Hogan (1969); Preston and De Waal (2002)
Affective	The ability to feel similar emotions and feelings of others.	Eisenberg and Strayer (1990); Decety and Jackson (2004)
Behavioral	The ability to manifest empathy through actions by adjusting to others' feelings, thoughts, points of view, and emotions.	Eisenberg (2018); De Waal (2008)

Table 7 shows the description of the initial dimensions based on the conceptual framework, from which each item on the initial scale was based. The framework initially identified the dimensions of cognitive, affective, and behavioral to represent the multidimensional nature of pedagogical empathy in mathematics. This cluster of constructs is the identified sets of dimensions: cognitive, affective, and behavioral (Davis, 1983; Decety & Jackson, 2004; Eisenberg, 2018; Eisenberg & Strayer, 1990; Hogan, 1969; Pres-

ton & De Waal, 2002; De Waal, 2008). The initial and second rounds of scale development, with 30 items, were based on these three dimensions. Some inconsistency in item construction based on the initial dimensions occurred, specifically on the behavioral dimension. Upon content validation from the experts, the three dimensions were put aside as the behavioral dimension was inconsistently captured in the scale. Consequently, the experts recommended finding other dimensions that measure pedagogical empathy. After a review of the framework and further literature review, the researcher, in consultation with the adviser, revised. Hence, explorations on other dimensions of pedagogical empathy were undertaken. Table 8 reflects the second set of dimensions of pedagogical empathy.

Table 8

Second Set of Dimensions of Pedagogical Empathy

Dimensions	Descriptions	Cited Authors
Empathic Understanding	The ability of teachers to understand and feel the thoughts, feelings, points of view, emotions, and difficulties of the students.	Davis, 1983; Decety & Meyer, 2008; Rogers, 1957; Starcevic & Piontek, 1997
Empathy in Teaching	The ability of teachers to adjust their educational decisions and actions to match students' difficulties, perspectives, anxieties, and actions.	Borich, 2016; Cherewick et al., 2022; Meyers et al., 2019

Upon further discussion with my adviser, we decided to revise the initial dimensions into two: empathy and empathy in teaching. Additional literature review has led the author to reconstruct and refigure the empathic understanding and empathy in teaching as dimensions of pedagogical empathy (Borich, 2016; Davis, 1983; Decety & Meyer, 2008; Meyers et al., 2019; Rogers, 1957; Starcevic & Piontek, 1997). Table 8 shows the description and references of the two dimensions.

The affective and cognitive dimensions were fused into one dimension, which is empathic understanding (Davis, 1983; Decety & Meyer, 2008; Rogers, 1957; Starcevic & Piontek, 1997). The reason for the fusion is based on the definition of empathic understanding by Rogers (1957), which states that empathic understanding is equivalent to the combined experience of affective and cognitive empathy. Also, several studies described empathic understanding as the ability to understand and feel the thoughts, feelings, points of view, emotions, and difficulties of others (Davis, 1983; Decety & Meyer, 2008; Starcevic & Piontek, 1997). Furthermore, the behavioral dimension was revised to include empathy in teaching (Borich, 2016; Meyers et al., 2019), as it refers to the action-oriented component and outward practice of empathy (Borich, 2016; Cherewick et al., 2022; Meyers et al., 2019). These dimensions were considered more consistent with the idea of pedagogical empathy because the concept of empathy is emphasized in them.

Item Writing. In coherence with the identified sets of dimensions, scale items were developed. For the initial dimensions, there were 30 scale items for the first and second rounds of scale development. A sample for the item distribution per dimension in the initial scale development (Appendix K) is shown below.

Initial Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	For each statement, you will see two different opposite words representing polar adjectives with seven numbers between them. Select a number from 1 to 7 that best shows the intensity of your opinion or feeling. Encircle the number that corresponds to your answer.	
1	I am able to authentically experience and feel the positive emotions that result from shared victories as I find satisfaction in our classroom successes. Able 1 2 3 4 5 6 7 Unable	Affective
2	I am sensitive to my students' feelings of satisfaction that arise from learning new ideas, which helps to build an emotional bond through mutual learning satisfaction. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
3	I relate to my students' emotional struggles as I am sensitive to the difficulties they feel while they are studying. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
4	I show a sincere emotional awareness of my students' worries about their academic performance by acknowledging and understanding their issues in the classroom. Extremely Sincere 1 2 3 4 5 6 7 Insincere	Affective

There were 10 items in the affective dimension numbered 1-10 in the scale, 10 items in the cognitive dimension numbered 11-20, and 10 items in the behavioral dimension numbered 21-30. This also applied to the second round of scale development in terms of the distribution of scale items per dimension (please refer to Appendix L). On the other hand, there were 24 items on the third and final round of scale development based on the second set of dimensions (see Appendices M and N). The sample of the final scale item distribution per dimension is shown below.

Final Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your response.	
1	I am aware of how excited my students are when they learn new things in our mathematics class. Inattentive 1 2 3 4 5 6 7 Aware	Empathic Understanding
2	I am attuned to my students' struggles in studying Mathematical concepts. Disconnected 1 2 3 4 5 6 7 Attuned	Empathic Understanding
3	I am sensitive to the worries of my students about their mathematical performance. Insensitive 1 2 3 4 5 6 7 Sensitive	Empathic Understanding
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem. Indifferent 1 2 3 4 5 6 7 Sympathetic	Empathic Understanding
5	I am attentive to the issues and concerns of my learners in our mathematics classroom. Neglectful 1 2 3 4 5 6 7 Attentive	Empathic Understanding

For both the third and final scale item distribution per dimension, there were 12 items in empathic understanding, numbered 1-12, and 12 items in empathy in teaching, numbered 13-24. These rounds of scale development, specifically item writing, were consistent with the content validation stage.

Content Validation. This section shows the results from content validation by experts and prospective respondents. Different rounds of content validation by experts and one-time point content validation by prospective respondents were undertaken.

Content Validation by Experts. This part presents the results and findings on content validation by experts. There are four sets of content validation by experts, undertaken in this study. The table of the initial content validation by experts is shown below.

Table 9

First Expert Content Validation

Item No.	Item	Content Validity Index	Comments & Suggestions
Directions	For each statement, you will see two different opposite words representing polar adjectives with seven numbers between them. Select a number from 1 to 7 that best shows the intensity of your opinion or feeling. Encircle the number that corresponds to your answer.	0.67	Make a clear direction.
1	I am able to authentically experience and feel the positive emotions that result from shared victories as I find satisfaction in our classroom successes. Able 1 2 3 4 5 6 7 Unable	0.33	Loaded item – 1item measuring more than 1concept/feeling and check the language use also – confusing to the respondent Need to simplify; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
2	I am sensitive to my students' feelings of satisfaction that arise from learning new ideas, which helps to build an emotional bond through mutual learning satisfaction. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.33	Same Need to simplify; Not related to mathematics teaching
3	I relate to my students' emotional struggles as I am sensitive to the difficulties they feel while they are studying. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.33	Same, Need to simplify – Suggestion: I am sensitive to my students' struggles in studying Mathematical concepts; Not related to mathematics teaching
4	I show a sincere emotional awareness of my students' worries about their academic performance by acknowledging and understanding their issues in the classroom. Extremely Sincere 1 2 3 4 5 6 7 Insincere	0.33	Same Need to simplify (acknowledging and understanding are two things); Not related to mathematics teaching
5	I relate to my students by acknowledging that I share the disappointments they may experience in their academic pursuits. Extremely Related 1 2 3 4 5 6 7 Unrelated	0.33	Same Need to simplify (relate – unrelate – not appropriate as the bipolar adjective here; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
6	I am sensitive of the feelings of isolation or loneliness that my students might have felt when participating in group activities, and I strive to build connections by carefully considering their social dynamics. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.33	Same Need to simplify So loaded – sensitive to as build connection while doing group work? isolation is different from loneliness); Not related to mathematics teaching.
7	I share in my students' satisfaction and sense of accomplishment by acknowledging and emotionally connecting with their individual academic accomplishments Extremely Involved 1 2 3 4 5 6 7 Uninvolved	0.33	Same Need to simplify So loaded -sense of satisfaction is different from sense of accomplishment..you use share – then the bipolar adjective is "involved" be consistent; Not related to mathematics teaching
8	I easily relate to the difficulties my students encounter when working on group assignments, forging an emotional connection as I become familiar with their dynamics. Extremely Related 1 2 3 4 5 6 7 Unrelated	0.33	Do not use "easily" Loaded also – forging, as I become familiar.. Which are you measuring – how you related with what? Are you forging an emotional connection which is hard to define…; Not related to mathematics teaching
9	I emotionally connect with my students' social experiences and am attentive to the emotional dynamics of their peer interactions in the classroom. Extremely Connected 1 2 3 4 5 6 7 Disconnected	0.33	Emotional connection – hard to measure! Then you are also attentive...2 things in 1 item; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
10	I can easily relate to my students' academic and personal accomplishments, joining in their happiness and acknowledging their contributions as essential members of our learning community. Extremely Related 1 2 3 4 5 6 7 Unrelated	0.33	Too loaded - simplify; Not related to mathematics teaching
11	I am good at adopting students' viewpoints, which shows that I am more logically sensitive to their feelings. Extremely Good 1 2 3 4 5 6 7 Inept	0.33	Good – inept? Check the use of these bipolar adjectives.. - you also mention logical sensitive? Too loaded...simplify. This is cognitive – so the adjective must focus on "thinking"; Not related to mathematics teaching
12	I have an exceptional ability to be mentally flexible, which enables me to adjust to different viewpoints and comprehend the emotions and ideas of my student. Extremely Flexible 1 2 3 4 5 6 7 Inflexible	0.33	Item and the adjectives are not aligned! This is cognitive – so the adjective must focus on "thinking"; Not related to mathematics teaching
13	I carefully examine the ideas that my students have, exhibiting a sense of engagement that entails exploring their viewpoints in the classroom. Extremely Engaged 1 2 3 4 5 6 7 Unengaged	0.33	Item and the adjectives are not aligned! This is cognitive – so the adjective must focus on "thinking" – examine is okay but the adjective does not; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
14	I actively encourage teaching with an open mind via cognitive awareness to recognize the distinct thoughts and feelings of students in particular learning contexts. Extremely Encouraging 1 2 3 4 5 6 7 Discouraging	0.33	Too loaded - simplify; Not related to mathematics teaching
15	I am able to understand and value other points of view in the classroom with ease, creating an environment where students feel heard and respected. Extremely Understanding 1 2 3 4 5 6 7 Unsympathetic	0.33	Loaded – able to understand and creating an environment. Which is which?; Not related to mathematics teaching
16	I usually engage in deliberate procedures that show my dedication to comprehending the ideas and viewpoints of students in a variety of learning contexts. Extremely Engaged 1 2 3 4 5 6 7 Unengaged	0.33	Delete – usually – Loaded /very complex – simplify. Make sure alignment with the semantic scale used; Not Related to mathematics teaching
17	I make a constant effort to build stronger relationships with my students as I recognize how critical it is to understand their perspectives in order to create a positive learning environment. Proactively Building 1 2 3 4 5 6 7 Detached	0.33	Delete – constant! Loaded – too many things to measure in 1 item - confusing; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
18	I am aware of the complex interplay between students' openness and other personality traits and my increased capacity to comprehend and relate to them more deeply in the classroom. Extremely Aware 1 2 3 4 5 6 7 Unaware	0.33	Loaded – too many things to measure in 1 item - confusing; Not related to mathematics teaching
19	I recognize that understanding students' feelings plays an integral part in promoting well-being in teaching, and that it can have a distinctive influence on students' mental health. Extremely Recognizing 1 2 3 4 5 6 7 Unacknowledging	0.33	Make it simple that is within the level of your respondents; Not related to mathematics teaching
20	I identify and interpret the facial expressions of students' emotional states in the classroom, emphasizing the importance of reading nonverbal cues from them. Extremely Involved 1 2 3 4 5 6 7 Uninvolved	0.33	Loaded – too many things to measure in 1 item – confusing' Not related to mathematics teaching
21	I am adept at paying close attention to my students' emotional needs, fostering a welcoming and inclusive learning environment. Extremely Attentive 1 2 3 4 5 6 7 Inattentive	0.33	Loaded – too many things to measure in 1 item – confusing; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
22	I demonstrate adaptability to the multiple learning styles of my students, exhibiting concern for their unique context. Extremely Adaptable 1 2 3 4 5 6 7 Inflexible	0.33	Simplify...go straight with exhibiting concern for..... Then have a good pair of adjectives to jibe with the item.
23	I promptly address the academic difficulties that students face, demonstrating caring and offering assistance without sacrificing the standards of their learning. Extremely Prompt 1 2 3 4 5 6 7 Negligent	0.33	Delete - promptly...Loaded – too many things to measure in 1 item – confusing; Not related to mathematics teaching
24	I facilitate an environment that is supportive and conducive to lifelong learning by skillfully recognizing and appreciating students' development. Extremely Supportive 1 2 3 4 5 6 7 Unsupportive	0.33	Loaded – too many things to measure in 1 item – confusing; Not related to mathematics teaching
25	I am sensitive to students' personal concerns and use tolerance to resolve issues without lowering the bar for academic performance. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.33	More on affective. “sensitive”; Not related to mathematics teaching

Item No.	Item	Content Validity Index	Comments & Suggestions
26	I address my students' errors with respect and assistance, placing more emphasis on positive opportunities for learning than on unpleasant repercussions. Extremely Respectful 1 2 3 4 5 6 7 Disrespectful	0.33	Loaded – too many things to measure in 1 item – confusing; Not related to mathematics teaching
27	I reinforce students' sense of worth and respect in their academic pursuits by acknowledging and appreciating their work. Extremely Acknowledging 1 2 3 4 5 6 7 Disregarding	0.33	Loaded – too many things to measure in 1 item – confusing; Not related to mathematics teaching
28	I take an inclusive approach in class discussions, making sure that every student feels appreciated and heard, which helps to foster a respectful learning atmosphere. Extremely Inclusive 1 2 3 4 5 6 7 Exclusive	0.33	Simplify the items –too complex; Not related to mathematics teaching
29	I appreciate and acknowledge that every student learns at a different rate, and I modify my style of instruction to meet a variety of needs without sacrificing academic standards. Extremely Appreciative 1 2 3 4 5 6 7 Appreciative	0.33	Loaded – too many things to measure in 1 item – confusing Simplify...appreciate is affective/ acknowledge is behavioral...

Item No.	Item	Content Validity Index	Comments & Suggestions
30	I encourage emotional resilience in my students, stressing the need to respond to obstacles while keeping an eye on their academic development. Extremely Encouraging Resilience 1 2 3 4 5 6 7 Discouraging Resilience	0.33	Use of "emotional resilience" is too technical – simplify. Then loaded item also – Revise the pair of adjectives also

The table contains directions, scale items, content validity index, and experts' comments and suggestions. Furthermore, only the directions are on the questionable threshold of 0.67. This means that it is subject to revision upon the recommendation of expert reviewers. On the other hand, the rest of the items were way below the acceptable threshold of 0.78. This means that all items are rejected and are to be omitted. According to Polit et al. (2007), for a CVI to be accepted, it must be at least 0.78. However, for CVIs closer to the threshold of 0.78, there is a need to revise the item (Yusoff, 2019). Therefore, the items on the initial scale are rejected.

The table also shows the suggestions to be considered for developing a new set of items for the scale. The scale was based on cognitive, affective, and behavioral dimensions of empathy as it applies to education. As indicated, based on the comments, not all of the items are related to mathematics teaching. Hence, the next set of items in the scale must be clearly rooted in mathematics teaching. Also, most of the items are loaded based on the expert's analysis. Consequently, simplified items with a specific focus must be de-

veloped. Further, the alignment of the items to their respective dimensions is questioned. In response, a thorough check on the dimension, adherence is necessary. In extension, experts have identified that some polar adjectives do not coincide with the item in reference to their respective dimensions. Hence, a revised scale in adherence to the comments and suggestions of the experts was made.

The second expert content validation (Appendix O) shows the content validity index (CVI) of directions and each item of the second developed scale for measuring the pedagogical empathy of secondary mathematics teachers. The table indicates that the directions and items 1 – 20 have a 0.67 content validity index. This means that each item is below the acceptable threshold of 0.78 but is within the questionable threshold (Yusoff, 2019). Hence, there is a need to revise items 1 – 20, including the directions. Similar comments and suggestions were given by the expert reviewers, such as revising polar adjectives that fit the item. Complementary to the CVI, experts' comments and suggestions are necessary to refine the scale (Lambert & Newman, 2023). Further, items 21 – 30 must be omitted and changed since each item has a CVI far from the acceptable threshold of 0.78. Experts' comments suggest that there is a need to align items 21 – 30 to their respective dimension. Upon the content validation by experts on the second developed scale, it has been decided in consultation with my adviser to explore other dimensions that are more suited to the context of pedagogical empathy in light of mathematics education.

In connection with the exploration of other dimensions as guided by the literature and my adviser, two dimensions were identified: empathic understanding (Davis, 1983;

Decety & Meyer, 2008; Rogers, 1957; Starcevic & Piontek, 1997) and empathy in teaching (Borich, 2016; Meyers et al., 2019). Appendix P enumerates that the acceptable threshold of 0.78 was satisfied by the directions, item 4, item 14, items 16 – 17, and items 19 – 23. Each of which has 1 as the content validity index. As a result, the directions and the given nine items are accepted and are part of the roster of items on the scale. Also, items 1 – 3, 5 – 13, and 18 have a content validity index of 0.67. This signifies that the items still fall under a questionable threshold. Therefore, there is a need to refine the given nine items. In contrast, each of the items 15 and 24 has a CVI of 0.33, which is way below the acceptable threshold of 0.78. The reason is that each scale item may measure the same concepts. As the experts suggested, it is imperative to choose which of the two items to include and which to exclude to generate an item that will complete the 24-item scale. Table 10 below reflects the final expert content validation.

Table 10

Final Expert Content Validation

Item No.	Item	Content Validity Index	Comments & Suggestions
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
	response.		
1	I am aware of how excited my students are when they learn new things in our mathematics class. Inattentive 1 2 3 4 5 6 7 Aware	1	Accepted
2	I am attuned to my students' struggles in studying Mathematical concepts. Disconnected 1 2 3 4 5 6 7 Attuned	1	Accepted
3	I am sensitive to the worries of my students about their mathematical performance. Insensitive 1 2 3 4 5 6 7 Sensitive	1	Accepted
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem. Indifferent 1 2 3 4 5 6 7 Sympathetic	1	Accepted
5	I am attentive to the issues and concerns of my learners in our mathematics classroom. Neglectful 1 2 3 4 5 6 7 Attentive	1	Accepted
6	I understand the difficulties encountered by my learners when working with mathematical tasks. Clueless 1 2 3 4 5 6 7 Understanding	1	Accepted
7	I am perceptive of my students' feelings in different learning situations in our mathematics class. Unobservant 1 2 3 4 5 6 7 Perceptive	1	Accepted
8	I am considerate on how my students' different personalities affect how well they learn in our mathematics class. Inconsiderate 1 2 3 4 5 6 7 Considerate	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
9	I am observant of my learners' potential mental health challenges in our mathematics class. Unaware 1 2 3 4 5 6 7 Observant	1	Accepted
10	I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions. Unmindful 1 2 3 4 5 6 7 Mindful	1	Accepted
11	I am proficient in understanding my learners' points of view in our mathematics class. Not Proficient 1234 5 6 7 Proficient	1	Accepted
12	I am conscious of my students' difficulties when working on activities in mathematics class. Unconscious 1 2 3 4 5 6 7 Conscious	1	Accepted
13	I examine the ideas that my students have in mathematics class. Ignore 1 2 3 4 5 6 7 Examine	1	Accepted
14	I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. Uncaring 1234 5 6 7 Compassionate	1	Accepted
15	I am consistent in fostering student motivation in our mathematics class. Inconsistent 1 2 3 4 5 6 7 Consistent	1	Accepted
16	I handle my students' errors in our mathematics class with respect. Rude 1 2 3 4 5 6 7 Superficially Respect	1	Accepted
17	I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Inflexible 1234 5 6 7 Flexible	1	Accepted
18	I am constructive in providing feedback to my learner in our mathematics class. Non-Constructive 1 2 3 4 5 6 7 Construc-	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
	tive		
19	I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. Negligent 1 2 3 4 5 6 7 Superficially Diligent	1	Accepted
20	I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. Disinterested 1 2 3 4 5 6 7 Enthusiastic	1	Accepted
21	I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. Unsupportive 1 2 3 4 5 6 7 Supportive	1	Accepted
22	I am eager in acknowledging my learners' efforts in our mathematics class. Reluctant1 2 3 4 5 6 7 Eager	1	Accepted
23	I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces. Rigid 1 2 3 4 5 6 7 Adaptive	1	Accepted
24	I create a helpful environment for my students in mathematics learning. Thoroughly Create 1 2 3 4 5 6 7 Do not Create	1	Accepted

Table 10 revealed that, based on the experts' review, the directions and each item reached a content validity index of 1. This shows that the acceptable threshold of 0.78 has been satisfied (Polit et al., 2007; Yusoff, 2019). All items are confirmed to be part of the 24-item scale roster in adherence to the experts' content validation and in consultation with my adviser. Hence, the scale is subjected to content validation by prospective respondents.

Content Validation by Prospective Respondents. This part of the chapter presents the content validity index from prospective respondents. Ten prospective respondents are teachers and master teachers for more than ten years. Table 11 shows the prospective respondents' content validity.

Table 11

Prospective Respondents Content Validity

Item No.	Item	Content Validity Index	Comments & Suggestions
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your response.	1	Accepted
1	I am aware of how excited my students are when they learn new things in our mathematics class. Inattentive 1 2 3 4 5 6 7 Aware	1	Accepted
2	I am attuned to my students' struggles in studying Mathematical concepts. Disconnected 1 2 3 4 5 6 7 Attuned	1	Accepted
3	I am sensitive to the worries of my students about their mathematical performance. Insensitive 1 2 3 4 5 6 7 Sensitive	1	Accepted
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
	right answer to a mathematics problem. Indifferent 1 2 3 4 5 6 7 Sympathetic		
5	I am attentive to the issues and concerns of my learners in our mathematics classroom. Neglectful 1 2 3 4 5 6 7 Attentive	1	Accepted
6	I understand the difficulties encountered by my learners when working with mathematical tasks. Clueless 1 2 3 4 5 6 7 Understanding	1	Accepted
7	I am perceptive of my students' feelings in different learning situations in our mathematics class. Unobservant 1 2 3 4 5 6 7 Perceptive	1	Accepted
8	I am considerate on how my students' different personalities affect how well they learn in our mathematics class. Inconsiderate 1 2 3 4 5 6 7 Considerate	1	Accepted
9	I am observant of my learners' potential mental health challenges in our mathematics class. Unaware 1 2 3 4 5 6 7 Observant	1	Accepted
10	I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions. Unmindful 1 2 3 4 5 6 7 Mindful	1	Accepted
11	I am proficient in understanding my learners' points of view in our mathematics class. Not Proficient 1234 5 6 7 Proficient	1	Accepted
12	I am conscious of my students' difficulties when working on activities in mathematics class. Unconscious 1 2 3 4 5 6 7 Conscious	1	Accepted
13	I examine the ideas that my students have in mathematics class. Ignore 1 2 3 4 5 6 7 Examine	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
14	I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. Uncaring 1234 5 6 7 Compassionate	1	Accepted
15	I am consistent in fostering student motivation in our mathematics class. Inconsistent 1 2 3 4 5 6 7 Consistent	1	Accepted
16	I handle my students' errors in our mathematics class with respect. Rude 1 2 3 4 5 6 7 Superficially Respect	1	Accepted
17	I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Inflexible 1234 5 6 7 Flexible	1	Accepted
18	I am constructive in providing feedback to my learner in our mathematics class. Non-Constructive 1 2 3 4 5 6 7 Constructive	1	Accepted
19	I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. Negligent 1 2 3 4 5 6 7 Superficially Diligent	1	Accepted
20	I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. Disinterested 1 2 3 4 5 6 7 Enthusiastic	1	Accepted
21	I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. Unsupportive 1 2 3 4 5 6 7 Supportive	1	Accepted
22	I am eager in acknowledging my learners' efforts in our mathematics	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
	class. Reluctant1 2 3 4 5 6 7 Eager		
23	I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces. Rigid 1 2 3 4 5 6 7 Adaptive	1	Accepted
24	I create a helpful environment for my students in mathematics learning. Thoroughly Create 1 2 3 4 5 6 7 Do not Create	1	Accepted

The prospective respondents answered the scale to test whether it is clear and respondent friendly. The table shows that all ten prospective respondents agreed that all items, including the directions, are acceptable. There were no suggestions made by the prospective respondents. Hence, I decided to proceed to scale tryouts.

