

# Social-Emotional Learning Competencies and Mathematical Reasoning Skills of Grade 12 Students

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## Abstract

Waning attention to the facets of social and emotional learning competencies (SEL) in an educational context along with the students' poor mathematical performance, which can be predicted through mathematical reasoning skills (MRS), is an issue that has to be addressed in the Philippines. Despite the fact that it has been shown to have an impact on mathematics achievement, associating SEL into the field of mathematical reasoning has yet to be explored. Hence, the researchers attempted to shed attention on the relationship between the perceived SEL of the respondents in terms of self-awareness, self-management, social awareness, relationship skills, and responsible decision-making and their level of MRS as to analyzing, generalizing, and justifying, and if strand moderates this relationship. A descriptive-correlational design with moderation analysis was used and stratified-random sampling technique was utilized in choosing 117 grade 12 students from one state university in Laguna. Adapted self-report survey and mathematical reasoning tasks were used to gather data. The results revealed that there is a significant relationship between the perceived SEL and MRS, except in self-management and relationship skills. Findings have also suggested that strand moderates the relationship of the two variables which implies that the interaction of SEL and strands of the respondents poses a direct relationship with their reasoning abilities in mathematics, when students are from STEM. Implementation of teaching strategies fostering students' social and emotional states is recommended.

**Keywords:** *Social-Emotional Learning Competencies, Mathematical Reasoning Skills, STEM, non-STEM, CASEL*

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## Introduction

Different studies have focused on variables to measure not just cognitive skills but also soft skills (Gokce & Guner, 2021) or the social-emotional skills of learners. In relation to this, Social and Emotional Learning (SEL) views students' social-emotional development through the lens of five specific competencies: self-awareness; self-management; social awareness; relationship skills; and responsible decision-making (Collaborative for Academic Social and Emotional Learning, 2020). This has become a growing field of educational research as international organizations, including the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2019), have also recognized its importance as it divides student learning into dimensions that are not solely cognitive, but also include domains of social and emotional, and behavioral. Thus, developing these social-emotional learning competencies (SEL) in the classroom serves as the preparation of the students (Organization for Economic Co-operation and Development, 2019). However, only 20 states all over the world have integrated SEL into their educational curriculum (CASEL, 2020), and the Philippines is not one of those. In fact, UNESCO (2019) stated that the social and emotional dimension has been given a declining emphasis across different educational levels until upper secondary. In effect, although it was proven to have an impact on mathematical performance (Bhoumick & Saha, 2020) and the students' academic performance in general, Duckworth and Yeager (2015) and West et al. (2018) stated that these soft skills are not assessed in school contexts.

Studies about SELC have shown its impact on the students' academic performance. Taylor et al. (2017) revealed the significant improvement in the social-emotional skills, positive attitudes, academic performance, and well-being of the students after the implementation of SEL-based interventions in schools. Specifically, SELC has also been linked to their mathematical performance (Cavadini et al., 2021; Kahl et al., 2021). In relation to this, mathematical performance is an important aspect that is recognized not just for educational purposes, but also for preparation for future workplaces (National Council of Teachers of Mathematics, 2014). This highlights the significance of mathematical reasoning skills (MRS) as they are a predictor of mathematical performance (Adegoke, 2013; Green et al., 2017).

Even though reasoning is an essential skill in mathematics education, educators still struggle to properly understand and assess it, which is why Loong et al. (2018) developed a MRS rubric based on three reasoning actions, namely analyzing, generalizing, and justifying. These

actions are elicited through challenging, open-ended tasks, with no readily available solution, that require students to use their own resources and knowledge (Mueller, 2014). Meanwhile, several studies have associated social-emotional learning competencies and mathematical reasoning skills of students separately with other factors such as strand (Almerino et al., 2020) due to the relevance of developing SELC during the transition of students from high school to college, as these skills improve their readiness for tertiary education (Dymnicki et al., 2013; Comedis, 2014).

Even though both areas of concern are related to mathematical performance, no further research has explored the association between SELC and MRS. In relation, this study is anchored to the control-value theory, which states that the perceived control and value of the students toward a task may lead them to feel positive or negative emotions toward it (Pekrun, 2006). These emotions are part of the SELC of the students which can affect their performance and achievement in mathematics. Thus, this study sought to determine if there exists a relationship between social-emotional learning competencies and mathematical reasoning skills of the grade 12 students as moderated by strand.

