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Teaching Mathematics in 'Different Tongues': An Analysis of Mathematics Anxiety and Proficiency among Elementary-Grade Learners

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***Abstract*---**Language choice in teaching mathematics is a legitimate area of concern. It is noted that tension exists in classrooms where mathematics is taught in a language different from the first language spoken by the learners (Martínez & Dominguez, 2018). It is then a logical supposition to make that if students in mathematics classes are taught and tested in a language that is not their native their scores and proficiency levels may not be a true measure of their abilities, but a reflection of their mastery of the language used as medium of instruction (Haag, Heppt, Stanat, Kuhl & Pant, 2013). Against this contention, this study is conducted to determine the mathematics proficiency and anxiety of students learning mathematics across different local languages. In addition, the study analyzed whether significant differences exist in the investigated variables across gender. The study disclosed interesting results which were discussed herein.

***Keywords*---**different tongues, elementary-grade learners, language of instruction, mathematics anxiety, mathematics.

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Introduction

Mathematics is one of the core subjects taught and learned across academic institutions. This means that the subject is noted to be important. With respect this, mathematics (also maths) is associated with terms and ideas such as 'universal subject' Vitasari et al. (2010), 'lingua franca of the modern world' Kim et al. (2012), 'important component in science, technology and engineering education' (Rozgonjuk et al., 2020). These associations and claims reflect the notion that mathematics is part of everybody's social life as social transactions often, if not always, require the need for math (i.e quantification, computation, measurement, among others). It could then be said that learning maths is not only important Sevindir et al. (2014), but also inevitable. In fact, it is a necessity, in order to function well, to possess adequate mathematical ability (Skagerlund et al. 2019). Relative to this, Lamb (1997), boldly claimed that success in mathematics serves as a predictor of success in life. Hence, it does not come as a surprise that low achievement in mathematics is a matter of concern across countries Dowker et al. (2016), especially that MA could prevent students from passing even basic mathematics courses more so with advanced ones (Richardson, & Suinn, 1972). Thus, it could be said that research on MA emanates from the perception it leads to poor performance and avoidance of a subject importance (Keshavarzi & Ahmadi, 2013).

Upon review of literature, it could be noted that there is no scarcity of investigations on MA. Certainly, researchers have sufficiently explored it, making it one of the most studied concepts (Çatlioğlu et al., 2009). However, most of the investigations were conducted in various contexts different from this study – relationship of MA with types of mathematical proficiency Vukovic et al. (2013), math anxiety and attitude effect on academic achievement Wahid et al. (2014), relationship between MA and students' demographic profile (e.g., gender, grade, number of sibling, parental education), perceived enjoyment and appreciation of mathematics, and math achievement, differences in MA across the binary category of gender), prior experience and confidence to teach (Brady & Bowd, 2005).

Although there is a preponderance of investigations on MA and Mathematics Proficiency (MP), there remain uninvestigated terrains , in particular, there is little research exploring the salience of language of instruction (LoI) and MA. This is specifically true in multilingual contexts in the Philippines where local languages are afforded an essential niche in the curriculum and used as LoIs. Therefore, this study aimed to determine the MA and MP of students instructed in different local languages (Chavacano, Bisaya, and Bahasa Sug) which are their first languages (L1). Addedly, the study intended to determine whether a gender gap exists with respect to MA and MP. In addition, the study aimed to identify a significant difference on MA and MP across languages of instruction. Finally, the study was designed to draw a significant relationship between MA and MP (Lewin & Smith, 1996; Cenzer & Remmel, 1998).

Research Questions

This present study on mathematics anxiety and proficiency of grade 3 pupils instructed in three Philippine languages specifically considered to answer the following research questions which served as guide in the conceptualization and design of this research endeavour:

- What is the Mathematics anxiety of the Grade III learners?
- What is the Mathematics proficiency of the Grade III learners?
- Is there significant differences in the Mathematics anxiety of the Grade III learners when data are grouped according to language of instruction, and gender?
- Is there significant differences in the Mathematics proficiency of the Grade III learners when data are grouped according to language of instruction, and gender?
- Is there a significant relationship between Mathematics proficiency and Mathematics Anxiety among Grade III learners?