Research Question 2: How valid and reliable is the developed measure for pedagogical empathy for secondary mathematics teachers?

Tryouts. To establish the validity and reliability of the developed instrument after content validation, two sets of tryouts were conducted. This part presents the results of the first and second scale tryouts. Exploratory factor analysis was used on the gathered data from the first tryout to test the validity and reliability of the scale. Results of the exploratory factor analysis contributed to the scale dimension revision, and scale item omission and retention. Confirmatory factor analysis was employed on the second tryout, corroborating the results from the exploratory factor analysis.

First Tryout. Before the use of exploratory factor analysis, assumptions about the use of the analysis were checked. Appendix Q shows the Bartlett's Test of Sphericity ($\chi^2 = 9712$, df = 276, $p < 0.001$), indicating that the correlation matrix is not an identity matrix. According to Sigudla & Maritz (2023), a p-value less than 0.05 indicates a significant correlation. This means that it is statistically significant to show the factorability of the data for the 24 items. Hence, it is appropriate to be subjected to factor analysis.

Furthermore, Appendix Q shows the Kaiser-Meyer-Olkin (KMO), which yielded an overall value of 0.854, which is above the meritorious threshold of 0.800 (Li et al., 2020; Sigudla & Maritz, 2023; Watkins, 2018). This connotes a strong sampling adequacy, suggesting that the items are suitable for exploratory factor analyses. Moreover, the KMO value for each item ranges from 0.718 (item 13) to 0.976 (item 17), demonstrating that the items are within the middling to meritorious values (Li et al., 2020; Sigudla & Maritz, 2023; Watkins, 2018). This confirms that the items are appropriate for exploratory factor analysis. Table 12 shows the result of the parallel analysis.

Table 12

Parallel Analysis – Factor Loadings

	Factor					
	1	2	3	4	5	Uniqueness
1. I am aware of how excited my students are when they learn new things in our mathemat-		0.827				0.3458

	Factor					
	1	2	3	4	5	Uniqueness
ics class.						
2. I am attuned to my students' struggles in studying Mathematical concepts.		0.843				0.2979
3. I am sensitive to the worries of my students about their mathematical performance.		0.88				0.2553
4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.		0.848				0.2954
5. I am attentive to the issues and concerns of my learners in our mathematics classroom.	0.904					0.1726
6. I understand the difficulties encountered by my learners when working with mathematical tasks.	0.834					0.2769
7. I am perceptive of my students' feelings in different learning situations in our mathematics class.	0.753					0.3267
8. I am considerate on how my students' different attitudes affect how they learn in our mathematics class.					0.955	0.1263
9. I am observant of my learners' potential mental health challenges in our mathematics class.		0.802				0.2489

	Factor					
	1	2	3	4	5	Uniqueness
10. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.		0.74				0.3977
11. I am proficient in understanding my learners' points of view in our mathematics class.		0.893				0.2278
12. I am conscious of my students' difficulties when working on activities in mathematics class.					0.922	0.1238
13. I examine the ideas that my students have in mathematics class.						0.7181
14. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.	0.967					0.1002
15. I am consistent in fostering student motivation in our mathematics class.				0.996		0.0898
16. I handle my students' errors in our mathematics class with respect.	0.931					0.1823
17. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.				0.528		0.4323

	Factor					
	1	2	3	4	5	Uniqueness
18. I am constructive in providing feedback to my learners in our mathematics class.	0.88					0.2674
19. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.				1.062		0.0234
20. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.			0.955			0.0886
21. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.	0.875					0.2277
22. I am eager to acknowledge my learners' efforts in our mathematics class.			1.085			-9.52e−4
23. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.						0.4215
24. I am facilitative in encouraging a helpful environment for my students in mathematics learning.			1.044			0.0273

Table 12 shows the result using parallel analysis via principal axis factoring extraction, used in combination with a promax rotation. Parallel analysis in exploratory fac-

tor analysis was used to identify the optimal number of factors to retain from the dataset (Ledesma & Valero-Mora, 2007). Principal axis factoring extraction was used since it is capable of recognizing essential factors and is extra vigorous to matters as uneven factor loadings while also alleviating Heywood cases (Grieder & Steiner, 2021; Tavakol & Wetzel, 2020). Further, the promax oblique rotation method was used since it is proven for computational efficacy (Akhtar-Danesh, 2023) and is easier to interpret than other rotation methods (Zuckerman & Aluja, 2015). The results show that the parallel analysis yields 5 factors. Only 2 factors (Factor 1 and Factor 2) out of 5 satisfied a minimum of 3-item acceptable loadings.

Factor 1 has 7-item acceptable loadings (items 5, 6, 7, 14, 16, 18, and 21) ranging from 0.753 to 0.967. Likewise, factor 2 has 7-item acceptable loadings (items 1, 2, 3, 4, 9, 10, and 11) ranging from 0.740 to 0.893. On the other hand, Factor 3 has a 1-item acceptable loading (item 20) with 0.955, which does not satisfy a minimum of 3 items per factor. Similarly, factor 4 has a 1-item acceptable loading (item 15) with 0.996, which does not satisfy a minimum of 3 items per factor. Lastly, factor 5 does not satisfy a minimum of 3 items per factor since it has 2-item acceptable loadings (items 8 and 12) with 0.922 and 0.955, respectively. This shows that the parallel analysis with 5 factors yielded an illogical distribution of items. I tried to analyze to retain items, but the result using parallel analysis via principal axis factoring extraction, used in combination with a promax rotation, was illogical. Hence, to explore the optimal number of factors, a series of forced numbers of factors was performed and tested.

Appendix R shows the results of the forced analysis, limiting four factors via the principal axis factoring extraction method used with promax rotation. The analyzed data show that there are only 2 factors (factors 1 and 2) that satisfy a minimum of 3-item acceptable loadings. Factor 1 yielded 7-item acceptable loadings (items 5, 6, 7, 14,16, 18, and 21) ranging from 0.760 to 0.978. Similarly, factor 2 generated 7-item acceptable loadings (items 1, 2, 3, 4, 9, 10, and 11) ranging from 0.775 to 0.909. In contrast, factor 3 has a 1-item acceptable loading (item 20) with a 0.974, which does not satisfy a minimum of 3 items per factor. Lastly, factor 4 has a 1-item acceptable loading (item 17) with 0.702, which does not satisfy a minimum of 3 items per factor. Clearly, the forced analysis with 4 fixed factors produces inconsistent and illogical results. Hence, a forced number of factors were performed and tested. Table 13 shows the result of forced analysis with three factor loadings.

Table 13

Forced Analysis – 3 Fixed Factors

	Factor			
	1	2	3	Uniqueness
1. I am aware of how excited my students are when they learn new things in our mathematics class.		0.794		0.38
2. I am attuned to my students' struggles in studying Mathematical concepts.		0.879		0.297
3. I am sensitive to the worries of my students about their mathematical performance.		0.87		0.273

	Factor			
	1	2	3	Uniqueness
4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.		0.884		0.295
5. I am attentive to the issues and concerns of my learners in our mathematics classroom.	0.903			0.178
6. I understand the difficulties encountered by my learners when working with mathematical tasks.	0.818			0.294
7. I am perceptive of my students' feelings in different learning situations in our mathematics class.	0.748			0.329
8. I am considerate on how my students' different attitudes affect how they learn in our mathematics class.			0.503	0.504
9. I am observant of my learners' potential mental health challenges in our mathematics class.		0.85		0.247
10. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.		0.767		0.396
11. I am proficient in understanding my learners' points of view in our mathematics class.		0.902		0.236
12. I am conscious of my students' difficulties when working on activities in mathematics class.			0.508	0.47
13. I examine the ideas that my students have in mathematics class.				0.734
14. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.	0.964			0.104

	Factor			
	1	2	3	Uniqueness
15. I am consistent in fostering student motivation in our mathematics class.			0.701	0.47
16. I handle my students' errors in our mathematics class with respect.	0.944			0.182
17. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.			0.767	0.482
18. I am constructive in providing feedback to my learners in our mathematics class.	0.889			0.267
19. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.			0.701	0.476
20. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.			0.927	0.229
21. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.	0.858			0.25
22. I am eager in acknowledging my learners' efforts in our mathematics class.			0.918	0.255
23. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.			0.746	0.408
24. I am facilitative in encouraging a helpful environment for my students in mathematics learning.			0.91	0.256

Note. 'Principal axis factoring' extraction method was used in combination with a 'promax' rotation

Table 13 shows the forced analysis with fixed three factors via the principal axis factoring extraction method alongside promax rotation. The analyzed data yielded three factors with logical factor loadings. Factor 1 has 7-item acceptable loadings ranging from 0.748 to 0.964 and was named *supportive teaching* (items 5, 6, 7, 14,16, 18, and 21). Likewise, factor 2 has 7-item acceptable loadings ranging from 0.767 to 0.902 and was named emotional awareness (items 1, 2, 3, 4, 9, 10, and 11). Furthermore, factor three has 9 factor loadings, seven of which are acceptable ranging from 0.701 to 0.927 and was named instructional adaptability (items 15, 17, 19, 20, 22, 23, and 24), while two did not satisfy a threshold of 0.6 and above (Sigudla & Maritz, 2023) which are items 8 (0.503) and 12 (0.508). Further, one of the three omitted items is item 13 since it did not load. Hence, each factor produced 7-item acceptable loadings, which generated a total of 21 items, omitting three from the 24-item pool. Out of the three exploratory factor analyses, only a forced analysis with three fixed factors logically produced acceptable items (21 items). Hence, a forced analysis with three fixed factors, which generated a 21-item scale, shows satisfactory validity. Table 14 shows the alpha and omega of subscales.

Table 14

Alpha and Omega of Subscales

Subscale	Number of Items	Cronbach's α	Interpretation	McDonald's ω	Interpretation
Emotional Awareness	7	0.937	Excellent Reliability	0.938	Excellent Reliability
Supportive Teaching	7	0.959	Excellent Reliability	0.959	Excellent Reliability

Subscale	Number of Items	Cronbach's α	Interpretation	McDonald's ω	Interpretation
Instructional Adaptability	7	0.923	Excellent Reliability	0.924	Excellent Reliability
Pedagogical Empathy in Mathematics Scale	21	0.937	Excellent Reliability	0.939	Excellent Reliability

Table 14 shows the alpha and omega of subscales and each reliability descriptor. Cronbach's alpha or tau-equivalent reliability measures the scale's internal consistency, while McDonalds omega or composite reliability (construct reliability) measures internal consistency of a set of items (Haji-Othman & Yusuff, 2022). A threshold of 0.7 to 0.8 suggests acceptable reliability (Hayes & Coutts, 2020), a threshold between 0.8 and 0.9 is considered good reliability, and a threshold of 0.9 and above connotes high reliability (Orçan, 2023). The subscale emotional awareness has excellent reliability, as indicated by $\alpha = 0.937$ and $\omega = 0.938$. Likewise, supportive teaching has excellent reliability with $\alpha = 0.959$ and $\omega = 0.959$. Similarly, $\alpha = 0.923$ and $\omega = 0.924$ yield excellent reliability for instructional adaptability. Overall, the pedagogical empathy in mathematics scale (PEMS) with 21 items generated excellent reliability with $\alpha = 0.937$ and $\omega = 0.939$. Therefore, it was decided that the scale to undergo a second tryout through confirmatory factor analysis.

Second Tryout. Upon the completion of the first tryout and its data analysis, the second tryout was done. Confirmatory factor analysis was used to analyze the gathered data from the second tryout. Appendix S indicates the factor loadings or the standard estimates and the p-values of each item in each factor. According to Chueng et al. (2024), a

factor loading of 0.5 or above is more than acceptable and shows a significant contribution of the items to the factor. Furthermore, a factor loading of 0.7 or above shows a strong indication that the item contributes to the factor (Shau, 2017). The factor loading for each item of Emotional Awareness (factor 1) ranges from 0.682 to 0.721. This suggests that the items in factor 1 are all acceptable, some of which indicate a substantial contribution to the factor (items 1 to 5).

Also, the p-values for Emotional Awareness are all less than 0.001, indicating that each item has a significant and strong relationship to the factor. Similarly, the factor loading for each item of Supportive Teaching (factor 2) ranges from 0.690 to 0.717. Items 8, 9, 10, and 13 show a strong, significant contribution to the factor, while items 11, 12, and 14 indicate a meaningful contribution to the factor. All the p-values ($p<0.001$) for the items of Supportive Teaching demonstrate a significant relationship to the factor. Lastly, the factor loading for each item of Instructional Adaptability (factor 3) ranges from 0.678 to 0.733, which suggests that there is a substantial and strong contribution of each item to the factor. This is supported by the p-value of each item ($p<0.001$), which indicates a strong relationship to the factor. Table 15 below shows the factor covariances.

Table 15

Factor Covariances

		Estimate	SE	Z	P	Stand. Estimate
Emotional Awareness	Emotional Awareness	1.000[a]				
	Supportive Teaching	0.287	0.0596	4.81	<.001	0.287
	Instructional Adaptability	0.262	0.0604	4.33	<.001	0.262
Supportive Teaching	Supportive Teaching	1.000[a]				
	Instructional Adaptability	0.207	0.0619	3.34	<.001	0.207
Instructional Adaptability	Instructional Adaptability	1.000[a]				

[a] fixed parameter

The table shows the standard estimates of each factor in relation to other factors. This shows the correlation of one factor to another, identifying whether the factors are one and the same (Dash & Paul, 2021). According to Wu and Little (2011), the factor covariance between each pair of factors must be less than 0.85. The covariance between emotional awareness and supportive teaching is 0.287, which is lower than 0.85. This connotes that emotional awareness and supportive teaching are distinct concepts but measure pedagogical empathy. Likewise, the covariance between emotional awareness and instructional adaptability implies a distinction between factors while measuring pedagogical empathy with 0.262. Finally, 0.207 is the factor covariance of supportive teach-

ing and instructional adaptability. Therefore, it can be inferred that pedagogical empathy is multi-dimensional with 3 distinct factors. Table 16 below shows the model fit indices.

Table 16

Model Fit

							RMSEA 90% CI	
χ^2	Df	P	CFI	TLI	SRMR	RMSEA	Lower	Upper
317	186	<.001	0.952	0.946	0.0352	0.0469	0.0379	0.0556

Table 16 shows the key indicators of model fit derived from the maximum likelihood. The chi-square values ($\chi^2 = 317$, $p < 0.001$) show that there is a significant result, which proposes that the model does not substantially represent the data. According to a non-significant ($p > 0.05$) chi-square test suggests that the proposed model fits well with the construct, while a significant p-value ($p < 0.05$) indicates that the model does not fit with the construct since it is sensitive to sample size. However, several studies explained that a significant p-value is not a conclusive indicator of a bad fit, but it suggests that further investigation of the model through fit measures such as Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standard Root Mean Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) is necessary (Alavi et al., 2020; Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019). Hence, it is imperative to investigate other indicators that explain a more comprehensive test of model fit.

Further investigation of the model fit through CFI was done, and generated an excellent model fit at CFI = 0.952, which failed to reject the model. Several studies posit that a CFI of 0.90 to 0.94 represents a good fit, while a CFI of 0.95 and above indicates an excellent fit (Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019). Like CFI, using TLI as an additional index for model fit with thresholds of 0.90 for good fit and 0.95 or above for excellent fit (Kyndt & Onghena, 2014), TLI assesses how satisfactory the recommended model fits the data in parallel to the baseline model (Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019). In this case, the TLI = 0.946 is close to an excellent model fit but is within the good fit threshold. Hence, based on the TLI, the model fit is validated with a good fit. Similarly, using SRMR with a threshold of less than 0.05 indicates a good fit, while a threshold between 0.05 to 0.08 indicates an acceptable fit (Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019).

In the context of the study, an SRMR = 0.0352 suggests a good fit. Finally, RMSEA was computed since the sample size is more than 200 (Bouton, 2014). This supplementary fit index mirrors the mean variance between predicted and observed correlations. Like SRMR, a good fit is based on a threshold of less than 0.05, while a value from 0.05 to 0.08 indicates a better fit (Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019). The result shows that RMSEA = 0.0469 connotes a good fit. In general, aside from the chi-square, all the fit indices were adequate or acceptable. Therefore, based on the test of exact fit and fit measures, it can be concluded that the model fits the pedagogical empathy construct. Table 17 shows the alpha and omega of subscales during the confirmatory factor analysis.

Table 17

Alpha and Omega of Subscales – Confirmatory Factor Analysis

Subscale	Number of Items	Cronbach's α	Interpretation	McDonald's ω	Interpretation
Emotional Awareness	7	0.871	Good Reliability	0.871	Good Reliability
Supportive Teaching	7	0.872	Good Reliability	0.872	Good Reliability
Instructional Adaptability	7	0.869	Good Reliability	0.87	Good Reliability
Pedagogical Empathy in Mathematics Scale	21	0.865	Good Reliability	0.865	Good Reliability

Table 17 shows the alpha and omega of subscales and each reliability descriptor. Cronbach's alpha or tau-equivalent reliability measures the scale's internal consistency, while McDonalds omega or composite reliability (construct reliability) measures internal consistency of a set of items (Haji-Othman & Yusuff, 2022). A threshold of 0.7 to 0.8 suggests acceptable reliability (Hayes & Coutts, 2020), a threshold between 0.8 and 0.9 is considered good reliability, and a threshold of 0.9 and above connotes high reliability (Orçan, 2023). The subscale emotional awareness has good reliability, as indicated by $\alpha = 0.871$ and $\omega = 0.871$. Likewise, supportive teaching has good reliability with $\alpha = 0.872$ and $\omega = 0.872$. Similarly, $\alpha = 0.869$ and $\omega = 0.870$ yield good reliability for instructional adaptability. Overall, the pedagogical empathy in mathematics scale (PEMS) with 21

items generates good reliability with $\alpha = 0.865$ and $\omega = 0.865$. Table 18 shows the average variance extracted.

Table 18

Average Variance Extracted

Factor	Emotional Awareness	Supportive Teaching	Instructional Adaptability
Average Variance Extracted	0.5	0.5	0.5

Average Variance Extracted is a statistical measure that evaluates the convergent validity by measuring the ratio of variation in observed variables that is described by the construct (Cheung et al., 2024). The threshold that indicates acceptable convergent validity is 0.5 or above (Cheung et al., 2024). Table 18 shows the AVE=0.5 for each factor (emotional awareness, supportive teaching, and instructional adaptability). This connotes that each factor has acceptable convergent validity.

Scale Reliability. This part presents the result of scale reliability. It shows the values that provide proof of the scale's internal consistency. Table 19 shows the results of the scale reliability statistics.

Table 19

Scale Reliability Statistics

	Cronbach's α	McDonald's ω
Scale	0.937	0.939

The standard deviation of 0.430 suggests that the respondents' answers spread close to the mean of 6.42. A Cronbach's α of 0.937 indicates strong internal consistency supplemented by the McDonald's ω of 0.939, showing excellent reliability. Appendix U shows that the means of the items ranging from 6.27 to 6.52 suggest that the respondents consistently answered high on the PEMS, with the standard deviation ranging from 0.599 to 0.756. The item-rest correlation, which ranges from 0.519 to 0.699, indicates a moderate to strong correlation (Ojio et al., 2021; Zijlmans et al., 2018). Item 17, in particular, has the lowest item-rest correlation of 0.519. However, it is within a substantial correlation range. Furthermore, Cronbach's alpha, which ranges from 0.933 to 0.936, and McDonald's omega, which ranges from 0.935 to 0.939, imply that the scale has a strong internal consistency. Deleting any item in the scale does not weaken reliability significantly.

Discussion

Phase 1 of the study explored the development and validation stages of a scale for measuring the pedagogical empathy of secondary mathematics teachers. This phase addressed the research questions 1 (*What measure of pedagogical empathy for secondary*

mathematics teachers can be developed?) and 2 (*How valid and reliable is the developed measure for pedagogical empathy for secondary mathematics teachers?*).

Addressing research question 1, the development stage was carried out through a search of the content domain, item writing, and content validation by experts and prospective respondents. The initial dimensions (affective, cognitive, and behavioral) based on the initial framework of this study were changed after the first and second scale development in adherence to the suggestions of experts, content validation indices, and feedback from my adviser. Specifically, there was a misalignment of scale items in the behavioral dimension. Furthermore, some items were not operationalized based on their respective dimensions, and the scale items lack specificity on mathematics teaching. This is parallel to the critique of several studies on empathy scales in education, which are frequently too broad and lack specificity in the contextual challenges that teachers face (Aldrup et al., 2022; Samavi et al., 2022; Wang et al., 2022). In that sense, mathematics-specific scale items that reflect teachers' empathy must be ensured. Consequently, in consultation with my adviser, we re-evaluated and reconceptualized the dimensions of pedagogical empathy in this study after the second scale development.

The exploration of dimensions with respect to the search for content domain and item writing based on the decision undergone has led to the reformation of theoretical bases and reformulation of the scale around these two dimensions: Empathic Understanding and Empathy in Teaching. The revised dimensions showcased conceptual fit accuracy to pedagogical empathy in the mathematics classroom. Affective and cognitive empathy were combined to form empathic understanding. This is supported by the definition pro-

vided by Rogers (1957), which states that empathic understanding is the combined experience of affective and cognitive empathy. Furthermore, several studies claim that affective and cognitive empathy are merged to mirror the complete receptiveness of teachers (Ampofo et al., 2025; Santiago, 2023). Also, the behavioral dimension was changed to empathy in teaching since it is the action-oriented component and the outward expression of empathy (Borich, 2016; Cherewick et al., 2022; Meyers et al., 2019). This notion is supported by Noddings (2012), who posits that teachers must employ reflective responses and make thoughtful connections for students to succeed. Hence, teachers must adapt contextual instruction, encourage, and provide meaningful feedback to students. In essence, these dimensions of pedagogical empathy showcase teachers' ability to feel and understand the feelings of the students, coupled with action-oriented teaching behavior. These dimensions fit the pedagogical responsiveness and decision-making of secondary mathematics teachers in the classroom.

The third and fourth rounds of scale development have undergone content validity by experts and prospective respondents. The third developed scale produced items that are acceptable and some items that need revision based on the content validity indices and the feedback of the experts. Several studies posit that expert validation diminishes the underrepresentation of constructs and guarantees that the items reflect the constructs' conceptual components (Elangovan & Sundaravel, 2021; Hair et al., 2019; Morgado et al., 2018). The fourth and final round of scale development achieved a CVI of 1 for all items, indicating a pool of 24 scale items that are acceptable. According to Polit et al. (2007), a strong indicator of clarity and content relevance is exemplified when the items

achieved a CVI of 1. The scale was finalized after the fourth round of content validation by experts and a one-time point content validation by prospective respondents. With the decision of the experts and prospective respondents, the scale was approved as acceptable in congruence with content validity indices and the feedback of my adviser. Therefore, the content validity of the developed scale was confirmed.