## **Methodology**

A descriptive-correlational design with moderation analysis was used and stratified-random sampling technique was utilized in choosing 117 grade 12 students from one state university in Laguna. Adapted self-report survey and mathematical reasoning tasks were used to gather data. The SELC survey was adapted from the Washoe County School District – Social and Emotional Competency Assessment (WCSD-SECA) which consists of 40 items: 25% for self-awareness; 35% for self-management; 12.5% for social awareness; 15% for relationship skills; and 12.5% for responsible decision-making. On the other hand, the mathematical reasoning test was composed of three reasoning tasks adapted from different studies. Each task has three guide questions that measure the respondents' reasoning skills as to analyzing, generalizing, and justifying.

Prior to commencing the study, the researchers requested approval from the Senior High School Department and Principal to carry it out at a time that would be most convenient for the respondents. The researchers scheduled an online meeting with the students through Google Meet, in which they were encouraged to open their cameras while answering. The instruments

were administered using Google Forms. Once collected, four pre-service mathematics teachers checked the raw data.

Descriptive statistics, namely mean, standard deviation, and frequency was used to analyze the strand (STEM and non-STEM), perceived social-emotional learning competence (very low, low, high, and very high) and level of mathematical reasoning skills (not evident, beginning, developing, consolidating, and extending). Meanwhile, Pearson Product-Moment Correlation was employed to analyze the relationship between SELC and MRS. A moderation analysis with Process Macro was also used to determine if a moderating effect of strand exists in the relationship between SELC and MRS.

## **Findings**

Among 117 grade 12 students, there are 53 from STEM and 64 from non-STEM strands. They perceive their social-emotional learning competencies as high. Their self-awareness competency was interpreted as high which can be understood that they find it easy to understand their emotions, thoughts, and behaviors in various contexts. A high self-management was also computed which is a reflection that they find it easy to manage their behaviors and emotions under different circumstances. Grade 12 students were also highly socially aware which suggests that it is easy for them to understand their classmates' perspectives while being aware of their different beliefs. Results have also shown that they demonstrated high relationship skills which is an indication that it is easy for them to create and maintain meaningful relationships with other people. Lastly, the respondents were highly responsible in terms of their decision-making competency which could mean that it is easy for them to create efficient and constructive decisions in academic and non-academic contexts.

From the three mathematical reasoning tasks, the respondents garnered consolidating analyzing skill which means that one to two errors were committed in provided similarities and differences among the mathematical concepts that they have noticed. On the other hand, the respondents were designated with developing generalizing skill, implying that three or more errors were made on the application of mathematical concepts from a specific case to a broader sense. In terms of justifying, this skill was interpreted with a developing level which shows that the students have committed three or more errors in constructing logical arguments in an attempt to support their mathematical claims. Additionally, the findings have shown that there exists a

significant relationship between the perceived SELC and MRS, except in self-management and relationship skills.

Results have also suggested that strand moderates the relationship between the two variables which implies that the interaction of SELC and strands of the respondents poses a direct relationship with their reasoning abilities in mathematics, when students are from STEM. The variation in the mathematical reasoning skills of STEM and non-STEM students is also associated with their strand.

## **Conclusion**

The result of this study suggests that the grade 12 students perceive their social-emotional learning competencies as high in all of its components. Meanwhile, their mean scores in terms of mathematical reasoning skill fall on the consolidating level of analyzing skill, and developing level on aspects of generalizing and justifying. In relation to this, it is suggested that students may periodically assess their perceived social-emotional learning competencies and improve it as it is associated with their level of their mathematical reasoning skills.

Results also manifest that there is a significant relationship between social-emotional learning competencies and mathematical reasoning skills except for self-management and relationship skills. Thus, teachers may consider implementing teaching strategies that could develop these soft skills and reasoning skills in and beyond the classroom context.

Furthermore, it can also be gleaned from the study that the strand moderates the relationship between SELC and MRS for STEM students only. With that, future researchers may also consider using a larger sample from college students in order to determine the extent of the moderating role of STEM courses on the association between the two variables.

Since the study was conducted through online set-up due to the pandemic, it is also recommended to conduct the study through face-to-face interactions if the situation permits. Finally, studying other potential moderating variables related to this field of study is also suggested.

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