In addressing research question 2, an exploration of the validity and reliability of the Pedagogical Empathy in Mathematics Scale (PEMS) was conducted through a series of two tryouts. The first tryout employed the Exploratory Factor Analysis (EFA) to investigate the fundamental elements of the scale and refine the dimensional structure. The Bartlett's Test of Sphericity ($\chi^2 = 9712$, df = 276, $p < 0.001$) and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.854 ensured that the data met the assumptions of EFA. This indicates that there is an adequate correlation among the items. Hence, the dataset was suitable for exploratory factor analysis. Several empirical studies claim that a dataset is suitable for exploratory factor analysis if it has a strong KMO and Bartlett's test result, which confirm the fundamental factorability of data (Amerioun et al., 2018; Hoelzle & J. Meyer, 2012). This offers a reliable statistical basis for polishing the dimensional structure of the scale.

Five factors were generated in the initial EFA using the parallel analysis via principal axis factoring extraction, used in combination with a promax rotation. However, only two of the five factors have at least three items with acceptable factor loadings. Therefore, a five-factor solution was not proven to be conceptually and statistically sound. Consequently, a series of forced analyses was undertaken. Based on the results of

the exploration of forced analyses, a three-factor solution provided the most logical and understandable structure. Hence, three distinct dimensions were determined: Emotional Awareness, Supportive Teaching, and Instructional Adaptability. These three dimensions reflect the conceptual structure of pedagogical empathy. Emotional awareness is the ability of teachers to be sensitive and attuned to the emotional state of their learners (Corcoran & Tormey, 2012; Lane & Smith, 2021; Samnøy et al., 2023). On the other hand, supportive teaching is the ability of teachers to provide motivation, emotional support, and positive feedback to students (Cornelius-White, 2007; Reeve & Cheon, 2021; Wentzel, 1997). Instructional adaptability refers to the teachers' ability to adapt to students' intellectual needs and emotional states by modifying teaching strategies and methods (Cornelius-White, 2007; Parsons & Vaughn, 2014; Parsons et al., 2018). Each dimension consists of 7 items, which total 21 items from the original 24. Furthermore, Cronbach's alpha and McDonald's omega of subscales range from 0.923 to 0.959. exceeded the excellent reliability threshold. According to Kline (2023), exceptional internal consistency is shown by a reliability coefficient exceeding 0.90. Hence, the scale exemplified excellent internal consistency.

A second tryout using Confirmatory Factor Analysis (CFA) was conducted to confirm the strength and structure of the scale. The results of the EFA were supported by the results of the CFA. As stated by Brown (2015), CFA is a potent tool to evaluate a construct's conceptual structure and indicators. The conceptual dimensionality identified in the EFA is validated by strong standardized loadings and significance of items via CFA (Hair et al., 2019). All of the items loaded substantially on their corresponding fac-

tors, with loadings ranging from 0.678 to 0.733. Moreover, all items have p-values less than 0.001. The factor loadings of each item with respect to their corresponding factors exceeded the acceptable threshold. According to McNeish (2018), alpha and omega coefficients that are way above the acceptable threshold indicate that the items within each dimension consistently measure a latent construct. Therefore, each item showed robust and major contributions to its respective factors. These results validated the dimensional construct gained from the exploratory phase and strengthened the structural reliability of the 21-item scale.

In addition, factor covariances were explored to evaluate the association among the identified dimensions. These covariances show how each factor is correlated with each other (Tavakol & Wetzel, 2020). A range from 0.207 to 0.287 of the inter-factor correlation standardized estimate showed statistical significance. This connotes the relationship between dimensions while demonstrating distinct constructs. Hence, the three subscales measure unique but interrelated aspects of pedagogical empathy in mathematics teaching, demonstrating the multidimensionality of pedagogical empathy. According to Davis (1983), a unidimensional construct is less informative than a multidimensional construct because it does not describe the different subtleties present in the construct. In this case, the scale captured the multidimensionality of pedagogical empathy as applied in mathematics teaching.

Moreover, the key indicators of model fit derived from the maximum likelihood were also checked. The chi-square values ($\chi^2 = 317$, $p < 0.001$) indicate that the model does not fit with the construct since it is sensitive to sample size. However, several stud-

ies posit that chi-square values alone are inconclusive model fit indicators (Alavi et al., 2020; Goretzko et al., 2024; Khademi et al., 2023; Xia & Yang, 2019). Hence, the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standard Root Mean Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) were undertaken. A CFI of 0.952 indicates excellent fit, a TLI of 0.946 indicates good fit, SRMR of 0.0352 suggests good fit, and an RMSEA of 0.0469 indicates good fit. Since the sample size is more than 200, RMSEA was computed (Bouton, 2014). In general, aside from the chi-square values, all the fit indices were adequate or acceptable. It is, therefore, encouraged to use multiple fit indices to secure a powerful and adequate assessment of model fit (Stone, 2021; Zheng & Bentler, 2025).

Alpha and omega of subscales were also done to check the internal consistency and construct reliability of the scale. All subscales exemplified good reliability as indicated by the alpha and omega values: emotional awareness ($\alpha = 0.871$ and $\omega = 0.871$), supportive teaching ($\alpha = 0.872$ and $\omega = 0.872$), and instructional adaptability ($\alpha = 0.869$ and $\omega = 0.870$). Overall, the pedagogical empathy in mathematics scale (PEMS) with 21 items generates good reliability with $\alpha = 0.865$ and $\omega = 0.865$.

Average Variance Extracted (AVE) was also computed to evaluate the convergent validity by measuring the ratio of variation in observed variables that is described by the construct (Cheung et al., 2024). The threshold that indicates acceptable convergent validity is 0.5 or above (Cheung et al., 2024). The AVE=0.5 for each factor (emotional awareness, supportive teaching, and instructional adaptability) connotes that each factor has acceptable convergent validity.

After the exploratory and confirmatory factor analyses, the reliability of the 21-item scale was established. The Cronbach's alpha of 0.937 and McDonald's omega of 0.939 indicated strong internal consistency. The alpha for each item ranges from 0.933 to 0.936, while the omega for each item ranges from 0.935 to 0.939. The strong reliability of the scale is reflected by the contributory items, which propose robust item homogeneity and show interconnectedness among subscales (Garcia et al., 2023). These highlight that all items in the scale meaningfully contribute to the reliability of the Pedagogical empathy Scale. Therefore, this further confirms the scale's psychometric veracity.

In conclusion, the sequential process of exploratory and confirmatory factor analysis ushered in a prudent evaluation and refinement of the 21-item scale composed of three distinct factors. The structural relationship among the factors was significant while each is unique from the other. Furthermore, the internal consistency of each subscale and the overall scale was excellent. Hence, the Pedagogical Empathy in Mathematics Scale (PEMS) was proven to be valid and reliable. Therefore, PEMS (see Appendix J) can be used to assess the level of pedagogical empathy of secondary mathematics teachers.

Implications of Phase 1 Results

The developed and validated Pedagogical Empathy in Mathematics Scale (PEMS) has important implications to mathematics education. This scale is potentially beneficial in terms of assessing the level of teachers' empathy in the classroom. Identifying the level of teachers' pedagogical empathy paves the way for modifying methods of teaching and learning in mathematics. Several studies established that students tend to be academ-

ically involved, self-efficacious, and perform better when teachers show empathy in the classroom (Borich, 2016); Meyer, 2019). Hence, this study offers a different perspective on how empathy works in a mathematics classroom and provides a research-based framework for mathematics teachers, which is grounded on three distinct dimensions – Emotional Awareness, Supportive Teaching, and Instructional Adaptability. These dimensions assist mathematics teachers in understanding the needs, feelings, and learning styles of the students. Hence, this study offers another perspective for teachers to avoid the use of one-size-fits-all methods (Ampofo et al., 2025). PEMS helps mathematics teachers to see instructional and relational aspects of teaching-learning where improvement is needed. Therefore, this scale aids teachers in identifying a contextual approach in teaching that is student-centered, which fosters an inclusive, compassionate, and productive environment for learning mathematics.

Furthermore, PEMS can be used as an assessment instrument for improving mathematics teachers' dispositions as well as a professional development tool. This is mainly lucrative in situations where the teacher-student relationship is essential to sustain student learning engagement. Several studies posit that it is important to assess the empathy of teachers as it is pivotal in fostering student-centered learning and enhancing classroom climate (Ampofo et al., 2025; Cherewick et al., 2022; Karasova & Nehyba, 2023; Wang et al., 2022). The scale's strong model fit indices and other psychometric qualities show how useful it is for accurately pinpointing dimensions of pedagogical empathy in which teachers can develop. Therefore, the promotion of reflective teaching methods, which is far beyond the delivery of content, is one of the implications of the use of PEMS

as a tool for teachers and educational leaders, especially for mentoring, coaching, and performance review.

Taking on a research vantage point, PEMS's multidimensional structure makes way for teachers to examine the association between students' mathematics achievement and pedagogical empathy. Each dimension may further be explored as it is applied directly in mathematics teaching. Hence, PEMS contributes to the body of knowledge on the use of empathy in teaching, not just a usual trait but an important aspect of teaching mathematics. This scale provides notable development in the literature since pedagogical empathy was chunked into dimensions specific to mathematics teaching. Future studies may use this scale to investigate the influence of each dimension of pedagogical empathy on students' mathematics achievement with diverse and marginalized backgrounds. Additionally, PEMS is suitable for experimental and longitudinal studies, particularly delving into investigations on interventions on quality of teaching and learning grounded in pedagogical empathy.

Primarily, this study offers a clear perspective for teachers and educational leaders to see PEMS not just as an instrument to measure pedagogical empathy but also as a way to deeply understand how to teach mathematics with empathy. The use of PEMS presents an avenue for more reactive, insightful, and compassionate teaching as mathematics classrooms become more pedagogically demanding and students become more diverse. This scale provides another vantage point for teachers to see that learners do not only need to learn, but they also need to be heard, cared for, and seen (Wang et al., 2022). Hence, with the use of PEMS, educational leaders and teachers can collaborate to create

policies and teaching interventions for strong, supportive instruction that sustains meaningful mathematics learning. In the context of the Department of Education, particularly in mathematics teaching, the use of this scale may facilitate the regional and national efforts in fostering empathy-based teaching strategies, upgrading in-service training, and enhancing mathematics classroom practices. Grounded in the application of pedagogical empathy in mathematics teaching, PEMS may aid DepEd policy decisions relative to teacher assessment, improvement of the curriculum, and instructional leadership.

Results of Phase 2: Analysis of Antecedents and Consequences of Pedagogical Empathy

This part presents the revised framework based on the results of phase 1 and the results of the investigation of the antecedents and consequences of pedagogical empathy.

Reconceptualized Framework

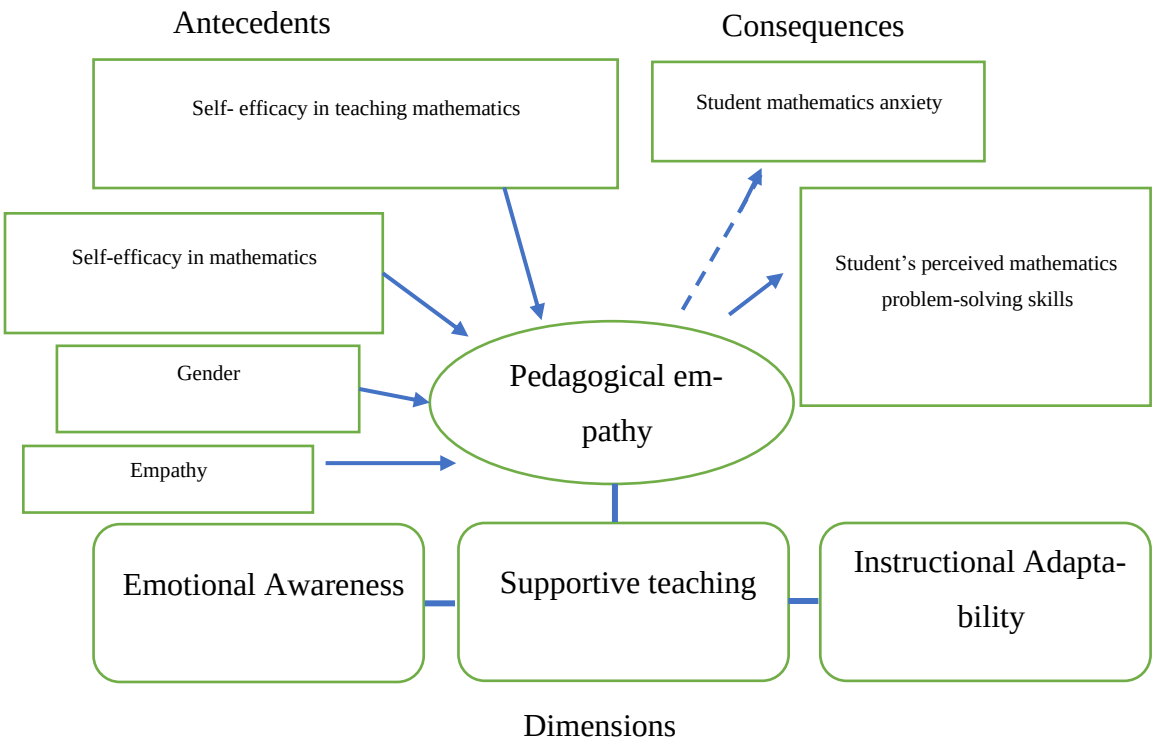
The conceptual framework was reconceptualized due to the results of phase 1. The initial dimensions, as guided by the literature, are affective, cognitive, and behavioral dimensions of pedagogical empathy. However, as the research progressed and upon adhering to the procedure of scale development and validation, the former dimensions were substituted by two other distinct dimensions, specifically empathic understanding and empathy in teaching.

On the other hand, the dimensions that guided the scale development from phase 1 refined the conceptual structure of pedagogical empathy of secondary mathematics teachers. The results revealed through forced analysis with fixed three factors were logi-

cal via principal axis factoring extraction method with promax rotation. Hence, three dimensions emerged, namely emotional awareness, supportive teaching, and instructional adaptability. Therefore, with the former conceptual framework, only the dimensions were changed.

Figure 2

Reconceptualized Dimensions of Pedagogical Empathy



Research Question 3: Do mathematics teachers' gender, self-efficacy in teaching mathematics, self-efficacy in mathematics, and basic empathy predict their pedagogical empathy?

Antecedents of Pedagogical Empathy. This part shows the results of the antecedents of pedagogical empathy. Table 20 shows the model fit measures of the antecedents of pedagogical empathy.

Table 20

Antecedents of Pedagogical Empathy – Model Fit Measures

				Overall Model Test			
Model	R	R^2	Adjusted R^2	F	df1	df2	P
Antecedents of Pedagogical Empathy	0.319	0.102	0.0772	4.12	4	145	0.003**

*Significant at $p<0.05$

**Significant at $p<0.01$

Multiple regression analysis was used to answer the third research question. This segment presents the results of the investigation of the predictive influence of the identified factors (antecedents) on pedagogical empathy. Table 20 shows the model fit of the antecedents of pedagogical empathy.

This research is conducted to determine if teachers' gender, self-efficacy in teaching mathematics, self-efficacy in mathematics, and basic empathy predict pedagogical

empathy. It is hypothesized that four predictors are positively associated with pedagogical empathy. Results revealed that 10% of the variance is explained by the four predictors, *F (4,145) = 4.12, p = 0.003*. This means that explained variance is small but significant. According to Fernando (2024), a higher R-squared value does not guarantee that it is good or bad since a good model may generate a low R-squared value and vice versa. Taking into account the results demonstrates that the overall model of regression is statistically significant. As a whole, some of the antecedents significantly predicted pedagogical empathy. The details of the association are shown in Table 21.

Table 21

Multiple Regression Analysis on the Antecedents of Pedagogical Empathy of Secondary Mathematics Teachers

Predictor	B	ß	SE	T	P
Intercept[a]	1.198		1.551	0.772	0.441
Gender	0.233	0.3577	0.104	2.241	0.027*
Self-efficacy in Teaching Mathematics	0.694	0.1712	0.347	2.001	0.047*
Self-efficacy in Mathematics	0.122	0.0857	0.12	1.021	0.309
Basic Empathy	0.222	0.1657	0.109	2.044	0.043*

[a] Represents reference level

*Significant at p<0.05

Results revealed that gender predicts pedagogical empathy. More specifically, it shows that female teachers indicated higher levels of pedagogical empathy than male

teachers *(B=0.233, ß=0.3577, t=2.241, p=0.027)*. Therefore, there is not enough evidence to reject the first research hypothesis. This is consistent with the findings of Christov-Moore et al. (2014), who examined neuroscientific data and found that empathy manifests more in females than in males as observed from infancy through adulthood. Hence, its implication for the professional context means that female teachers are more aptly to be naturally empathic than their male counterparts. To extend this idea, teachers in general are empathic towards students' learning processes (Genç, 2024). This can be seen in how teachers conceptualize the way they teach students and build their self-efficacy in teaching.

Further, teachers' self-efficacy in teaching mathematics *(B=0.694, β =0.1712, t=2.001, p=0.047)* and teachers' basic empathy *(B=0.222, β=0.1657, t=2.044, p=0.043)* are positively associated with teachers' pedagogical empathy. This means that the greater level of teachers' mathematics teaching self-efficacy and basic empathy predicts a higher level of pedagogical empathy. The former is supported by several studies, which posit that an increase in the level of self-efficacy in teaching contributes to greater empathy (Hettinger et al., 2023; Saadati et al., 2023). This is indicated by the unstandardized estimate (B=0.694), which connotes that a unit increase in the level of teachers' self-efficacy in teaching mathematics is correlated with a 0.694-unit increase in teachers' pedagogical empathy. Furthermore, Cohen et al. (2017) posit that a standardized coefficient (β) threshold of 0.1 indicates a small effect size, meaning weaker effects; 0.3 indicates a medium effect size, meaning average effects; and 0.5 indicates a large effect size, meaning stronger effects. In this case, the standardized coefficient (β= 0.1712) is right above but is

closer to 0.1 with a small size effect and denotes weaker effects. However, a p-value (p=0.043) implies that there is a statistical significance, which suggests that self-efficacy in teaching mathematics predicts pedagogical empathy. Therefore, there is insufficient evidence to reject the second research hypothesis.

Likewise, basic empathy predicts pedagogical empathy as indicated in the results. The unstandardized coefficient (B=0.222) suggests that a unit increase in the level of basic empathy is associated with a 0.222 unit increase in the level of pedagogical empathy. The standardized coefficient (β=0.1657) indicates slightly higher but still closer to the 0.1 threshold of small–weaker effects. On the contrary, the p-value shows a statistically significant value of 0.043. Therefore, there is no sufficient evidence to reject the fourth research hypothesis.

On the other hand, teachers' mathematics self-efficacy is not significantly related to pedagogical empathy *(B=0.122, ß=0.0857, t=1.021, p=0.309)*. This is also indicated in the value of the standardized coefficient (ß=0.0857), showing no size effect. This positis that teachers' mathematics self-efficacy does not predict their pedagogical empathy. In this case, there is sufficient evidence to reject the third research hypothesis.

Research Question 4: Does pedagogical empathy of mathematics teachers predict student mathematics anxiety and students' perceived mathematics problem-solving skills?

Consequences of Pedagogical Empathy. A series of simple regression analyses was done to check whether pedagogical empathy predicts each consequence. The results are presented in Table 22 below to illustrate the association.

Table 22

Consequences of Pedagogical Empathy - Model Fit Measures

Model	R	R^2	Adjusted R^2	Overall Model Test			
				F	df1	df2	P
1. Students' Math Anxiety	0.095	0.00902	0.00836	13.6	1	1498	<.001***
2. Students' Perceived Math Problem-solving Skills	0.0805	0.00648	0.00581	9.77	1	1498	<.002**

Note. Model 1 estimated using a sample size of N=150.

Models 2 and 3 were estimated using a sample size of N=1500.

**Significant at p<0.01

***Significant at p<0.001

This research was conducted to determine if pedagogical empathy predicts students' math anxiety and students' perceived math problem-solving skills. It is hypothesized that the two outcome variables are positively or negatively associated with pedagogical empathy.

Results revealed that nearly 1% of the variance is explained by pedagogical empathy on students' math anxiety. Hence, the explained variance is extremely small. This means that more than 90% of the variance is explained by other variables not in the model. However, the p-value (p<0.001) indicates a very strong correlation between students' perceived teacher's pedagogical empathy and students' math anxiety. Furthermore,

roughly 1% of the variance is explained by pedagogical empathy on students' perceived math problem-solving skills as a consequence. Similar to the explained variance of pedagogical empathy on students' math anxiety, the explained variance of pedagogical empathy on students' perceived math problem-solving skills is extremely small. In contrast, the p-value ($p<0.001$) shows that there is a very strong relationship between students' perceived teacher's pedagogical empathy and students' perceived math problem-solving skills. In totality, both consequences were significantly predicted by pedagogical empathy with extremely small explained variance. For further discussion of the details of the association, tables 23 and 24 are shown below.

Table 23

Simple Regression Analysis of Students' Mathematics Anxiety as a Consequence of Pedagogical Empathy

Predictor	B	ß	SE	T	P
Intercept	3.278		0.1685	19.46	<.001***
Teacher's Pedagogical Empathy	-0.103	-0.095	0.0279	-3.69	<.001***

[a] Represents reference level

***Significant at $p<0.001$

The table indicates that teachers' pedagogical empathy is negatively associated with students' mathematics anxiety ($B=-0.103$, $\beta=-0.0950$, $t=-3.69$, $p<0.001$). The un-

standardized coefficient (B=-0.103) shows that a unit increase in the students' perceived teacher's pedagogical empathy with a 7-point scale ushers a decrease of 0.103 on students' mathematics anxiety with a 5-point scale. Furthermore, the standardized coefficient (β=-0.0950) suggests a small effect size since it is less than -0.1. On the other hand, the p-value ($p<0.001$) indicates a very strong association between students' perceived teacher's pedagogical empathy and students' mathematics anxiety.

This implies that teachers' higher levels of pedagogical empathy tend to have lower levels of students' mathematics anxiety. This coincides with the study of (C. Wang et al., 2024), who suggested that there is a negative relationship between students' mathematics anxiety and teachers' educational-emotional support. In addition, perceived teachers' empathy regulates students' anxiety in learning (Ampofo et al., 2025). Hence, these strengthen the result that when a teacher has higher pedagogical empathy, students tend to have lower mathematics anxiety. Therefore, there is no sufficient evidence to reject the fifth research hypothesis.

Table 24

Simple Regression Analysis of Students' Perceived Math Problem-Solving Skills as a Consequence of Pedagogical Empathy

Predictor	B	ß	SE	t	P
Intercept	3.1154		0.1424	21.88	<.001***
Teacher's Pedagogical Empathy	0.0738	0.0805	0.0236	3.13	<.002**

[a] Represents reference level

**Significant at p<0.01

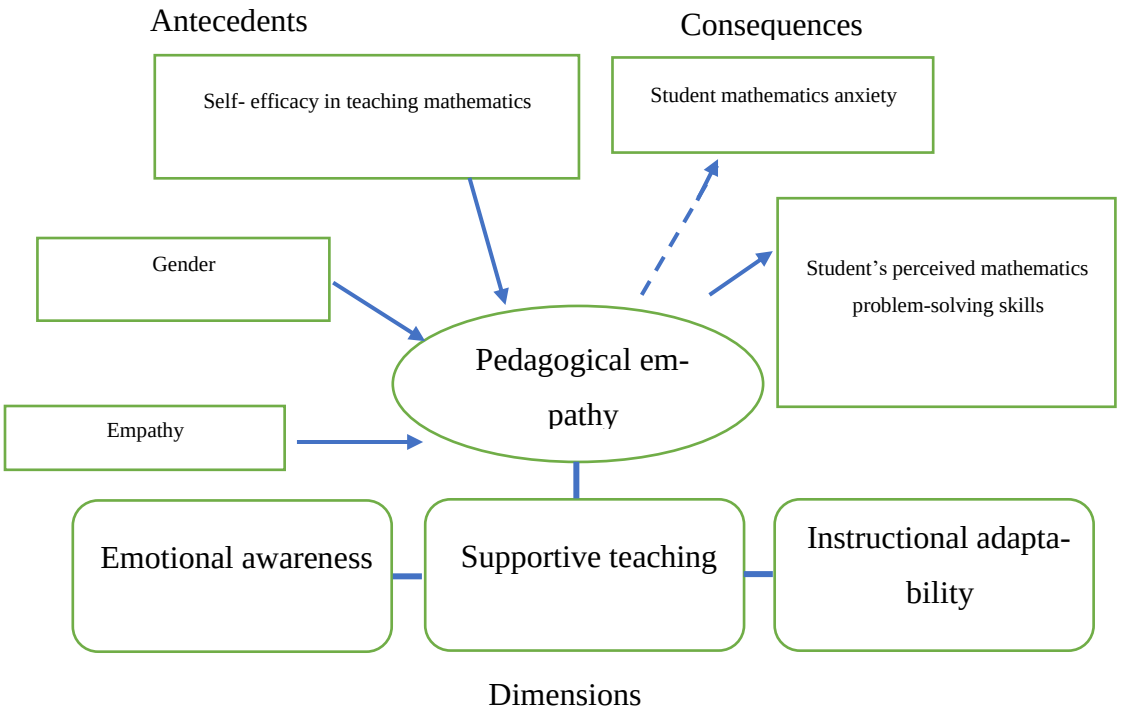
***Significant at p<0.001

The results revealed that teachers' pedagogical empathy is positively correlated with students' perceived mathematics problem-solving skills (B=0.0738, β=0.0805, t=21.88, p=0.002). The unstandardized estimate (B=0.0738) suggests that for every unit increase in teachers' pedagogical empathy, there is a 0.0738 unit increase in students' perceived math problem-solving skills. Moreover, the standardized estimate (β=0.0805) indicates that there is a small effect size since it is less than 0.1. This shows that there is enough evidence that connects teachers' pedagogical empathy and students' perception of their mathematics problem-solving skills. Findings suggest that an empathic learning environment fostered by teachers leads to higher academic achievement and increased student motivation (Uhing, 2020). By incorporating empathy into the teaching of mathematics, Uhing (2020) finds that students benefit from improved problem-solving skills and

academic attainment. Hence, integrating pedagogical empathy into mathematics teaching can bolster students' perceived problem-solving skills and academic performance (Uhing, 2020). Therefore, there is no sufficient evidence to reject the sixth research hypothesis.

Figure 3

Empirical Framework Based on the Results of Phase 2



Based on the results of the investigation of the antecedents and consequences of pedagogical empathy, the empirical framework was reframed from the reconceptualized model of pedagogical empathy. Results show that self-efficacy in teaching mathematics, gender, and basic empathy positively predict pedagogical empathy. On the other hand,

self-efficacy in mathematics does not predict pedagogical empathy; thus, it was omitted in the framework. Furthermore, results show that pedagogical empathy negatively predicts student mathematics anxiety, while positively predicting students' perceived mathematics problem-solving skills. All anchored on the three dimensions: Emotional Awareness, Supportive Teaching, and Instructional Adaptability.

Discussion

With the reconceptualized framework based on the results of phase 1, phase 2 of the study aimed at answering research questions 3 (*Do mathematics teachers' gender, self-efficacy in teaching mathematics, self-efficacy in mathematics, and basic empathy predict their pedagogical empathy?)* and 4 (*Does pedagogical empathy of mathematics teachers predict student mathematics anxiety and students' perceived mathematics problem-solving skills?).*

The investigation on the antecedents of pedagogical empathy addressed research question 3. This research question sought to identify if self-efficacy in teaching mathematics, self-efficacy in mathematics, gender, and basic empathy predict pedagogical empathy. Multiple regression analysis results revealed the statistical significance of the overall model, specifically highlighting gender, self-efficacy in teaching mathematics, and basic empathy statistically predicted pedagogical empathy. The result is parallel with the findings of the study by, where they posit that effective pedagogical methods are apt to be utilized by teachers with high self-efficacy in teaching mathematics. Through self-efficacy in teaching mathematics, the adaptation of a supportive learning atmosphere ad-

dresses the essential learning needs of the students. Furthermore, the analysis conducted by Giles and his team (2016) indicates a strong connection between the degree of empathy possessed by teachers and their confidence in teaching mathematics. In addition, the study by Perera and John (2020) suggests that teachers who adopt student-centered approaches and provide tailored support to students tend to have higher self-efficacy views regarding teaching mathematics.

Further, female teachers were found to be more empathic than male teachers. Christov-Moore et al. (2014) support this notion, suggesting that women are generally more empathic than men. This has implications for how this nuance influences female teachers in their teaching decisions and their relationship to their students, likewise with male teachers. Moreover, the findings of the study by Graziano et al. (2024) suggest that female teachers exemplified a higher level of empathy and are more empathic communicators during student interactions than male teachers. Also, the findings of the study by De Ruig et al. (2024) revealed that several teachers with high self-efficacy in teaching are likely to be understanding and show concern when interacting with their students. Furthermore, the findings of Aparicio-Flores et al. (2020 and Graziano et al. (2024) indicate that teachers with high self-efficacy in teaching are capable of reacting in a helpful fashion and can handle the emotional conditions of their students. In addition, teachers who have a higher level of basic empathy and robust self-efficacy in teaching mathematics scored higher on pedagogical empathy (Ventista & Brown, 2023). This underscores the interconnectedness of empathic disposition and professional competence of mathematics

teachers. Based on the empirical underpinnings, the identified antecedents demonstrated influence over teachers' pedagogical empathy.

Intriguingly, multiple regression analysis revealed that self-efficacy in mathematics does not statistically predict pedagogical empathy. This suggests that a high level of self-efficacy in mathematics does not guarantee a high level of pedagogical empathy, as it is reflected in both standardized and unstandardized estimates. However, it is necessary to underscore that to respond to the demand for the standard and quality of teaching mathematics concerning the students' needs, teachers must be able to effectively shape and enhance their mathematical aptitude or content knowledge. According to Hashweh (2005), content knowledge helps anticipate students' misconceptions, interpret students' thinking processes, and accurately tailor-fit the explanation, which transforms into meaningful student learning. Thus, there is a need to further study the connection between teacher self-efficacy in mathematics and pedagogical empathy. There is a lack of focus on the direct relationship of teacher self-efficacy in mathematics and pedagogical empathy. While there is research that connects self-efficacy and empathy, there is no research that directly suggests that self-efficacy in mathematics predicts pedagogical empathy. Hence, there is a need to put this in light for more research investigations. It can then be concluded that a high level of self-efficacy in teaching mathematics and basic empathy improves the level of pedagogical empathy over proficiency in mathematics content knowledge.

Investigation on the consequences of pedagogical empathy addressed research question 4 using a series of simple regression analyses. The identified consequences were

students' mathematics anxiety and students' perceived mathematics problem-solving skills. Gathered data from the students' perceived teacher's pedagogical empathy were compared to each student variable (students' math anxiety and students' perceived math problem-solving skills) as a consequence of pedagogical empathy via simple regression analysis.

Results revealed a negative relationship between pedagogical empathy and students' mathematics anxiety. This connotes that the greater the teachers' level of pedagogical empathy, the lower the level of students' mathematics anxiety. This is supported by the study of Aldrup et al. (2022), where they posit that students who perceive their teacher as empathic have reported lower mathematics anxiety. This underscores the influence of the empathy of teachers on the emotional well-being of students. Hence, empathic teachers help alleviate students' mathematics anxiety. This aligned with the results of several studies indicating that empathy in education lowers anxiety in an academic context (Ampofo et al., 2025; C. Wang et al., 2024). Moreover, a study by Yang et al. (2021) revealed that when teachers exemplified empathy in the classroom, students tend to increase self-efficacy and confidence, which alleviates mathematics anxiety, leading to an increase in students' learning engagement and improved academic achievements. In extension, Rozgonjuk et al. (2020) also posited that through teachers' supportive learning, students improve their self-efficacy, which results in lower mathematics anxiety. Furthermore, teachers who are passionate about mathematics and deliver adequate mathematics-related instruction may help in reducing students' apprehension about math. According to a study by Cooper et al. (2018), collaborative tasks and other forms of active

learning can help students feel less anxious. Therefore, empathetic teachers can promote deep learning, boost students' confidence in their mathematical abilities, and deliver effective mathematics-related instruction, which helps alleviate students' anxiety.

Finally, results revealed that pedagogical empathy statistically predicted students' perceived mathematics problem-solving skills. Findings suggest that emphatic teachers who foster an inclusive learning environment lead to improved students' overall academic performance, math problem-solving skills, and motivation (Uhing, 2020). For students to develop life skills like critical thinking, problem-solving, and mathematical reasoning, teachers should actively encourage students to love learning (Mukuka et al., 2023) in light of empathy. Several studies claim that teaching with empathy generally influences students' academic achievement and problem-solving skills (Aldrup et al., 2022; Ampofo et al., 2025). Empirical findings indicate that utilizing empathy in the classroom enhances students' appreciation of their capacity to tackle complex math issues and encourages them to pursue math learning with greater enthusiasm.

In conclusion, Phase 2 offered an ample analysis of the antecedents and consequences of pedagogical empathy. Multiple regression analyses revealed that self-efficacy in teaching mathematics, gender, and basic empathy predict pedagogical empathy. On the other hand, there is no sufficient evidence that suggests that self-efficacy in mathematics statistically predicts pedagogical empathy. Furthermore, a series of regression analyses revealed significant evidence that pedagogical empathy negatively predicts students' mathematics anxiety and positively predicts students' perceived mathematics problem-

solving skills. Overall, the results of phase 2 confirm the multidimensional structure of pedagogical empathy grounded by personal and professional factors.

Implications of Phase 2 Results

The results of Phase 2 of the study provide meaningful implications in mathematics education, exhibiting that high mathematical competence does not solely define effective mathematics teaching. The findings challenge the notion that effective mathematics teaching mediated by pedagogical empathy is not uniquely determined by the teachers' mastery of mathematics alone, which is shown by the gap in the insufficiency of evidence on the influence of teachers' self-efficacy in mathematics on pedagogical empathy. It can be derived, thereby, that a teacher's high competence in mathematics does not mean that they are empathic in teaching. This is a noteworthy notion in the literature that needs to be investigated further for future research. Interventions on the integration of pedagogical empathy in teacher training, as well as in pre-service teacher training, may be explored.

Affirmatively, the findings established that self-efficacy in teaching mathematics and basic empathy of teachers predict pedagogical empathy. The results highlight the significance of confidence in facilitating mathematics learning and understanding the viewpoint of the students. Several studies claim that effective teaching practices through student-centered methods and stronger student-teacher relationships are some of the benefits when teachers manifest a high self-efficacy in teaching (Emiru & Gedifew, 2024; Schunk & DiBenedetto, 2015; Shah, 2023; Woodcock et al., 2023) and empathy (Posokhova et al., 2020). This implies that apart from the content knowledge in mathe-

matics, professional development for teachers must also build on their emotional faculty and confidence in content mastery. This, in turn, influences how teachers view the use of their competence in teaching mathematics and design effective instructions that fit the context of students, mindful of their feelings and situations.

In connection with mathematics teaching and learning, results imply that pedagogical empathy as a direct predictor of student mathematics anxiety and students' perceived mathematics problem-solving skills have evident functional importance. Empirical studies posit that students report a lower level of learning anxiety when they perceive their teachers as empathic (Rozgonjuk et al., 2020; Yang et al., 2021). Additionally, several studies claim that empathy helps in forming students' problem-solving skills as integrated in the teaching-learning routine (Uhing, 2020). Therefore, teachers who adjust the way they teach, contextual to the students' ability and emotional state, create a co-creative classroom. A classroom that alleviates students' fear of creating mistakes but is a haven for self-correction with the use of mathematical problem-solving and reasoning. These only show that pedagogical empathy is not just a personal trait but is a formidable means for refining mathematics teaching and learning.

In terms of the practice assessment, teachers and educational leaders must consider students' emotional components as part of the formative assessment. Teaching mathematics should not only focus on the correctness of students' answers but also on their feelings about their classroom activities. Teachers and educational leaders can benefit from tools that identify students' anxiety, emotional readiness, and confidence in doing their mathematical tasks. According to Ampofo et al. (2025), empathy in education is a

critical pedagogical approach that is aligned with students' learning pace and emotional state while considering their psychological well-being. This does not mean that the standard in teaching-learning is reduced but is contextually fitted to the learners while effectively learning. Hence, pedagogical empathy helps teachers to see the appropriate way to enhance students' mathematical achievement while fostering an emotionally safe environment.

In the context of the Department of Education, these findings hold significant importance for the improvement of mathematics teaching across the country. The results can be utilized to support policy making for in-service training, advocate empathy-focused mathematics teaching techniques, and develop systems for teacher evaluation. The findings offer a research-based underpinning to reinforce schemes that go beyond content delivery and aspire to improve student-centered mathematics classrooms that are emotionally responsive across the public schools. Incorporating pedagogical empathy in DepEd programs will empower mathematics teachers to cultivate meaningful learning and student engagement, especially in addressing challenges associated with mathematics anxiety, inclusion, and performance gaps.

Ultimately, the study provides a vantage point for teachers and educational leaders to see what it means to be an effective mathematics teacher. Being a good mathematics teacher is not boxed to knowing the right formula and correct mathematical procedures, but is supplementary to understanding students as people. Good teachers are those who are sensitive to their students' needs, understand how they feel, and make education-

al decisions to help them. These findings should help not only with how we teach mathematics but also how we train and support teachers.

Chapter 4:

Summary, Conclusion, and Recommendations

This chapter presents the summary of the research findings based on the research objectives. It encapsulates the summary, synthesis of the research results, limitations, conclusions, and recommendations of the study.

Summary of the Study

This is a multi-phase study that sought to realize two main goals: (1) to develop and validate a scale that measures teachers' empathy in the classroom (pedagogical empathy), and (2) to examine the ways in which different factors influence and are influenced by pedagogical empathy. Phase 1 addressed the research questions 1 (What measure of pedagogical empathy for secondary mathematics teachers can be developed?) and 2 (How valid and reliable is the developed measure for pedagogical empathy for secondary mathematics teachers?). This phase employed survey-instrument development using a quantitative research design. It is comprised of identifying the content domain, the appropriate scaling technique, writing the items of the scale using a semantic differential scale format, expert and field review, and scale tryouts with exploratory and confirmatory factor analyses. There are three expert validators, 10 field validators, 280 respondents from several regions of the Philippines for the first scale tryout, and 320 respondents from several regions of the Philippines for the second tryout. Stratified random sampling was used to identify 600 respondents who participated in the scale tryouts in this study.

Phase 2 addressed research questions 3 (*Do mathematics teachers' gender, self-efficacy in teaching mathematics, self-efficacy in mathematics, and basic empathy predict their pedagogical empathy?)* and 4 (*Does pedagogical empathy of mathematics teachers predicts student mathematics anxiety and students' perceived mathematics problem-solving skills?)*. This study examined the relationship between pedagogical empathy and its antecedents (teacher self-efficacy in teaching mathematics, teacher self-efficacy in mathematics, gender, and basic empathy) and consequences (students' mathematics anxiety and students' perceived mathematics problem-solving skills). This phase adopted a cross-sectional survey-correlational quantitative research design where multiple regression and a series of simple regression analyses were used. A total of 150 teacher-respondents through stratified random sampling were identified. For every teacher in the second phase of the study, 10 respective student-counterparts were identified through random sampling. Hence, a total of 1500 students were gathered as counterpart respondents of the study.

Summary of Results

Based on the objectives of the study, the findings are outlined as follows:

Results of Phase 1: Scale Development and Validation

1.1 The initial dimensions of pedagogical empathy, which are Affective, Cognitive, and Behavioral, were extracted from the conventional theory of empathy. These dimensions were intended to capture the multidimensionality of empathy within a pedagogical context. A 30-item scale was developed parallel to these dimensions. However, sev-

eral issues emerged upon the first and second conduct of validation by experts. Specifically, the lack of relevance of the developed scale in terms of its applicability to mathematics teaching. Moreover, there were misalignments of scale items to behavioral dimensions as exhibited in the inconsistencies in the scale operationalization with respect to behavioral components. Therefore, based on the validation of experts, CVIs, and upon consultation with my adviser, the reevaluation of the scale's conceptual framework was prompted.

1.2. In consequence of the reassessment of the conceptual underpinnings of the initial dimensions with respect to the experts and my adviser's recommendation, the framework was refined. The dimensions were reframed by combining the affective and cognitive dimensions into a single dimension – Empathic Understanding. On the other hand, the behavioral dimension was reframed to Empathy in Teaching with a focus on the practical classroom application of the action-oriented component of empathy. The reformation of the dimensions addressed previous discrepancies and alignment inconsistencies of scale items to each dimension.

1.3. A 24-item scale was confirmed through construct validity using a content validity index. Four rounds of expert content validity and field content validity established the scale's construct validity. Cronbach's alpha and McDonald's omega ensured that the scale was internally consistent and reliable. Barlett's Test of Sphericity and KMO checked that the scale was appropriate for factor analysis. Exploratory factor analyses were used to validate the scale. Parallel analysis via principal axis factoring extraction in combination with Promax rotation yielded 5-factor illogical results. A forced analysis

with 4 fixed factors was explored and yielded illogical results. Finally, a forced analysis with 3 fixed factors yielded acceptable and logical results, generating a 21-item scale.

1.4. The results of the first phase of the study confirmed a 21-item Pedagogical Empathy in Mathematics Scale (PEMS) in a semantic differential scale format. Exploratory and confirmatory factor analyses cemented the construct's validity. The alpha and omega of subscales and average variance extracted ensured acceptable tau-equivalent reliability, composite reliability, and convergent validity. Hence, all of these indicated and confirmed the development of a valid and reliable scale with three dimensions: (1) Emotional Awareness - the ability of teachers to be sensitive and attune to the emotional state of their learners, (2) Supportive Teaching - the ability of teachers to provide motivation, emotional support, and positive feedback to students., and (3) Instructional Adaptability - the teachers' ability to adapt to students' intellectual needs and emotional states by modifying teaching strategies and methods.

Results of Phase 2: Analysis of the Antecedents and Consequences of Pedagogical Empathy

2.1. The investigation of the antecedents of pedagogical empathy for the second phase of the study using multiple regression analysis revealed that teacher self-efficacy in teaching mathematics, gender, and basic empathy significantly predicted pedagogical empathy. Further, female teachers were reported to have higher levels of pedagogical empathy than male teachers. On the other hand, there is insufficient evidence that suggests that teachers’ self-efficacy in mathematics predicts pedagogical empathy.

2.2. The investigation on the consequences of pedagogical empathy for the second phase of the study showed that pedagogical empathy predicts students' mathematics anxiety and students' perceived mathematics problem-solving skills. Simple regression analysis revealed that there is a significantly negative relationship between pedagogical empathy and student mathematics anxiety. The higher the pedagogical empathy of teachers, the lower the mathematics anxiety of learners. On the other hand, simple regression analysis generated strong positive statistically significant results showing that pedagogical empathy predicts students' perceived mathematics problem-solving skills. This highlights that a teacher's higher level of pedagogical empathy directly correlates with higher students' perceived mathematics problem-solving skills.

Limitations of the Study

The summary of results highlighted the contribution of this study to the body of knowledge in providing a validated tool to measure pedagogical empathy of secondary mathematics teachers, as well as the investigation of the factors that influence pedagogical empathy and are influenced by pedagogical empathy. However, several limitations of this study were noted:

1. There is a limitation of generalizability to all subject areas since it focuses only on secondary mathematics teachers. Future researchers are encouraged to improve the scale so that it will be used in all subject areas. This will validate whether the structure and dimensions of pedagogical empathy set in the scale are consistent with different learning areas to ensure the generalizability of the findings.

2. The underrepresentation of the samples of all regions of the Philippines is limited because of constraints on logistical and respondent access. Future researchers are encouraged to use samples from all regions of the Philippines to ensure equal regional representation. This will also help with the generalizability of the findings of the study.

3. The study's cross-sectional design limits its ability to identify causality or follow changes over time. Future researchers are encouraged to use a longitudinal design to investigate how pedagogical empathy evolves over time among teachers. This method may provide more insights into the developmental nature and impact of pedagogical empathy on internal and external teacher-student factors.

4. If the self-report questionnaires are not answered honestly, they may be prone to response biases such as social desirability. Also, if the items are not fully understood, there is a danger of misinterpretation of the items. For future researchers who will duplicate this study, you may provide mechanisms that ensure honest answers from the survey respondents to eliminate response bias, such as social desirability and misinterpretations.

5. The hierarchical structure of data exhibits that each teacher's data was matched with responses from 10 of their students. The use of standard regression analysis may have limited the ability to detect teacher-level effects accurately. In that sense, multilevel analysis would have been used to treat the data appropriately. However, conducting the multilevel analysis was not part of the design of the study.

6. The study conducted a rigorous quantitative research design to investigate the constructs and their associations with pedagogical empathy. However, reliance on numerical data limits the depth of interpretation regarding teachers' day-to-day use of pedagog-

ical empathy and the contextual factors of the students' perception of the use of pedagogical empathy by their respective teachers. Triangulating the findings with classroom observations, focus group discussions, or interviews may enrich the understanding of how pedagogical empathy is enacted in a classroom setting.

7. While the explained variance is significant for both consequences of pedagogical empathy, their generated variances are just nearly 1%. This means that for both consequences, around 90% of the variance is explained by other factors not in the model. Hence, there are other factors that are not in the model that should be investigated.

Conclusion

The primary purpose of this study is to develop and validate a tool that measures the pedagogical empathy of secondary mathematics teachers and investigate the antecedents and consequences of pedagogical empathy. Several phases and procedures were exhausted in this study.

The study satisfactorily developed and validated a 21-item Pedagogical Empathy in Mathematics Scale (PEMS) based on a redefined conceptualization of pedagogical empathy dimensions related to mathematics teaching. Relevant dimensions such as Emotional Awareness, Supportive Teaching, and Instructional Adaptability superseded the typical affective-cognitive-behavioral framework of empathy in teaching. Through PEMS, this study offers a dependable measure to assess mathematics teachers' emotional and pedagogical realities in the classroom. Furthermore, this study shows a more in-depth

knowledge of how empathy works in instructional practices and the pivotal role of empathy as an essential component of effective mathematics teaching.

The results reinforce the idea that improving students' perceived mathematics problem-solving skills is just as important as alleviating student mathematics anxiety for enhancing learning outcomes through pedagogical empathy. On top of that, the study substantiates that pedagogical empathy is determined by internal teacher factors such as self-efficacy in teaching mathematics, gender, and basic empathy. This notion suggests that pedagogical empathy can be improved and enhanced through constant, sustained practice and institutional or agency intervention via training and workshops. These findings allow the researcher to move forward using the limitations of the study to continually improve PEMS in the future.

Recommendations

This study established a scale that measures the pedagogical empathy of secondary mathematics teachers. Additionally, the study also solidifies that internal teacher factors such as self-efficacy in teaching mathematics, gender, and basic empathy predict pedagogical empathy. Moreover, teachers' higher level of pedagogical empathy predicts a higher level of students' perceived mathematics problem-solving skills and lower students' mathematics anxiety. Given the findings and conclusions, the following are recommendations for policy, practice, and research:

1. The Department of Education and private organizations providing training to teachers are encouraged to foster the pedagogical empathy of teachers in their in-service

training programs. In these trainings, PEMS are recommended to be used to gather baseline data for teachers' pedagogical empathy as a reference in testing the effectiveness of interventions or trainings developed to promote or enhance pedagogical empathy.

2. The Department of Education and private organizations are encouraged to craft gender-responsive policies, acknowledging the distinction of the level of pedagogical empathy across gender by providing equal support to male and female teachers. In this study, it was established that female teachers are more empathic than male teachers. Without prejudice, aside from female teachers, supportive policies in enhancing the pedagogical empathy of male teachers should be created.

3. The Department of Education, partner stakeholders, and educational leaders are encouraged to create mechanisms through INSET that ensure the integration of teacher mathematical competence, pedagogical strategies, and pedagogical empathy. This guarantees that teachers deliver responsive and empathic teaching grounded in the standards of effective mathematics education.

4. Policy makers in the Department of Education and other private learning institutions are recommended to update teaching assessment standards to include empathy-related indicators. Such indicators may be used as a basis for future training and capacity-building workshops.

5. Education programs preparing future teachers are encouraged to include pedagogical empathy as part of the pre-service teacher curricula. Incorporating modules and reflective practices in everyday classroom settings among pre-service courses helps fu-

ture teachers to elicit the importance of delivering emotionally-responsive and effective mathematics instruction.

6. Educational leaders and teachers are encouraged to integrate the PEMS into their day-to-day routine. Teachers are to assess themselves every day via PEMS and shall collect the data weekly as a basis for their reflective conversation with their educational leaders to address issues and concerns for technical assistance. Also, students may be given a self-assessment of their teacher's empathy after the lesson. This will help teachers see the dimensions of pedagogical empathy that need improvement.

7. School heads, department heads, and educational leaders are recommended to incorporate regular sessions with teachers on reflective teaching, peer observations, and feedback in matters of teaching practices in relation to pedagogical empathy. This may be done during Learning Action Cell (LAC) sessions or In-service Training (INSETs).

8. Teachers and school leaders are recommended to share teaching strategies that promote inclusive classroom teaching, student learning empowerment, and empathy-focused practices during LAC or INSET. This will help other teachers identify good teaching practices that they may adapt in their own way of teaching.

9. Teachers are encouraged to consider students' emotional components as part of the formative assessment. Teaching mathematics should not only focus on the correctness of students' answers but also on their feelings in their classroom activities. This will help teachers to progressively frame the lesson better with contextually appropriate strategies.

10. Future researchers are encouraged to examine and validate PEMS across teacher contexts and populations. For instance, an investigation of pedagogical empathy

among master teachers with extensive years of experience. This may strengthen the reliability and validity of the scale.

11. Future researchers are encouraged to explore and investigate other antecedents of pedagogical empathy to have a deeper and broader perspective on the factors that predict pedagogical empathy. Antecedents such as: Teaching Experience, Educational Background, classroom management styles, reflective teaching practices, and perceived administrative support – may be investigated.

12. Future researchers are encouraged to examine further consequences of pedagogical empathy, which will aid in the development of appropriate interventions to increase or mitigate the impact of pedagogical empathy. Consequences of pedagogical empathy such as instructional effectiveness, classroom management, students' emotional regulation, students' responsibility, student participation and engagement, peer relationship, student self-efficacy, and student absenteeism, may be examined.

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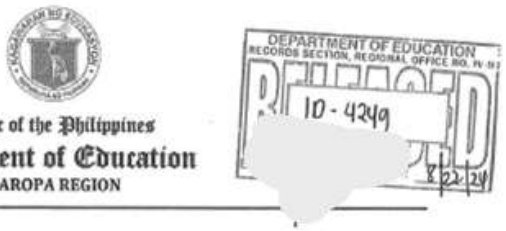
Appendices

Appendix A



Republic of the Philippines
Department of Education
MIMAROPA REGION

Office of the Regional Director

Advisory No. 249, s. 2024
August 22, 2024

PARTICIPATION IN THE STUDY ON PEDAGOGICAL EMPATHY OF SECONDARY MATHEMATICS TEACHERS

This is to inform all concerned that Mr. Eugene J. Menorca, a PhD Mathematics Education student at the Philippine Normal University, is conducting a research study titled "Pedagogical Empathy of Secondary Mathematics Teachers: Measurement, Antecedents, and Consequences." The study aims to develop and validate a scale that measures pedagogical empathy in mathematics teaching and to examine factors influenced by pedagogical empathy.

Selected secondary mathematics teachers from the DepEd MIMAROPA region are encouraged to participate in the study by answering a questionnaire administered via Google Forms. The questionnaire can be accessed through the following link: https://forms.gle/a7WrYTn9dgdSYDYD7.

Division Mathematics Supervisors and School Principals are requested to disseminate this information and encourage the participation of their teachers in this important research activity.

For further inquiries or assistance, Mr. Eugene L. Menorca can be contacted through his mobile number 0968 524 6201 or email at eugene.menorca@deped.gov.ph / elm.pnu@edu.ph

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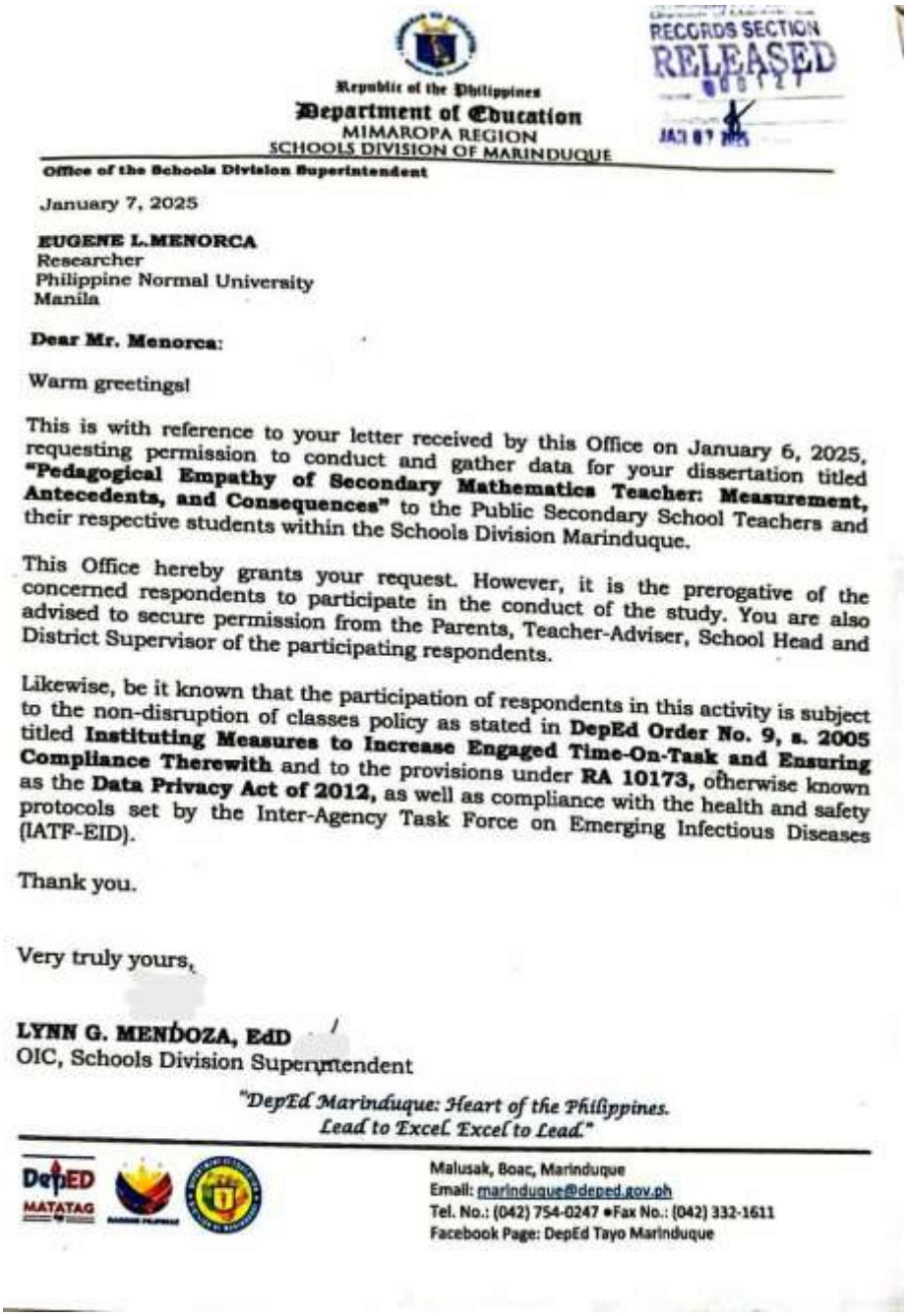
Appendix B



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RELEASED

January 7, 2025

EUGENE L.MENORCA
Researcher
Philippine Normal University
Manila

Dear Mr. Menorca:

Warm greetings!

This is with reference to your letter received by this Office on January 6, 2025, requesting permission to conduct and gather data for your dissertation titled **"Pedagogical Empathy of Secondary Mathematics Teacher: Measurement, Antecedents, and Consequences"** to the Public Secondary School Teachers and their respective students within the Schools Division Marinduque.

This Office hereby grants your request. However, it is the prerogative of the concerned respondents to participate in the conduct of the study. You are also advised to secure permission from the Parents, Teacher-Adviser, School Head and District Supervisor of the participating respondents.

Likewise, be it known that the participation of respondents in this activity is subject to the non-disruption of classes policy as stated in **DepEd Order No. 9, s. 2005** titled **Instituting Measures to Increase Engaged Time-On-Task and Ensuring Compliance Therewith** and to the provisions under **RA 10173,** otherwise known as the **Data Privacy Act of 2012,** as well as compliance with the health and safety protocols set by the Inter-Agency Task Force on Emerging Infectious Diseases (IATF-EID).

Thank you.

Very truly yours,

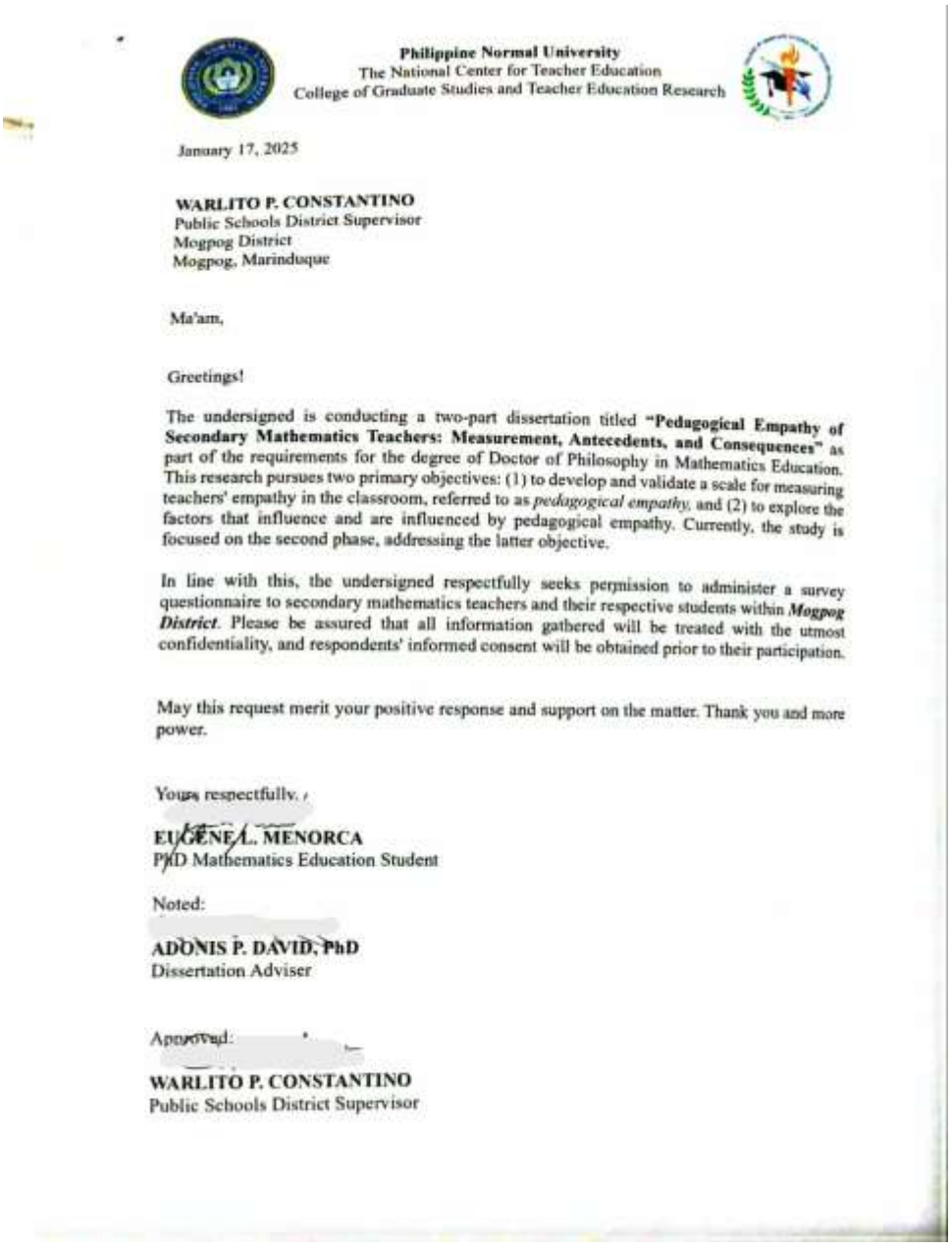
LYNN G. MENDOZA, EdD
OIC, Schools Division Superintendent

"DepEd Marinduque: Heart of the Philippines.
Lead to Excel. Excel to Lead."

DepED MATATAG

Malusak, Boac, Marinduque
Email: marinduque@deped.gov.ph
Tel. No.: (042) 754-0247 •Fax No.: (042) 332-1611
Facebook Page: DepEd Tayo Marinduque

Appendix C



Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

January 17, 2025

WARLITO P. CONSTANTINO
Public Schools District Supervisor
Mogpog District
Mogpog, Marinduque

Ma'am,

Greetings!

The undersigned is conducting a two-part dissertation titled **"Pedagogical Empathy of Secondary Mathematics Teachers: Measurement, Antecedents, and Consequences"** as part of the requirements for the degree of Doctor of Philosophy in Mathematics Education. This research pursues two primary objectives: (1) to develop and validate a scale for measuring teachers' empathy in the classroom, referred to as *pedagogical empathy*, and (2) to explore the factors that influence and are influenced by pedagogical empathy. Currently, the study is focused on the second phase, addressing the latter objective.

In line with this, the undersigned respectfully seeks permission to administer a survey questionnaire to secondary mathematics teachers and their respective students within ***Mogpog District***. Please be assured that all information gathered will be treated with the utmost confidentiality, and respondents' informed consent will be obtained prior to their participation.

May this request merit your positive response and support on the matter. Thank you and more power.

Yours respectfully,

EUGENE L. MENORCA
PhD Mathematics Education Student

Noted:

ADONIS P. DAVID, PhD
Dissertation Adviser

Approved:

WARLITO P. CONSTANTINO
Public Schools District Supervisor

Appendix D

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

January 17, 2025

JAYSON M. LUNA
Principal I
Balanacan National High School
Balanacan, Mogpog, Marinduque

Sir:

Greetings!

The undersigned is conducting a two-part dissertation titled **"Pedagogical Empathy of Secondary Mathematics Teachers: Measurement, Antecedents, and Consequences"** as part of the requirements for the degree of Doctor of Philosophy in Mathematics Education. This research pursues two primary objectives: (1) to develop and validate a scale for measuring teachers' empathy in the classroom, referred to as *pedagogical empathy*; and (2) to explore the factors that influence and are influenced by pedagogical empathy. Currently, the study is focused on the second phase, addressing the latter objective.

In line with this, the undersigned respectfully seeks permission to administer a survey questionnaire to secondary mathematics teachers and their respective students within ***Balanacan National High School***. Please be assured that all information gathered will be treated with the utmost confidentiality, and respondents' informed consent will be obtained prior to their participation.

May this request merit your positive response and support on the matter. Thank you and more power.

Yours respectfully,

EUGENE L. MENORCA
PhD Mathematics Education Student

Noted:

ADONIS P. DAVID, PhD
Dissertation Adviser

Approved:

JAYSON M. LUNA
Principal I

Appendix E

Pedagogical Empathy in Mathematics Scale

Dear respondents,

Greetings!

The undersigned is conducting a study entitled "PEDAGOGICAL EMPATHY OF SECONDARY MATHEMATICS TEACHERS: MEASUREMENT, ANTECEDENTS, AND CONSEQUENCES" as partial fulfillment of the requirements for the Doctor of Philosophy in Mathematics Education. This study has two main goals: (1) to develop and validate a scale that measures teacher's empathy in the classroom (pedagogical empathy), and (2) examine the ways in which different factors influenced and are influenced by pedagogical empathy.

In connection with this, the undersigned is conducting a confirmatory try-out of the newly developed scale to ensure its validity and reliability that guarantees that it accurately measures what it intends to measure. Hence, you are selected to participate in this scale try-out.

Thank you in advance for taking part on this study! Keep safe and God bless!

Respectfully yours,

EUGENE L. MENORCA
PhD Mathematics Education Student
Philippine Normal University

Informed Consent Form
Invitation to Participate

You have been invited to take part in a study of the **pedagogical empathy of secondary mathematics teachers**. It is absolutely up to you whether you participate or not. There will be no negative consequences if you choose not to join. The information on this form outlines what the research entails, what you will be asked to undertake, and any potential risks or advantages. Please read this form carefully and ask any questions you may have.

Consent is a continuous process. I will keep you updated on any noteworthy findings that may influence your willingness to continue participating in this study during the research process.

Procedure for Study

If you volunteer to take part in this study you will be requested to complete a 15-20-minute scale regarding pedagogical empathy.

Safeguards

Your name won't appear on any data collected form questions because the researcher will assign an ID code to each respondent. This document will only be accessible to the researcher and his adviser working on the project. The Data Privacy Act (RA 10173) governs the treatment of the personal data gathered for this research study. So, as permitted by the aforementioned act, the researcher simply gathers the data necessary to carry out his investigation. The Data Privacy Act not only safeguards our personal information, but also grants you the right to request access to and correction of that information.

Benefits of Taking Part in the Study

As one among many others who will participate in this study, you have got a chance to make your contribution to the development of knowledge about pedagogical empathy in Education within secondary mathematics teaching. Through this research, it is possible for you to learn more about why empathy matters for teachers' work, especially with respect to how it affects anxiety in mathematics, their own well-being as a teacher or mathematical reasoning of the student. By being involved in research as an educator you become an integral part of an intellectually rewarding academic achievement that eventually benefits both the teacher and student learner. Although you may not derive an immediate personal benefit from participating, it means that your input is contributing towards the progress of knowledge.

Contact Information

Should you have any questions, concerns, or require further information regarding this study or your participation, please do not hesitate to reach out to the researcher, Eugene L. Menorca, PhD Math Ed Student, via the provided contact details: phone no. 09685246201; e-mail: menorca.el@pnu.edu.ph/eugene.menorca@deped.gov.ph. Feel free to ask any questions or give your feedback, as the researcher will be on hand to provide explanations or help whenever required. Creating a positive research experience requires that you have first made me feel comfortable and understand my position.

Participant's Consent

By accomplishing this form, I agree to the following:

- The research has been explained to me.
- All my inquiries have been addressed.
- This study's potential risks and discomforts, as well as its potential advantages (if any), have been discussed with me.
- My personal information will be kept private, according to what I've been informed.

Furthermore, I understand:

- I have the right not to participate and to withdraw at any moment.
- I may refuse to participate with no repercussions.
- I have the option of not answering specific questions.
- I am allowed to ask any questions concerning the study now and in the future.
- No information that could be used to identify me will be released or printed without my permission.

Do you want to continue? *

- ◯ Yes
- ◯ No

Next Clear form

Pedagogical Empathy in Mathematics Scale

eugene.menorca@deped.gov.ph Switch account

Your email will be recorded when you submit this form

* Indicates required question

Respondent's Profile

Name: Surname, First Name Middle Initial (Optional)

Your answer

Age *

Your answer

Gender *

Choose

Region *

Division *

Your answer

School *

Your answer

Type of School *

- ◯ Public
- ◯ Private
- ◯ Other: _____

Position or Designation

Your answer

Number of years in service *

Your answer

Highest Educational Attainment *

- ◯ Bachelor's Degree
- ◯ With Master's Degree units
- ◯ Master's Degree
- ◯ With Doctorate Degree units

This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Tick the number that corresponds to your response.

1. I am aware of how excited my students are when they learn new things in our mathematics class. *

	1	2	3	4	5	6	7	
Inattentive	○	○	○	○	○	○	○	Aware

2. I am deeply attuned to my students' struggles in studying Mathematical concepts. *

	1	2	3	4	5	6	7	
Disconnected	○	○	○	○	○	○	○	Attuned

3. I am highly sensitive to the worries of my students about their mathematical performance. *

	1	2	3	4	5	6	7	
Insensitive	○	○	○	○	○	○	○	Sensitive

4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem. *

	1	2	3	4	5	6	7	
Indifferent	○	○	○	○	○	○	○	Sympathetic

5. I am observant of my learners' potential mental health challenges in our mathematics class. *

	1	2	3	4	5	6	7	
Unaware	○	○	○	○	○	○	○	Observant

6. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions. *

	1	2	3	4	5	6	7	
Unmindful	○	○	○	○	○	○	○	Mindful

7. I am proficient in understanding my learners' points of view in our mathematics class. *

	1	2	3	4	5	6	7	
Not Proficient	○	○	○	○	○	○	○	Proficient

8. I am closely attentive to the issues and concerns of my learners in our mathematics classroom. *

	1	2	3	4	5	6	7	
Neglectful	○	○	○	○	○	○	○	Attentive

9. I understand the difficulties encountered by my learners when working with mathematical tasks. *

	1	2	3	4	5	6	7	
Clueless	○	○	○	○	○	○	○	Understanding

10. I am perceptive of my students' feelings in different learning situations in our mathematics class. *

	1	2	3	4	5	6	7	
Unobservant	○	○	○	○	○	○	○	Perceptive

11. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. *

	1	2	3	4	5	6	7	
Uncaring	○	○	○	○	○	○	○	Compassionate

12. I handle my students' errors in our mathematics class with respect. *

	1	2	3	4	5	6	7	
Rude	○	○	○	○	○	○	○	Respectful

13. I am constructive in providing feedback to my learner in our mathematics class. *

	1	2	3	4	5	6	7	
Non-Constructive	○	○	○	○	○	○	○	Constructive

14. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. *

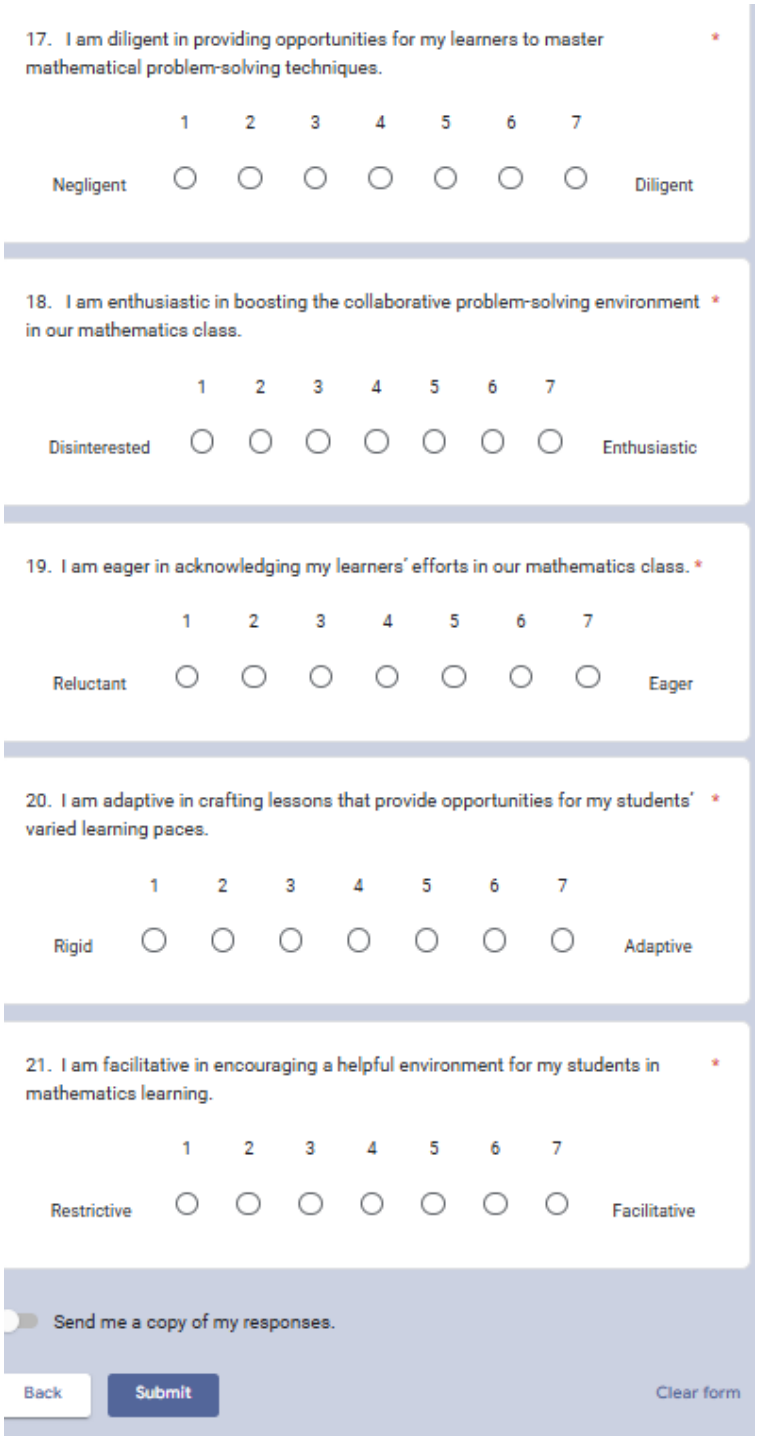
	1	2	3	4	5	6	7	
Unsupportive	○	○	○	○	○	○	○	Supportive

15. I am consistent in fostering student motivation in our mathematics class. *

	1	2	3	4	5	6	7	
Inconsistent	○	○	○	○	○	○	○	Consistent

16. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. *

	1	2	3	4	5	6	7	
Inflexible	○	○	○	○	○	○	○	Flexible



17. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. *

	1	2	3	4	5	6	7	
Negligent	○	○	○	○	○	○	○	Diligent

18. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. *

	1	2	3	4	5	6	7	
Disinterested	○	○	○	○	○	○	○	Enthusiastic

19. I am eager in acknowledging my learners' efforts in our mathematics class. *

	1	2	3	4	5	6	7	
Reluctant	○	○	○	○	○	○	○	Eager

20. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces. *

	1	2	3	4	5	6	7	
Rigid	○	○	○	○	○	○	○	Adaptive

21. I am facilitative in encouraging a helpful environment for my students in mathematics learning. *

	1	2	3	4	5	6	7	
Restrictive	○	○	○	○	○	○	○	Facilitative

Send me a copy of my responses.

Back Submit Clear form

Appendix F

MENORCA, EUGENE <menorca.el@pnu.edu.ph>

Request for Permission and Copy of the Scale

Jolliffe, Darrick <Darrick.Jolliffe@rhul.ac.uk> Sun, Nov 24, 2024 at 3:33 AM
To: "MENORCA, EUGENE" <menorca.el@pnu.edu.ph>

Dear Eugene,

Apologies for the delay in my response,

I have attached the scale and the scoring key. I have also attached a form that I would ask you to sign and return to me if you decide to use the scale. This allows me to keep track of who is using the scale and send around results as they become available.

All the best

Darrick

Professor of Criminology

Department of Law, Criminology and Social Work

Royal Holloway, University of London

Egham, Surrey

TW20 0EX

Farrington, D. P.., Piquero, A. P., Jennings, W. J. & Jolliffe, D. (2023). *Offending from Childhood to Late Middle Age: Recent Results from the Cambridge Study in Delinquent Development.* New Youk, NY: Springer.

Jolliffe, D. & Farrington, D. P. (Eds.). (2021). *Empathy versus Offending, Aggression and Bullying: Advancing Knowledge using the Basic Empathy Scale.* Abingdon: Routledge

[Quoted text hidden]

3 attachments

BES contract.pdf
211K

BES Scoring key.pdf
207K

BES.pdf
97K

DeAnn M Huinker <huinker@uwm.edu>
to me ▾

Eugene,

You have my permission to use the Mathematics Teaching Self-efficacy Belief Instrument. Attached is the article in which it originally appeared.

Best regards,
DeAnn Huinker

Dr. DeAnn Huinker, Mathematics Education

Professor, Department of Teaching & Learning

Director, Center for Mathematics & Science Education Research

University of Wisconsin-Milwaukee

huinker@uwm.edu ~ 414-251-7797

Elementary & Middle Education Program: uwm.edu/eme

•••

One attachment • Scanned by Gmail ⓘ

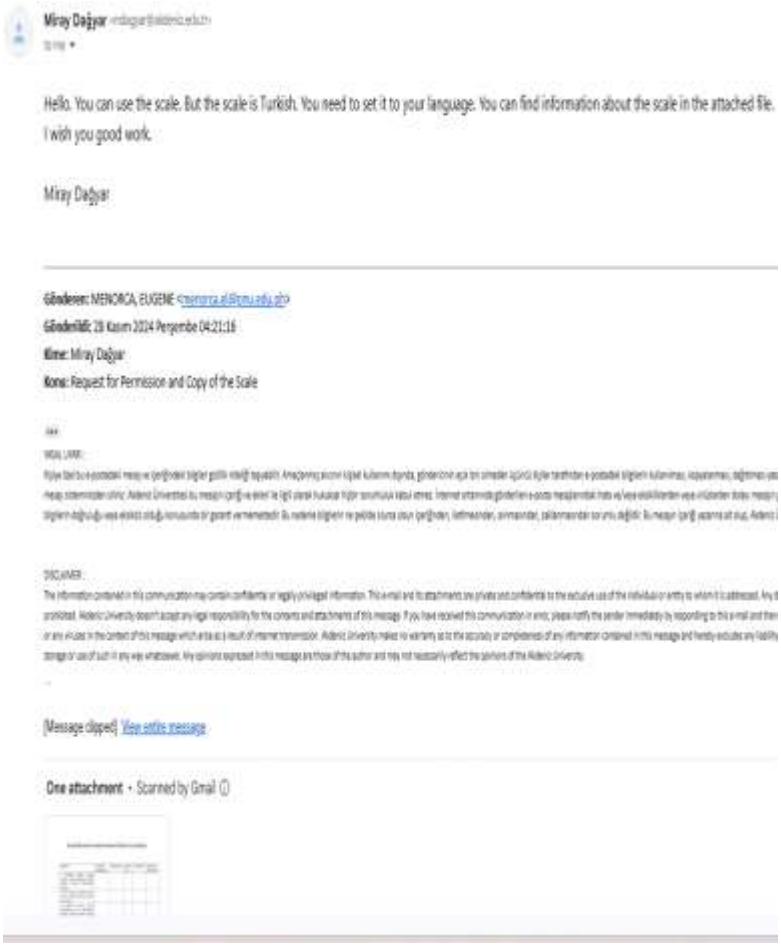
PDF MTEBI-2000-Eno...

Diana Swanagan <dswanagan@shorter.edu>
to me

Yes, you have my permission to use the questionnaire. Good luck with your research.

Sent from my iPhone

On Nov 30, 2024, at 8:55 PM, MENORCA, EUGENE <menorca.el@pnu.edu.ph> wrote:



Miray Dağyar

Hello. You can use the scale. But the scale is Turkish. You need to set it to your language. You can find information about the scale in the attached file.
I wish you good work.

Miray Dağyar

Gönderen: MENORCA, EUGENE
Gönderildi: 28 Kasım 2024 Perşembe 04:21:16
Kime: Miray Dağyar
Konu: Request for Permission and Copy of the Scale

[Message clipped] View entire message

One attachment • Scanned by Gmail

Appendix G

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

PARTICIPATION INVITATION LETTER

Dear respondents,

Greetings!

The undersigned is conducting a study entitled "PEDAGOGICAL EMPATHY OF SECONDARY MATHEMATICS TEACHERS: MEASUREMENT, ANTECEDENTS, AND CONSEQUENCES" as partial fulfillment of the requirements for the Doctor of Philosophy in Mathematics Education. This study has two main goals: (1) to develop and validate a scale that measures teacher's empathy in the classroom (pedagogical empathy), and (2) examine the ways in which different factors influenced and are influenced by pedagogical empathy.

In connection with this, the undersigned is conducting a survey on the identified antecedents and consequences of pedagogical empathy with regard to the second objective of the dissertation. Hence, you are selected to participate in this survey.

Thank you in advance for taking part on this study! Keep safe and God bless!

Respectfully yours

EUGENE L. MENORCA
PhD Mathematics Education Student
Philippine Normal University

Appendix H

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

INFORMED CONSENT FORM

Invitation to Participate

You have been invited to take part in a study of the pedagogical empathy of secondary mathematics teachers. It is absolutely up to you whether you participate or not. There will be no negative consequences if you choose not to join. The information on this form outlines what the research entails, what you will be asked to undertake, and any potential risks or advantages. Please read this form carefully and ask any questions you may have.

Consent is a continuous process. I will keep you updated on any noteworthy findings that may influence your willingness to continue participating in this study during the research process.

Procedure for Study

If you volunteer to take part in this study, you will be requested to complete a 15-20-minute scale regarding the antecedents and consequences of pedagogical empathy.

Safeguards

Your name won't appear on any data collected form questions because the researcher will assign an ID code to each respondent. This document will only be accessible to the researcher and his adviser working on the project. The Data Privacy Act (RA 10173) governs the treatment of the personal data gathered for this research study. So, as permitted by the aforementioned act, the researcher simply gathers the data necessary to carry out his investigation. The Data Privacy Act not only safeguards our personal information, but also grants you the right to request access to and correction of that information.

Benefits of Taking Part in the Study

As one among many others who will participate in this study, you have got a chance to make your contribution to the development of knowledge about pedagogical empathy in Education within secondary mathematics teaching. Through this research, it is possible for you to learn more about why empathy matters for teachers' work, especially with respect to how it affects anxiety in mathematics, their own well-being as a teacher or mathematical reasoning of the student. By being involved in research as an educator you become an integral part of an intellectually rewarding academic achievement that eventually benefits both the teacher and student learner. Although you may not derive an immediate

personal benefit from participating, it means that your input is contributing towards the progress of knowledge.

Contact Information

Should you have any questions, concerns, or require further information regarding this study or your participation, please do not hesitate to reach out to the researcher, Eugene L. Menorca, PhD Math Ed Student, via the provided contact details: phone no. 09685246201; e-mail: menorca.el@pnu.edu.ph/eugene.menorca@deped.gov.ph. Feel free to ask any questions or give your feedback, as the researcher will be on hand to provide explanations or help whenever required. Creating a positive research experience requires that you have first made me feel comfortable and understand my position.

Participant's Consent

By accomplishing this form, I agree to the following:

- The research has been explained to me.
- All my inquiries have been addressed.
- This study's potential risks and discomforts, as well as its potential advantages (if any), have been discussed with me.
- My personal information will be kept private, according to what I've been informed.

Furthermore, I understand:

- I have the right not to participate and to withdraw at any moment.
- I may refuse to participate with no repercussions.
- I have the option of not answering specific questions.
- I am allowed to ask any questions concerning the study now and in the future.
- No information that could be used to identify me will be released or printed without my permission.

_____

Respondent (Signature over printed name)

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

Section 1: PEDAGOGICAL EMPATHY SCALE

Directions: This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Shade the circle that corresponds to your response.

1. I am aware of how excited my students are when they learn new things in our mathematics class.

	1	2	3	4	5	6	7	
Inattentive	○	○	○	○	○	○	○	Aware

2. I am attuned to my students' struggles in studying Mathematical concepts.

	1	2	3	4	5	6	7	
Disconnected	○	○	○	○	○	○	○	Attuned

3. I am sensitive to the worries of my students about their mathematical performance.

	1	2	3	4	5	6	7	
Insensitive	○	○	○	○	○	○	○	Sensitive

4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.

	1	2	3	4	5	6	7	
Indifferent	○	○	○	○	○	○	○	Sympathetic

5. I am observant of my learners' potential mental health challenges in our mathematics class.

	1	2	3	4	5	6	7	
Unaware	○	○	○	○	○	○	○	Observant

6. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.

	1	2	3	4	5	6	7	
Unmindful	○	○	○	○	○	○	○	Mindful

7. I am proficient in understanding my learners' points of view in our mathematics class.

	1	2	3	4	5	6	7	
Not Proficient	○	○	○	○	○	○	○	Proficient

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

8. I am attentive to the issues and concerns of my learners in our mathematics classroom.

	1	2	3	4	5	6	7	
Neglectful	○	○	○	○	○	○	○	Attentive

9. I understand the difficulties encountered by my learners when working with mathematical tasks.

	1	2	3	4	5	6	7	
Clueless	○	○	○	○	○	○	○	Understanding

10. I am perceptive of my students' feelings in different learning situations in our mathematics class.

	1	2	3	4	5	6	7	
Unobservant	○	○	○	○	○	○	○	Perceptive

11. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.

	1	2	3	4	5	6	7	
Uncaring	○	○	○	○	○	○	○	Compassionate

12. I handle my students' errors in our mathematics class with respect.

	1	2	3	4	5	6	7	
Rude	○	○	○	○	○	○	○	Respectful

13. I am constructive in providing feedback to my learner in our mathematics class.

	1	2	3	4	5	6	7	
Non-Constructive	○	○	○	○	○	○	○	Constructive

14. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.

	1	2	3	4	5	6	7	
Unsupportive	○	○	○	○	○	○	○	Supportive

15. I am consistent in fostering student motivation in our mathematics class.

	1	2	3	4	5	6	7	
Inconsistent	○	○	○	○	○	○	○	Consistent

16. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.

	1	2	3	4	5	6	7	
Inflexible	○	○	○	○	○	○	○	Flexible

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

17. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.

	1	2	3	4	5	6	7	
Negligent	○	○	○	○	○	○	○	Diligent

18. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.

	1	2	3	4	5	6	7	
Disinterested	○	○	○	○	○	○	○	Enthusiastic

19. I am eager in acknowledging my learners' efforts in our mathematics class.

	1	2	3	4	5	6	7	
Reluctant	○	○	○	○	○	○	○	Eager

20. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.

	1	2	3	4	5	6	7	
Rigid	○	○	○	○	○	○	○	Adaptive

21. I am facilitative in encouraging a helpful environment for my students in mathematics learning.

	1	2	3	4	5	6	7	
Restrictive	○	○	○	○	○	○	○	Facilitative

Section 2: MATHEMATICS TEACHING EFFICACY BELIEF INSTRUMENT

This scale is adapted from [Enochs, L. G., Smith, P. L., & Huinker, D., 2000, *Mathematics Teaching Efficacy Belief Instrument*]. Permission to use this scale was granted by Dr. DeAnn Huinker.

Enochs, L. G., Smith, P. L., & Huinker, D. (2000). Establishing factorial validity of the Mathematics Teaching Efficacy Beliefs instrument. *School Science and Mathematics*, *100*(4), 194–202. https://doi.org/10.1111/j.1949-8594.2000.tb17256.x

Directions: Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of each statement.

SA	A	UN	D	SD
Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

1	When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.	SA	A	UN	D	SD
2	I will continually find better ways to teach mathematics.	SA	A	UN	D	SD

3	Even if I try very hard, I will not teach mathematics as well as I will most subjects.	SA	A	UN	D	SD
4	When the mathematics grades of students improve, it is often due to their teacher having found a more effective teaching approach.	SA	A	UN	D	SD
5	I know how to teach mathematics concepts effectively.	SA	A	UN	D	SD
6	I will not be very effective in monitoring mathematics activities.	SA	A	UN	D	SD
7	If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.	SA	A	UN	D	SD
8	I will generally teach mathematics ineffectively.	SA	A	UN	D	SD
9	The inadequacy of a student's mathematics background can be overcome by good teaching.	SA	A	UN	D	SD
10	When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.	SA	A	UN	D	SD
11	I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	SA	A	UN	D	SD
12	The teacher is generally responsible for the achievement of students in mathematics.	SA	A	UN	D	SD
13	Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.	SA	A	UN	D	SD
14	If parents comment that their child is showing more interest in mathematics at school, it is probably due to the performance of the child's teacher.	SA	A	UN	D	SD
15	I will find it difficult to use manipulatives to explain to students why mathematics works.	SA	A	UN	D	SD
16	I will typically be able to answer students' questions.	SA	A	UN	D	SD
17	I wonder if I will have the necessary skills to teach mathematics.	SA	A	UN	D	SD
18	Given a choice, I will not invite the principal to evaluate my mathematics teaching.	SA	A	UN	D	SD
19	When a student has difficulty understanding a mathematics concept, I will usually be at a loss as to how to help the student understand it better.	SA	A	UN	D	SD
20	When teaching mathematics, I will usually welcome student questions.	SA	A	UN	D	SD
21	I do not know what to do to turn students on to mathematics.	SA	A	UN	D	SD

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Section 3: MATHEMATICS SELF-EFFICACY

This scale is adapted from [May, D. K., 2009, *Mathematics Self-Efficacy Scale*]. Permission to use this scale was granted by Dr. Diana May – Swanagan.

May, D. K. (2009). *Mathematics Self-Efficacy and Anxiety questionnaire*. https://athenaeum.libs.uga.edu/handle/10724/25886

Directions: In order to better understand what you think and feel about your mathematics efficacy, please respond to each of the following statements. Encircle the number that corresponds to your response.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Usually

1	I believe I am the kind of person who is good at mathematics.	1	2	3	4	5
2	I believe I am the type of person who can do mathematics.	1	2	3	4	5
3	I believe I can learn well in a mathematics course.	1	2	3	4	5
4	I feel that I will be able to do well in future mathematics courses.	1	2	3	4	5
5	I believe I can understand the content in a mathematics course.	1	2	3	4	5
6	I believe I can get an "A" when I am in a mathematics course.	1	2	3	4	5
7	I believe I can do the mathematics in a mathematics course.	1	2	3	4	5

Section 4: BASIC EMPATHY SCALE

This scale is adapted from [Jolliffe, D., & Farrington, D. P., 2005, *Basic Empathy Scale*]. Permission to use this scale was granted by Dr. Darrick Jolliffe.

Jolliffe, D., & Farrington, D. P. (2005). Development and validation of the Basic Empathy Scale. *Journal of Adolescence*, *29*(4), 589–611. https://doi.org/10.1016/j.adolescence.2005.08.010

Directions: The following are characteristics that may or may not apply to you. Please encircle one answer for each statement to indicate how much you agree or disagree with each statement. Please answer as honestly as you can.

SA	A	NAD	D	SD
Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree

1	My friend's emotions don't affect me much.	SA	A	NAD	D	SD

2	After being with a friend who is sad about something, I usually feel sad.	SA	A	NAD	D	SD
3	I can understand my friend's happiness when she/he does well at something	SA	A	NAD	D	SD
4	I get frightened when I watch characters in a good scary movie.	SA	A	NAD	D	SD
5	I get caught up in other people's feelings easily.	SA	A	NAD	D	SD
6	I find it hard to know when my friends are frightened.	SA	A	NAD	D	SD
7	I don't become sad when I see other people crying.	SA	A	NAD	D	SD
8	Other people's feelings don't bother me at all.	SA	A	NAD	D	SD
9	When someone is feeling 'down' I can usually understand how they feel.	SA	A	NAD	D	SD
10	I can often tell or notice when my friends are feeling afraid or worried.	SA	A	NAD	D	SD
11	I often become sad when watching sad things on TV or in films.	SA	A	NAD	D	SD
12	I can often understand how people are feeling even before they tell me.	SA	A	NAD	D	SD
13	Seeing a person who has been angered has no effect on my feelings.	SA	A	NAD	D	SD
14	I can usually work out when people are cheerful.	SA	A	NAD	D	SD
15	I tend to feel scared when I am with friends who are afraid.	SA	A	NAD	D	SD
16	I can usually realize quickly when a friend is angry.	SA	A	NAD	D	SD
17	I often get swept up in my friend's feelings.	SA	A	NAD	D	SD
18	My friend's unhappiness doesn't make me feel anything.	SA	A	NAD	D	SD
19	I am not usually aware of my friend's feelings.	SA	A	NAD	D	SD
20	I have trouble figuring out when my friends are happy.	SA	A	NAD	D	SD

Appendix I

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PARENTAL CONSENT LETTER

Dear parents,

Greetings!

The undersigned is conducting a study entitled **"PEDAGOGICAL EMPATHY OF SECONDARY MATHEMATICS TEACHERS: MEASUREMENT, ANTECEDENTS, AND CONSEQUENCES"** as partial fulfillment of the requirements for the **Doctor of Philosophy in Mathematics Education.** This study has two main goals: (1) to develop and validate a scale that measures teacher's empathy in the classroom (pedagogical empathy), and (2) examine the ways in which different factors influenced and are influenced by pedagogical empathy.

In connection with this, the undersigned is requesting your permission to allow your child to answer the survey questionnaire on the identified consequences of pedagogical empathy about the second objective of the dissertation.

Thank you in advance for your consent on this study! Keep safe and God bless!

Respectfully yours,

EUGENE L. MENORCA
PhD Mathematics Education Student
Philippine Normal University

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PARTICIPATION INVITATION LETTER

Dear respondents,

Greetings!

The undersigned is conducting a study entitled **"PEDAGOGICAL EMPATHY OF SECONDARY MATHEMATICS TEACHERS: MEASUREMENT, ANTECEDENTS, AND CONSEQUENCES"** as partial fulfillment of the requirements for the **Doctor of Philosophy in Mathematics Education.** This study has two main goals: (1) to develop and validate a scale that measures teacher's empathy in the classroom (pedagogical empathy), and (2) examine the ways in which different factors influenced and are influenced by pedagogical empathy.

In connection with this, the undersigned is conducting a survey on the identified consequences of pedagogical empathy with regard to the second objective of the dissertation.

Thank you in advance for taking part on this study! Keep safe and God bless!

Respectfully yours,

EUGENE L. MENORCA
PhD Mathematics Education Student
Philippine Normal University

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INFORMED CONSENT FORM

Invitation to Participate

You are invited to take part in a study about the pedagogical empathy of secondary mathematics teachers. Your participation is entirely voluntary. There will be no negative consequences if you choose not to participate. The information in this form explains the content of the research, what you will be asked to do, and any possible risks or benefits. Please read it carefully and feel free to ask questions if you have any. Consent is an ongoing process. I will continue to provide you with information about any significant findings that may affect your willingness to remain in the study.

Study Procedure

If you voluntarily choose to participate in this study, you will be asked to answer a scale that will take about 15–20 minutes regarding the effects of pedagogical empathy.

Confidentiality

Your name will not appear in any collected data. The acceptance and use of data are protected under the Data Privacy Act (RA 10173). In accordance with this law, the researcher will collect only the data necessary to carry out the study. This law not only protects your personal information but also grants you the right to access and correct such information.

Benefits of Participating in the Study

As a participant in this study, you will have the opportunity to contribute to the growing knowledge about pedagogical empathy in education, particularly in the teaching of mathematics in secondary schools. Through this research, you may gain greater insight into the importance of empathy in the teaching profession—especially in how it affects math anxiety, teacher well-being, or students' mathematical reasoning. While you may not directly benefit from participating, your contribution will be part of advancing knowledge that is beneficial to both teachers and students.

Contact Information

If you have any questions, concerns, or need more information about this study or your participation, please do not hesitate to contact the researcher:
Eugene L. Menorca, PhD Math Ed Student
Phone: 09685246201
Email: menorca.el@pnu.edu.ph / eugene.menorca@deped.gov.ph
Feel free to ask questions or provide feedback. The researcher is always ready to provide clarification or assistance to ensure a positive research experience.

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Participant's Consent

By answering this form, I agree to the following:
• The research has been explained to me.
• All of my questions have been answered satisfactorily.
• The possible risks and uncomfortable aspects of the study, as well as its potential benefits (if any), have been explained to me.
• My personal information will remain confidential, as explained.
Furthermore, I understand that:
• I have the right not to participate and to withdraw at any time.
• I may decline to participate without any penalty.
• I may choose not to answer certain questions.
• I am allowed to ask questions about the study now and in the future.
• No identifying information about me will be published or shared without my consent.

_____ _____
Signature over printed name (Student) Date

_____ _____
Signature over printed name (Parent) Date

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Section 1: MATHEMATICS ANXIETY SCALE

This scale is adapted from [May, D. K., 2009, *Mathematics Anxiety Scale*]. Permission to use this scale was granted by Dr. Diana May – Swanagan.

May, D. K. (2009). *Mathematics Self-Efficacy and Anxiety questionnaire*. https://athenaeum.libs.uga.edu/handle/10724/25886

Directions: In order to better understand what you think and feel about your mathematics anxiety, please respond to each of the following statements. Encircle the number that corresponds to your response.

	1 Never	2 Seldom	3 Sometimes	4 Often		5 Usually	
1	I worry that I will not be able to do well on mathematics tests.	1	2	3	4	5	
2	I get tense when I prepare for a mathematics test.	1	2	3	4	5	
3	I get nervous when taking a mathematics test.	1	2	3	4	5	
4	I worry that I will not be able to get an "A" in my mathematics course.	1	2	3	4	5	
5	I worry that I will not be able to get a good grade in my mathematics class.	1	2	3	4	5	
6	Working on mathematics homework is stressful for me.	1	2	3	4	5	
7	I get nervous when I have to use mathematics outside of school.	1	2	3	4	5	
8	I worry that I will not be able to use mathematics in my future career when needed.	1	2	3	4	5	
9	I worry I will not be able to understand the mathematics.	1	2	3	4	5	
10	I worry that I will not be able to learn well in my mathematics class.	1	2	3	4	5	
11	I feel stressed when listening to mathematics instructors in class.	1	2	3	4	5	

12	I worry that I do not know enough mathematics to do well in future mathematics class.	1	2	3	4	5
13	I am afraid to give an incorrect answer during my mathematics class.	1	2	3	4	5
14	I get nervous when asking questions in class.	1	2	3	4	5
15	I worry that I will not be able to complete every assignment in a mathematics course.	1	2	3	4	5

Section 2: MATHEMATICS PROBLEM-SOLVING PERCEPTION SCALE

This scale is adapted from [Ersoy, M., & Dağyar, M., 2022, *Mathematics Problem-Solving Perception Scale*]. Permission to use this scale was granted by Dr. Miray Dağyar

.

Ersoy, M., & Dağyar, M. (2022). A Mathematical problem-solving perception scale for secondary school students: A validity and reliability study. *Problems of Education in the 21st Century*, *80*(5), 693-707. https://doi.org/10.33225/pec/22.80.693

Directions: In order to better understand what you think and feel about your mathematics problem-solving perception, please respond to each of the following statements. Encircle the number that corresponds to your response.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1	I feel happy when I voluntarily participate in problem-solving activities in mathematics class.	1	2	3	4	5
2	I enjoy participating voluntarily in problem-solving activities during mathematics class.	1	2	3	4	5
3	I raise my hand multiple times in the same lesson to participate in problem-solving activities.	1	2	3	4	5
4	I feel proud of myself when I voluntarily (by raising my hand) participate in problem-solving activities in mathematics class.	1	2	3	4	5

5	I fear volunteering (raising my hand) for problem-solving activities in mathematics class.	1	2	3	4	5
6	I feel happy when I do problem-solving exercises outside of class.	1	2	3	4	5
7	I have fun doing problem-solving exercises outside of class.	1	2	3	4	5
8	I voluntarily do problem-solving exercises outside of class (without it being homework).	1	2	3	4	5
9	I don't care whether there are few or many problem-solving activities in mathematics class.	1	2	3	4	5
10	I do not feel bored when I do problem-solving exercises outside of class.	1	2	3	4	5
11	I feel proud of myself when I do problem-solving exercises outside of class.	1	2	3	4	5
12	I do not feel stressed when I participate in problem-solving activities in mathematics class, even when I don't raise my hand.	1	2	3	4	5
13	I do not fear being chosen for problem-solving activities in mathematics class, even when I don't raise my hand.	1	2	3	4	5
14	I feel proud of myself when my teacher allows me to speak in problem-solving activities, even without volunteering.	1	2	3	4	5
15	I regularly and systematically engage in problem-solving activities outside of class.	1	2	3	4	5
16	I believe having a lot of problem-solving activities in mathematics class is beneficial for me.	1	2	3	4	5
17	I can carry out my plan to do problem-solving exercises outside of class.	1	2	3	4	5
18	I pay more attention to the problem-solving activities prepared by my teacher in mathematics class compared to other activities.	1	2	3	4	5
19	I feel happy when there are many problem-solving activities in mathematics class.	1	2	3	4	5

20	I don't care whether there are few or many problem-solving questions in the exams.	1	2	3	4	5
21	I do not feel bored when there are many problem-solving activities in mathematics class.	1	2	3	4	5
22	I do not feel scared when there are too many problem-solving activities in mathematics class.	1	2	3	4	5
23	I do not feel stressed when there are problem-solving questions in exams.	1	2	3	4	5
24	I do not feel scared when there are problem-solving questions in exams.	1	2	3	4	5

Appendix J

PEDAGOGICAL EMPATHY IN MATHEMATICS SCALE

Directions: This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Shade the circle that corresponds to your response.

1. I am aware of how excited my students are when they learn new things in our mathematics class.

	1	2	3	4	5	6	7	
Inattentive	○	○	○	○	○	○	○	Aware

2. I am attuned to my students' struggles in studying Mathematical concepts.

	1	2	3	4	5	6	7	
Disconnected	○	○	○	○	○	○	○	Attuned

3. I am sensitive to the worries of my students about their mathematical performance.

	1	2	3	4	5	6	7	
Insensitive	○	○	○	○	○	○	○	Sensitive

4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.

	1	2	3	4	5	6	7	
Indifferent	○	○	○	○	○	○	○	Sympathetic

5. I am observant of my learners' potential mental health challenges in our mathematics class.

	1	2	3	4	5	6	7	
Unaware	○	○	○	○	○	○	○	Observant

6. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.

	1	2	3	4	5	6	7	
Unmindful	○	○	○	○	○	○	○	Mindful

7. I am proficient in understanding my learners' points of view in our mathematics class.

	1	2	3	4	5	6	7	
Not Proficient	○	○	○	○	○	○	○	Proficient

8. I am attentive to the issues and concerns of my learners in our mathematics classroom.

	1	2	3	4	5	6	7	
Neglectful	○	○	○	○	○	○	○	Attentive

9. I understand the difficulties encountered by my learners when working with mathematical tasks.

	1	2	3	4	5	6	7	
Clueless	○	○	○	○	○	○	○	Understanding

10. I am perceptive of my students' feelings in different learning situations in our mathematics class.

	1	2	3	4	5	6	7	
Unobservant	○	○	○	○	○	○	○	Perceptive

11. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.

	1	2	3	4	5	6	7	
Uncaring	○	○	○	○	○	○	○	Compassionate

12. I handle my students' errors in our mathematics class with respect.

	1	2	3	4	5	6	7	
Rude	○	○	○	○	○	○	○	Respectful

13. I am constructive in providing feedback to my learner in our mathematics class.

	1	2	3	4	5	6	7	
Non-Constructive	○	○	○	○	○	○	○	Constructive

14. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.

	1	2	3	4	5	6	7	
Unsupportive	○	○	○	○	○	○	○	Supportive

15. I am consistent in fostering student motivation in our mathematics class.

	1	2	3	4	5	6	7	
Inconsistent	○	○	○	○	○	○	○	Consistent

16. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.

	1	2	3	4	5	6	7	
Inflexible	○	○	○	○	○	○	○	Flexible

17. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.

	1	2	3	4	5	6	7	
Negligent	○	○	○	○	○	○	○	Diligent

18. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.

	1	2	3	4	5	6	7	
Disinterested	○	○	○	○	○	○	○	Enthusiastic

19. I am eager in acknowledging my learners' efforts in our mathematics class.

	1	2	3	4	5	6	7	
Reluctant	○	○	○	○	○	○	○	Eager

20. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.

	1	2	3	4	5	6	7	
Rigid	○	○	○	○	○	○	○	Adaptive

21. I am facilitative in encouraging a helpful environment for my students in mathematics learning.

	1	2	3	4	5	6	7	
Restrictive	○	○	○	○	○	○	○	Facilitative

PEDAGOGICAL EMPATHY IN MATHEMATICS SCALE (PES) SCORING SYSTEM

Response Format

Each item is rated on a **7-point semantic differential scale**, where:

- **1 = Very Low Empathy**
- **7 = Very High Empathy**

Respondents choose the number that best represents their experience for each statement.

Scale Dimensions and Item Distribution

Dimension	Items	Possible Score Range
1. Emotional Awareness	Items 1–7	7 – 49
2. Supportive Teaching	Items 8–14	7 – 49
3. Instructional Adaptability	Items 15–21	7 – 49

Total Score Range: 21 – 147

Scoring Procedure

1. **Add up the scores** for each dimension separately.
2. **Compute the total score** by summing up the scores of all 21 items.

Computation for the Score Range for the Level of Pedagogical Empathy:

147 – 21 = 126/5= 25.2 = 25

Score Interpretation

Total Pedagogical Empathy Score

Score Range	Level of Pedagogical Empathy
123–147	Very High Empathy
98–122	High Empathy
73–97	Moderate Empathy
48–72	Low Empathy
21–47	Very Low Empathy

49-7= 42/5= 8.4= 8

Dimension-Specific Interpretation

For each dimension (out of 49 points):

Score Range	Interpretation
42–49	Very High
34–41	High
26–33	Moderate
18–25	Low
7–17	Very Low

Initial Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	For each statement, you will see two different opposite words representing polar adjectives with seven numbers between them. Select a number from 1 to 7 that best shows the intensity of your opinion or feeling. Encircle the number that corresponds to your answer.	
1	I am able to authentically experience and feel the positive emotions that result from shared victories as I find satisfaction in our classroom successes. Able 1 2 3 4 5 6 7 Unable	Affective
2	I am sensitive to my students' feelings of satisfaction that arise from learning new ideas, which helps to build an emotional bond through mutual learning satisfaction. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
3	I relate to my students' emotional struggles as I am sensitive to the difficulties they feel while they are studying. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
4	I show a sincere emotional awareness of my students' worries about their academic performance by acknowledging and understanding their issues in the classroom. Extremely Sincere 1 2 3 4 5 6 7 Insincere	Affective

Item No.	Item	Dimensions
5	I relate to my students by acknowledging that I share the disappointments they may experience in their academic pursuits. Extremely Related 1 2 3 4 5 6 7 Unrelated	Affective
6	I am sensitive of the feelings of isolation or loneliness that my students might have felt when participating in group activities, and I strive to build connections by carefully considering their social dynamics. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
7	I share in my students' satisfaction and sense of accomplishment by acknowledging and emotionally connecting with their individual academic accomplishments Extremely Involved 1 2 3 4 5 6 7 Uninvolved	Affective
8	I easily relate to the difficulties my students encounter when working on group assignments, forging an emotional connection as I become familiar with their dynamics. Extremely Related 1 2 3 4 5 6 7 Unrelated	Affective
9	I emotionally connect with my students' social experiences and am attentive to the emotional dynamics of their peer interactions in the classroom. Extremely Connected 1 2 3 4 5 6 7 Disconnected	Affective

Item No.	Item	Dimensions
10	I can easily relate to my students' academic and personal accomplishments, joining in their happiness and acknowledging their contributions as essential members of our learning community. Extremely Related 1 2 3 4 5 6 7 Unrelated	Affective
11	I am good at adopting students' viewpoints, which shows that I am more logically sensitive to their feelings. Extremely Good 1 2 3 4 5 6 7 Inept	Cognitive
12	I have an exceptional ability to be mentally flexible, which enables me to adjust to different viewpoints and comprehend the emotions and ideas of my student. Extremely Flexible 1 2 3 4 5 6 7 Inflexible	Cognitive
13	I carefully examine the ideas that my students have, exhibiting a sense of engagement that entails exploring their viewpoints in the classroom. Extremely Engaged 1 2 3 4 5 6 7 Unengaged	Cognitive
14	I actively encourage teaching with an open mind via cognitive awareness to recognize the distinct thoughts and feelings of students in particular learning contexts. Extremely Encouraging 1 2 3 4 5 6 7 Discouraging	Cognitive
15	I am able to understand and value other points of view in the classroom with ease, creating an environment where students feel heard and respected. Extremely Understanding 1 2 3 4 5 6 7 Unsympathetic	Cognitive

Item No.	Item	Dimension
16	I usually engage in deliberate procedures that show my dedication to comprehending the ideas and viewpoints of students in a variety of learning contexts. Extremely Engaged 1 2 3 4 5 6 7 Unengaged	Cognitive
17	I make a constant effort to build stronger relationships with my students as I recognize how critical it is to understand their perspectives in order to create a positive learning environment. Proactively Building 1 2 3 4 5 6 7 Detached	Cognitive
18	I am aware of the complex interplay between students' openness and other personality traits and my increased capacity to comprehend and relate to them more deeply in the classroom. Extremely Aware 1 2 3 4 5 6 7 Unaware	Cognitive
19	I recognize that understanding students' feelings plays an integral part in promoting well-being in teaching, and that it can have a distinctive influence on students' mental health. Extremely Recognizing 1 2 3 4 5 6 7 Unacknowledging	Cognitive
20	I identify and interpret the facial expressions of students' emotional states in the classroom, emphasizing the importance of reading nonverbal cues from them. Extremely Involved 1 2 3 4 5 6 7 Uninvolved	Cognitive

Item No.	Item	Dimensions
21	I am adept at paying close attention to my students' emotional needs, fostering a welcoming and inclusive learning environment. Extremely Attentive 1 2 3 4 5 6 7 Inattentive	Behavioral
22	I demonstrate adaptability to the multiple learning styles of my students, exhibiting concern for their unique context. Extremely Adaptable 1 2 3 4 5 6 7 Inflexible	Behavioral
23	I promptly address the academic difficulties that students face, demonstrating caring and offering assistance without sacrificing the standards of their learning. Extremely Prompt 1 2 3 4 5 6 7 Negligent	Behavioral
24	I facilitate an environment that is supportive and conducive to lifelong learning by skillfully recognizing and appreciating students' development. Extremely Supportive 1 2 3 4 5 6 7 Unsupportive	Behavioral
25	I am sensitive to students' personal concerns and use tolerance to resolve issues without lowering the bar for academic performance. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Behavioral
26	I address my students' errors with respect and assistance, placing more emphasis on positive opportunities for learning than on unpleasant repercussions. Extremely Respectful 1 2 3 4 5 6 7 Disrespectful	Behavioral
27	I reinforce students' sense of worth and respect in their academic pursuits by acknowledging and appreciating their work. Extremely Acknowledging 1 2 3 4 5 6 7 Disregarding	Behavioral

Item No.	Item	Dimensions
28	I take an inclusive approach in class discussions, making sure that every student feels appreciated and heard, which helps to foster a respectful learning atmosphere. Extremely Inclusive 1 2 3 4 5 6 7 Exclusive	Behavioral
29	I appreciate and acknowledge that every student learns at a different rate, and I modify my style of instruction to meet a variety of needs without sacrificing academic standards. Extremely Appreciative 1 2 3 4 5 6 7 Appreciative	Behavioral
30	I encourage emotional resilience in my students, stressing the need to respond to obstacles while keeping an eye on their academic development. Extremely Encouraging Resilience 1 2 3 4 5 6 7 Discouraging Resilience	Behavioral

Appendix L

Second Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	Directions: This part of the questionnaire is about your thoughts and feelings on your empathy in the mathematics classroom. For each statement, you will see two different opposite words representing opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your opinion or feeling. Tick the number that corresponds to your answer.	
1	I feel happy when our mathematics classroom achieves success together. Extremely Feel 1 2 3 4 5 6 7 Detached	Affective
2	I feel how happy my students are when they learn new things in mathematics class. Extremely Feel 1 2 3 4 5 6 7 Detached	Affective
3	I am attuned to my students' struggles in studying Mathematical concepts. Extremely Attuned 1 2 3 4 5 6 7 Unattuned	Affective
4	I am sensitive to the worries of my students towards their mathematical performance. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
5	I feel the disappointment that my learners experience when they fail to achieve the right answer in a mathematics problem. Extremely Feel 1 2 3 4 5 6 7 Detached	Affective
6	I empathize with the emotions of isolation that my students experience while participating in mathematics group activities. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
7	I am sensitive to the issues and concerns of my learners in mathematics classroom. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	Affective
8	I relate to the difficulties encountered by my learners when working with mathematical tasks. Extremely Related 1 2 3 4 5 6 7 Unrelated	Affective
9	I connect to my students' social experiences as they interact in mathematics class. Extremely Connect 1 2 3 4 5 6 7 Disconnect	Affective
10	I share in my students' happiness regarding their contributions as essential members of our mathematics learning community. Extremely Share 1 2 3 4 5 6 7 Detach	Affective
11	I understand my learners' point of views in our mathematics class. Extremely Understand 1234 5 6 7 Misunderstand	Cognitive

Item No.	Item	Dimension
12	I comprehend the emotions and ideas of my student in our mathematics class. Extremely Comprehend 1 2 3 4 5 6 7 Miscomprehend	Cognitive
13	I carefully examine the ideas that my students have in mathematics class. Thoroughly Examine 1 2 3 4 5 6 7 Superficially Examine	Cognitive
	I understand my students' feelings in different learning situations in our mathematics class. Extremely Understand 1234 5 6 7 Misunderstand	Cognitive
15	I comprehend the personal struggles my students may face academically. Extremely Comprehend 1 2 3 4 5 6 7 Miscomprehend	Cognitive
16	I reflect on my students varied mathematical ideas and learning contexts. Thoroughly Reflect 1 2 3 4 5 6 7 Superficially Reflect	Cognitive
17	I understand that there is a need to make an effort to build stronger relationships with my students. Extremely Understand 1234 5 6 7 Misunderstand	Cognitive
18	I reflect on how students' different personalities affect how well I can connect with them in mathematics class. Thoroughly Reflect 1 2 3 4 5 6 7 Superficially Reflect	Cognitive
19	I understand that knowing how students feel is important for their well-being in mathematics learning and mental health. Thoroughly Understand 1 2 3 4 5 6 7 Superficially Understand	Cognitive
20	I interpret the facial expressions of students' emotional states in the mathematics classroom. Thoroughly Interpret 1 2 3 4 5 6 7 Superficially Interpret	Cognitive
21	I pay attention to my students' emotional needs. Extremely Attentive 1 2 3 4 5 6 7 Inattentive	Behavioral
22	I exhibit concern for the multiple learning styles of my students in our mathematics class. Extremely Concern 1 2 3 4 5 6 7 Indifferent	Behavioral
23	I address the academic difficulties that students face without sacrificing the standards of their learning. Thoroughly Adress 1 2 3 4 5 6 7 Superficially Adress	Behavioral

Item No.	Item	Dimension
24	I create a helpful environment for my students in mathematics learning. Thoroughly Create 1 2 3 4 5 6 7 Do not Create	Behavioral
25	I listen to my students' worries patiently without compromising academic standards. Thoroughly Listen 1 2 3 4 5 6 7 Superficially Listen	Behavioral
26	I address my students' errors in our mathematics class with respect. Thoroughly Adress 1 2 3 4 5 6 7 Superficially Adress	Behavioral
27	I acknowledge my students' efforts by appreciating their work in our mathematics class. Extremely Acknowledging 1 2 3 4 5 6 7 Disregarding	Behavioral
28	I take an inclusive approach in mathematics class discussions. Inclusive Approach 1 2 3 4 5 6 7 Exclusive Approach	Behavioral
29	I modify my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Flexible 1 2 3 4 5 6 7 Inflexible	Behavioral
30	I remind my students that they are capable of completing their mathematics tasks. Extremely Encouraging 1 2 3 4 5 6 7 Discouraging	Behavioral

Appendix M

Third Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your response.	
1	I am keenly aware of how excited my students are when they learn new things in mathematics class. Ignorant 1 2 3 4 5 6 7 Aware	Empathic Understanding
2	I am deeply attuned to my students' struggles in studying mathematical concepts. Unaligned 1 2 3 4 5 6 7 Detached	Empathic Understanding
3	I am highly sensitive to the worries of my students about their mathematical performance. Insensitive 1 2 3 4 5 6 7 Sensitive	Empathic Understanding
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem. Indifferent 1 2 3 4 5 6 7 Sympathetic	Empathic Understanding
5	I am closely attentive to the issues and concerns of my learners in our mathematics classroom. Neglectful 1 2 3 4 5 6 7 Attentive	Empathic Understanding
6	I understand the difficulties encountered by my learners when working with mathematical tasks. Unsympathetic 1 2 3 4 5 6 7 Understanding	Empathic Understanding
7	I am sincerely perceptive of my students' feelings in different learning situations in our mathematics class. Observant 1 2 3 4 5 6 7 Perceptive	Empathic Understanding
8	I am considerate on how my students' different personalities affect how well they learn in our mathematics class. Inconsiderate 1 2 3 4 5 6 7 Considerate	Empathic Understanding
9	I am a keen observant of my learners' potential mental health challenges in our mathematics class. Unaware 1 2 3 4 5 6 7 Observant	Empathic Understanding
10	I am mindful in discerning the facial expressions of my learners' moods in our mathematics classroom. Careless 1 2 3 4 5 6 7 Mindful	Empathic Understanding

Item No.	Item	Dimension
11	I understand my learners' point of views in our mathematics class. Less Skilled 1234 5 6 7 Proficient	Empathic Understanding
12	I am conscious to my students' difficulties when working on group activities. Unconscious 1 2 3 4 5 6 7 Conscious	Empathic Understanding
13	I carefully examine the ideas that my students have in mathematics class. Ignore 1 2 3 4 5 6 7 Superficially Examine	Empathy in Teaching
14	I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. Uncaring 1234 5 6 7 Compassionate	Empathy in Teaching
15	I am constant in encouraging a helpful environment for my students in mathematics learning. Inconsistent 1 2 3 4 5 6 7 Constant	Empathy in Teaching
16	I handle my students' errors in our mathematics class with respect. Rude 1 2 3 4 5 6 7 Respectful	Empathy in Teaching
17	I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Inflexible1234 5 6 7 Flexible	Empathy in Teaching
18	I am constructive in providing feedback to my learner in our mathematics class. Destructive 1 2 3 4 5 6 7 Constructive	Empathy in Teaching
19	I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. Negligent 1 2 3 4 5 6 7 Superficially Diligent	Empathy in Teaching
20	I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. Disinterested 1 2 3 4 5 6 7 Enthusiastic	Empathy in Teaching
21	I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. Unsupportive 1 2 3 4 5 6 7 Supportive	Empathy in Teaching
22	I am eager in acknowledging my learners' efforts in our mathematics class. Reluctant 1 2 3 4 5 6 7 Eager	Empathy in Teaching

Item No.	Item	Dimension
23	I am adaptive in crafting lessons that provide opportunities for my students' varied learning rates. Rigid 1 2 3 4 5 6 7 Adaptive	Empathy in Teaching
24	I am facilitative in encouraging a helpful environment for my students in mathematics learning.	Empathy in Teaching

Appendix N

Final Scale Item Distribution per Dimension

Item No.	Item	Dimension
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your response.	
1	I am aware of how excited my students are when they learn new things in our mathematics class.	Empathic Understanding
	Inattentive 1 2 3 4 5 6 7 Aware	
2	I am attuned to my students' struggles in studying Mathematical concepts.	Empathic Understanding
	Disconnected 1 2 3 4 5 6 7 Attuned	
3	I am sensitive to the worries of my students about their mathematical performance.	Empathic Understanding
	Insensitive 1 2 3 4 5 6 7 Sensitive	
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.	Empathic Understanding
	Indifferent 1 2 3 4 5 6 7 Sympathetic	
5	I am attentive to the issues and concerns of my learners in our mathematics classroom.	Empathic Understanding
	Neglectful 1 2 3 4 5 6 7 Attentive	
6	I understand the difficulties encountered by my learners when working with mathematical tasks.	Empathic Understanding
	Clueless 1 2 3 4 5 6 7 Understanding	
7	I am perceptive of my students' feelings in different learning situations in our mathematics class.	Empathic Understanding
	Unobservant 1 2 3 4 5 6 7 Perceptive	
8	I am considerate on how my students' different personalities affect how well they learn in our mathematics class.	Empathic Understanding
	Inconsiderate 1 2 3 4 5 6 7 Considerate	
9	I am observant of my learners' potential mental health challenges in our mathematics class.	Empathic Understanding
	Unaware 1 2 3 4 5 6 7 Observant	
10	I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.	Empathic Understanding
	Unmindful 1 2 3 4 5 6 7 Mindful	
11	I am proficient in understanding my learners' points of view in our mathematics class.	Empathic Understanding
	Not Proficient 1234 5 6 7 Proficient	

Item No.	Item	Dimension
12	I am conscious of my students' difficulties when working on activities in mathematics class. Unconscious 1 2 3 4 5 6 7 Conscious	Empathic Understanding
13	I examine the ideas that my students have in mathematics class. Ignore 1 2 3 4 5 6 7 Examine	Empathy in Teaching
14	I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. Uncaring 1234 5 6 7 Compassionate	Empathy in Teaching
15	I am consistent in fostering student motivation in our mathematics class. Inconsistent 1 2 3 4 5 6 7 Consistent	Empathy in Teaching
16	I handle my students' errors in our mathematics class with respect. Rude 1 2 3 4 5 6 7 Superficially Respect	Empathy in Teaching
17	I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Inflexible 1234 5 6 7 Flexible	Empathy in Teaching
18	I am constructive in providing feedback to my learner in our mathematics class. Non-Constructive 1 2 3 4 5 6 7 Constructive	Empathy in Teaching
19	I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. Negligent 1 2 3 4 5 6 7 Superficially Diligent	Empathy in Teaching
20	I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. Disinterested 1 2 3 4 5 6 7 Enthusiastic	Empathy in Teaching
21	I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. Unsupportive 1 2 3 4 5 6 7 Supportive	Empathy in Teaching
22	I am eager in acknowledging my learners' efforts in our mathematics class. Reluctant1 2 3 4 5 6 7 Eager	Empathy in Teaching
23	I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces. Rigid 1 2 3 4 5 6 7 Adaptive	Empathy in Teaching
24	I create a helpful environment for my students in mathematics learning. Thoroughly Create 1 2 3 4 5 6 7 Do not Create	Empathy in Teaching

Second Expert Content Validation

Item No.	Item	Content Validity Index	Comments & Suggestions
Directions	Directions: This part of the questionnaire is about your thoughts and feelings on your empathy in the mathematics classroom. For each statement, you will see two different opposite words representing opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your opinion or feeling. Tick the number that corresponds to your answer.	0.67	This is wrong. You are not assessing teachers' feelings on empathy. You are assessing their empathy. There's a major difference.
1	I feel happy when our mathematics classroom achieves success together. Extremely Feel 1 2 3 4 5 6 7 Detached	0.67	The item is aligned with the affective dimension. However, the polar adjectives need to be revised to be coherent with the item.
2	I feel how happy my students are when they learn new things in mathematics class. Extremely Feel 1 2 3 4 5 6 7 Detached	0.67	The item is aligned with the affective dimension. However, the polar adjectives need to be revised to be coherent with the item.
3	I am attuned to my students' struggles in studying Mathematical concepts. Extremely Attuned 1 2 3 4 5 6 7 Unattuned	0.67	The item is aligned with the affective dimension. However, drop the use of extremely. Use other adjective for unattuned.
4	I am sensitive to the worries of my students towards their mathematical performance. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.67	The item is aligned with the affective dimension. However, drop the use of extremely. Use other adjective for insensitive.
5	I feel the disappointment that my learners experience when they fail to achieve the right answer in a mathematics problem. Extremely Feel 1 2 3 4 5 6 7 Detached	0.67	Make this simple. Change the polar adjective detached.

Item No.	Item	Content Validity Index	Comments & Suggestions
6	I empathize with the emotions of isolation that my students experience while participating in mathematics group activities. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.67	Change the term isolation. The polar is not congruent to the item.
7	I am sensitive to the issues and concerns of my learners in mathematics classroom. Extremely Sensitive 1 2 3 4 5 6 7 Insensitive	0.67	The adjective "sensitive" have already been used. Change this.
8	I relate to the difficulties encountered by my learners when working with mathematical tasks. Extremely Related 1 2 3 4 5 6 7 Unrelated	0.67	Change the polar adjective unrelated. Find an adjective that is more appropriate.
9	I connect to my students' social experiences as they interact in mathematics class. Extremely Connect 1 2 3 4 5 6 7 Disconnect	0.67	Simplify social experiences. Be more specific.
10	I share in my students' happiness regarding their contributions as essential members of our mathematics learning community. Extremely Share 1 2 3 4 5 6 7 Detach	0.67	Change mathematics learning community. Drop extremely on the polar adjectives
11	I understand my learners' point of views in our mathematics class. Extremely Understand 1234 5 6 7 Misunderstand	0.67	This item is aligned with the cognitive dimension. Drop extremely
12	I comprehend the emotions and ideas of my student in our mathematics class. Extremely Comprehend 1 2 3 4 5 6 7 Miscomprehend	0.67	Drop extremely
13	I carefully examine the ideas that my students have in mathematics class. Thoroughly Examine 1 2 3 4 5 6 7 Superficially Examine	0.67	Drop thoroughly and superficially
14	I understand my students' feelings in different learning situations in our mathematics class. Extremely Understand 1234 5 6 7 Misunderstand	0.67	Drop extremely

Item No.	Item	Content Validity Index	Comments & Suggestions
15	I comprehend the personal struggles my students may face academically. Extremely Comprehend 1 2 3 4 5 6 7 Miscomprehend	0.67	Drop extremely
16	I reflect on my students varied mathematical ideas and learning contexts. Thoroughly Reflect 1 2 3 4 5 6 7 Superficially Reflect	0.67	Drop thoroughly and superficially
17	I understand that there is a need to make an effort to build stronger relationships with my students. Extremely Understand 1234 5 6 7 Misunderstand	0.67	Drop extremely
18	I reflect on how students' different personalities affect how well I can connect with them in mathematics class. Thoroughly Reflect 1 2 3 4 5 6 7 Superficially Reflect	0.67	Drop thoroughly and superficially
19	I understand that knowing how students feel is important for their well-being in mathematics learning and mental health. Thoroughly Understand 1 2 3 4 5 6 7 Superficially Understand	0.67	Drop thoroughly and superficially
20	I interpret the facial expressions of students' emotional states in the mathematics classroom. Thoroughly Interpret 1 2 3 4 5 6 7 Superficially Interpret	0.67	Drop thoroughly and superficially
21	I pay attention to my students' emotional needs. Extremely Attentive 1 2 3 4 5 6 7 Inattentive	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."

Item No.	Item	Content Validity Index	Comments & Suggestions
22	I exhibit concern for the multiple learning styles of my students in our mathematics class. Extremely Concern 1 2 3 4 5 6 7 Indifferent	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
23	I address the academic difficulties that students face without sacrificing the standards of their learning. Thoroughly Adress 1 2 3 4 5 6 7 Superficially Adress	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
24	I create a helpful environment for my students in mathematics learning. Thoroughly Create 1 2 3 4 5 6 7 Do not Create	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
25	I listen to my students' worries patiently without compromising academic standards. Thoroughly Listen 1 2 3 4 5 6 7 Superficially Listen	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."

Item No.	Item	Content Validity Index	Comments & Suggestions
26	I address my students' errors in our mathematics class with respect. Thoroughly Adress 1 2 3 4 5 6 7 Superficially Adress	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
27	I acknowledge my students' efforts by appreciating their work in our mathematics class. Extremely Acknowledging 1 2 3 4 5 6 7 Disregarding	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
28	I take an inclusive approach in mathematics class discussions. Inclusive Approach 1 2 3 4 5 6 7 Exclusive Approach	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
29	I modify my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Flexible 1 2 3 4 5 6 7 Inflexible	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."
30	I remind my students that they are capable of completing their mathematics tasks. Extremely Encouraging 1 2 3 4 5 6 7 Discouraging	0.33	Revisit the behavioral dimension. If the item does not fit the dimension, all dimensions in the scale shall be changed. Hence, some items may be revised and changed. Change other items to the two dimensions "empathic understanding and empathy in teaching."

Third Expert Content Validation

Item No.	Item	Content Validity Index	Comments & Suggestions
Directions	This scale assesses your empathy in the mathematics classroom. For each statement, you will see two different words representing polar opposites with a line of seven numbers between them. Select a number from 1 to 7 on the line that best shows the intensity of your empathy. Encircle the number that corresponds to your response.	1	Accepted
1	I am keenly aware of how excited my students are when they learn new things in mathematics class. Ignorant 1 2 3 4 5 6 7 Aware	0.67	Drop keenly and check the grammar. Drop Ignorant. Revise this
2	I am deeply attuned to my students' struggles in studying mathematical concepts. Unaligned 1 2 3 4 5 6 7 Detached	0.67	Drop deeply and change the polar adjective unaligned.
3	I am highly sensitive to the worries of my students about their mathematical performance. Insensitive 1 2 3 4 5 6 7 Sensitive	0.67	Drop highly
4	I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem. Indifferent 1 2 3 4 5 6 7 Sympathetic	1	Accepted
5	I am closely attentive to the issues and concerns of my learners in our mathematics classroom. Neglectful 1 2 3 4 5 6 7 Attentive	0.67	Drop closely
6	I am understanding the difficulties encountered by my learners when working with mathematical tasks. Unsympathetic 1 2 3 4 5 6 7 Understanding	0.67	Drop am and change understanding to understand. Find polar adjective other than unsympathetic.

Item No.	Item	Content Validity Index	Comments & Suggestions
7	I am sincerely perceptive of my students' feelings in different learning situations in our mathematics class. Observant 1 2 3 4 5 6 7 Perceptive	0.67	Drop sincerely
8	I am considerate on how my students' different personalities affect how well they learn in our mathematics class. Inconsiderate 1 2 3 4 5 6 7 Considerate	0.67	Change personalities to attitude and drop well. Check the grammar.
9	I am a keen observant of my learners' potential mental health challenges in our mathematics class. Unaware 1 2 3 4 5 6 7 Observant	0.67	Drop keen
10	I am mindful in discerning the facial expressions of my learners' moods in our mathematics classroom. Careless 1 2 3 4 5 6 7 Mindful	0.67	Change classroom to class. Change the polar adjective polar.
11	I understand my learners' point of views in our mathematics class. Less Skilled 1234 5 6 7 Proficient	0.67	Change "less skilled" to "not proficient"
12	I am conscious to my students' difficulties when working on group activities. Unconscious 1 2 3 4 5 6 7 Conscious	0.67	Change "to" to "of". Drop group activities and add in mathematics class.
13	I carefully examine the ideas that my students have in mathematics class. Ignore 1 2 3 4 5 6 7 Superficially Examine	0.67	Drop carefully
14	I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning. Uncaring 1234 5 6 7 Compassionate	1	Accepted
15	I am constant in encouraging a helpful environment for my students in mathematics learning. Inconsistent 1 2 3 4 5 6 7 Constant	0.33	Too similar with item 24. Delete this or delete item 24.
16	I handle my students' errors in our mathematics class with respect. Rude 1 2 3 4 5 6 7 Respectful	1	Accepted

Item No.	Item	Content Validity Index	Comments & Suggestions
17	I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards. Inflexible1234 5 6 7 Flexible	1	Accepted
18	I am constructive in providing feedback to my learner in our mathematics class. Destructive 1 2 3 4 5 6 7 Constructive	0.67	Change "destructive" to "non-constructive"
19	I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques. Negligent 1 2 3 4 5 6 7 Superficially Diligent	1	Accepted
20	I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class. Disinterested 1 2 3 4 5 6 7 Enthusiastic	1	Accepted
21	I am supportive of fostering a classroom culture that allows positive learners' expression of concerns. Unsupportive 1 2 3 4 5 6 7 Supportive	1	Accepted
22	I am eager in acknowledging my learners' efforts in our mathematics class. Reluctant 1 2 3 4 5 6 7 Eager	1	Accepted
23	I am adaptive in crafting lessons that provide opportunities for my students' varied learning rates. Rigid 1 2 3 4 5 6 7 Adaptive	1	Change "rates" to "paces"
24	I am facilitative in encouraging a helpful environment for my students in mathematics learning.	0.33	Too similar with item 15. Delete this or delete item 15.

Appendix Q

Bartlett's Test of Sphericity

χ^2	Df	P
9712	276	<.001

KMO Measure of Sampling Adequacy

	MSA
Overall	0.854
1. I am aware of how excited my students are when they learn new things in our mathematics class.	0.769
2. I am attuned to my students' struggles in studying Mathematical concepts.	0.800
3. I am sensitive to the worries of my students about their mathematical performance.	0.787
4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.	0.798
5. I am attentive to the issues and concerns of my learners in our mathematics classroom.	0.853
6. I understand the difficulties encountered by my learners when working with mathematical tasks.	0.837
7. I am perceptive of my students' feelings in different learning situations in our mathematics class.	0.931
8. I am considerate on how my students' different attitudes affect how they learn in our mathematics class.	0.874
9. I am observant of my learners' potential mental health challenges in our mathematics class.	0.784
10. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.	0.772
11. I am proficient in understanding my learners' points of view in our mathematics class.	0.949
12. I am conscious of my students' difficulties when working on activities in mathematics class.	0.888

KMO Measure of Sampling Adequacy

	MSA
13. I examine the ideas that my students have in mathematics class.	0.958
14. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.	0.849
15. I am consistent in fostering student motivation in our mathematics class.	0.837
16. I handle my students' errors in our mathematics class with respect.	0.890
17. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.	0.976
18. I am constructive in providing feedback to my learners in our mathematics class.	0.883
19. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.	0.821
20. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.	0.946
21. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.	0.820
22. I am eager in acknowledging my learners' efforts in our mathematics class.	0.832
23. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.	0.930
24. I am facilitative in encouraging a helpful environment for my students in mathematics learning.	0.828

Forced Analysis – 4 Fixed Factors

	Factor				
	1	2	3	4	Uniqueness
1. I am aware of how excited my students are when they learn new things in our mathematics class.		0.796			0.3840
2. I am attuned to my students' struggles in studying Mathematical concepts.		0.887			0.2941
3. I am sensitive to the worries of my students about their mathematical performance.		0.874			0.2756
4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.		0.891			0.2917
5. I am attentive to the issues and concerns of my learners in our mathematics classroom.	0.912				0.1791
6. I understand the difficulties encountered by my learners when working with mathematical tasks.	0.853				0.2749
7. I am perceptive of my students' feelings in different learning situations in our mathematics class.	0.760				0.3296
8. I am considerate on how my students' different attitudes affect how they learn in our mathematics class.					0.5029

Forced Analysis – 4 Fixed Factors

	Factor				
	1	**2**	**3**	**4**	**Uniqueness**
9. I am observant of my learners' potential mental health challenges in our mathematics class.		0.861			0.2463
10. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.		0.775			0.3955
11. I am proficient in understanding my learners' points of view in our mathematics class.		0.909			0.2345
12. I am conscious of my students' difficulties when working on activities in mathematics class.					0.4723
13. I examine the ideas that my students have in mathematics class.					0.7316
14. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.	0.978				0.1052
15. I am consistent in fostering student motivation in our mathematics class.				1.058	0.1401
16. I handle my students' errors in our mathematics class with respect.	0.951				0.1823
17. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.				0.702	0.4214

Forced Analysis – 4 Fixed Factors

	Factor				
	1	**2**	**3**	**4**	**Uniqueness**
18. I am constructive in providing feedback to my learners in our mathematics class.	0.900				0.2677
19. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.				1.113	0.0966
20. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.			0.974		0.0942
21. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.	0.897				0.2259
22. I am eager in acknowledging my learners' efforts in our mathematics class.			1.080		0.0304
23. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.				0.425	0.4230
24. I am facilitative in encouraging a helpful environment for my students in mathematics learning.			1.083		0.0258

Note. 'Principal axis factoring' extraction method was used in combination with a 'promax' rotation

Factor Loadings

Factor	Indicator	Estimate	SE	Z	P	Stand. Estimate
Emotional Awareness	EA1	0.603	0.0427	14.1	<.001	0.721
	EA2	0.583	0.0426	13.7	<.001	0.704
	EA3	0.585	0.0426	13.7	<.001	0.708
	EA4	0.591	0.0434	13.6	<.001	0.702
	EA5	0.576	0.0418	13.8	<.001	0.707
	EA6	0.565	0.0431	13.1	<.001	0.682
	EA7	0.573	0.0436	13.1	<.001	0.683
Supportive Teaching	ST8	0.568	0.0417	13.6	<.001	0.702
	ST9	0.578	0.0422	13.7	<.001	0.706
	ST10	0.577	0.0417	13.8	<.001	0.711
	ST11	0.572	0.0426	13.4	<.001	0.694
	ST12	0.559	0.0420	13.3	<.001	0.690
	ST13	0.559	0.0400	14.0	<.001	0.717

Factor Loadings

Factor	Indicator	Estimate	SE	Z	P	Stand. Estimate
	ST14	0.554	0.0415	13.3	<.001	0.692
Instructional Adaptability	IA15	0.563	0.0433	13.0	<.001	0.678
	IA16	0.550	0.0422	13.0	<.001	0.680
	IA17	0.580	0.0422	13.8	<.001	0.708
	IA18	0.556	0.0416	13.4	<.001	0.693
	IA19	0.577	0.0419	13.8	<.001	0.708
	IA20	0.570	0.0429	13.3	<.001	0.689
	IA21	0.595	0.0412	14.4	<.001	0.733

Item Reliability Statistics

	Mean	SD	Item-rest correlation	If item dropped	
				Cronbach's α	McDonald's ω
1. I am aware of how excited my students are when they learn new things in our mathematics class.	6.33	0.676	0.592	0.935	0.938
2. I am attuned to my students' struggles in studying Mathematical concepts.	6.27	0.756	0.539	0.936	0.939
3. I am sensitive to the worries of my students about their mathematical performance.	6.34	0.705	0.626	0.934	0.937
4. I am sympathetic towards the disappointment that my students experience when they fail to achieve the right answer to a mathematics problem.	6.27	0.755	0.535	0.936	0.939
5. I am attentive to the issues and concerns of my learners in our mathematics classroom.	6.46	0.632	0.695	0.933	0.935
6. I understand the difficulties encountered by my learners when working with mathematical tasks.	6.52	0.604	0.659	0.934	0.936
7. I am perceptive of my students' feelings in different learning situations in our mathematics class.	6.44	0.625	0.687	0.933	0.935

Item Reliability Statistics

	Mean	SD	Item-rest correlation	If item dropped	
				Cronbach's α	McDonald's ω
9. I am observant of my learners' potential mental health challenges in our mathematics class.	6.40	0.676	0.634	0.934	0.937
10. I am mindful in discerning my learners' moods in our mathematics class based on their facial expressions.	6.40	0.675	0.574	0.935	0.938
11. I am proficient in understanding my learners' points of view in our mathematics class.	6.36	0.630	0.628	0.934	0.937
14. I am compassionate in managing the academic difficulties that students face without sacrificing the standards of their learning.	6.47	0.627	0.699	0.933	0.935
15. I am consistent in fostering student motivation in our mathematics class.	6.42	0.617	0.619	0.935	0.937
16. I handle my students' errors in our mathematics class with respect.	6.50	0.605	0.638	0.934	0.936
17. I practice flexibility in my style of instruction to meet a variety of my students' needs without sacrificing academic standards.	6.34	0.631	0.519	0.936	0.938
18. I am constructive in providing feedback to my learner in our mathematics class.	6.50	0.599	0.608	0.935	0.936

Item Reliability Statistics

	Mean	SD	Item-rest correlation	If item dropped	
				Cronbach's α	McDonald's ω
19. I am diligent in providing opportunities for my learners to master mathematical problem-solving techniques.	6.43	0.613	0.606	0.935	0.937
20. I am enthusiastic in boosting the collaborative problem-solving environment in our mathematics class.	6.50	0.634	0.685	0.933	0.935
21. I am supportive of fostering a classroom culture that allows positive learners' expression of concerns.	6.50	0.611	0.669	0.934	0.935
22. I am eager in acknowledging my learners' efforts in our mathematics class.	6.52	0.616	0.671	0.934	0.936
23. I am adaptive in crafting lessons that provide opportunities for my students' varied learning paces.	6.37	0.609	0.625	0.934	0.936
24. I am facilitative in encouraging a helpful environment for my students in mathematics learning.	6.52	0.610	0.672	0.934	0.936

Curriculum Vitae

Name	Eugene L. Menorca
Date of Birth	September 23, 1985
Place of Birth	Mataas na Bayan, Mogpog, Marinduque
Attainment	
Doctorate Degree	Doctor of Philosophy with Specialization in Mathematics Education Philippine Normal University – Manila
Master's Degree	Master of Arts in Education (Mathematics Teaching) Marinduque State College, Boac Campus Boac, Marinduque; 2018
Bachelor's Degree	Bachelor of Secondary Education Major in Mathematics Marinduque State College, Boac Campus Boac, Marinduque; 2006
Award	Awardee, 1st Runner Up - Search for Outstanding Achiever in the Region 2023 (MIMAROPA), 2022 Outstanding Secondary Classroom Teacher (Marinduque), Two-time (2019,2022) Outstanding Secondary Classroom Teacher

Teaching Experiences

2018 – present	Secondary School Teacher III Balanacan National High School, Mogpog Mogpog, Marinduque
2013 – 2018	Secondary School Teacher I Balanacan National High School, Mogpog Mogpog, Marinduque
2011 – 2013	Secondary School Teacher I Sibuyao National High School, Torrijos Torrijos, Marinduque go