Related Literature

Mathematics anxiety

Mathematics anxiety or simply math anxiety is regarded as an emotional response towards tasks or activities involving computation (Aarnos & Perkkilä, 2012). The said emotional response is generally considered to be a negative kind. For Vitasari et al. (2010), it is considered as a psychological barrier because it causes '*cognitive deficits*' – hindrance in recall, memory block and mistaken interpretation of information. For Karasel et al. (2010), MA includes a behaviour characterized as withdrawn. As for Hill et al. (2016), it is ' *a debilitating negative emotional reaction towards mathematics*'.

Other authors have also advanced varied conceptual definitions of MA, and are yet to attain consensus with respect to it (Çatlioğlu et al., 2009). This means that MA is complex , and could be defined in numerous means (Hamza & Helal, 2013; Brady & Bowd, 2005). One of the earliest definitions is put forth by Richardson & Suinn (1972), that '*mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations*'. On another hand, Vitasari et al. (2010), maintained that '*Mathematics anxiety is lack of ability for an intelligent person to cope with quantification, confronted with a math problem*'. For Aarnos & Perkkilä (2012), MA is an '*individual's negative affect when engaging in numerical and mathematical tasks*'.

There are types of MA conceptually conceived (Vukovic et al., 2013). The first is numerical anxiety and the other is mathematics test anxiety. The first one is the feeling of tension evoked when using maths in daily and academic lives. The second kind, on the other hand, is the feeling of fear elicited when one is taking a test or examination in mathematics. A different perspective was provided (Chiu & Henry, 1990). The authors discussed that there are four aspects constituting the construct of MA, namely : mathematics evaluation anxiety, mathematics learning anxiety, mathematics problem solving anxiety, and mathematics teacher anxiety. Keshavarzi & Ahmadi (2013), defined that mathematics evaluation anxiety '*refers to the situations related to evaluation of learning math, for example, preparation for math exam or thinking about the exam the day before the exam*'; mathematics learning anxiety is the dimension relating to consideration of the '*activities and processes related to math learning, such as preparing a new math book, participation in math class, or starting to study new chapters of math book*'; mathematics problem solving anxiety '*refers to math problem solving in a situation different from the exam. It includes situations like studying and interpreting tables and charts or listening to another student solving a math problem*'; and Mathematics teacher anxiety relates '*to the math teacher's characteristics*'.

Additionally, several terms and expressions were associated with MA such as fear Ashcraft (2002), unreasonable fear Abbasi et al. (2013), worry Wigfield & Meece (1988), tension Richardson & Suinn (1972); Vukovic et al. (2013), fright Karasel et al. (2010), negative affect Aarnos & Perkkilä (2012), powerlessness Zavalsky (1994), unpleasant emotional response Cemen (1987), panic Bekdemir (2010), inhibitor of attitude Novak & Tassell (2017), apprehension Zhang et all. (2019), and interference Leppävirta (2011), cognitive disorder Brewster & Miller (2020), and avoidance (Wadlington & Wadlington, 2008). These terms connote one thing – that MA is something which is undesirable and should be avoided. And, this feeling could be triggered when one is given a math problem to solve, asked to perform a calculation or even whe simply presented with numbers (Brewster & Miller,2020).

Likewise, researchers have perceived mathematics anxiety differently from the construction of anxiety (Dower et al., 2016). This means that there are those who identify MA as a single factor construct while others looked at it to be consisting of two dimensions Liebert & Morris (1967), the cognitive and affective dimensions. The cognitive aspect of MA relates to the concern of an individual's '*performance and consequences of failure'* while the affective aspect, also referred to as '*emotionality*', '*refers to the nervousness and tension in testing situations'* (Dowker et al., 2016). However, for Hembree (1990), MA is an omnibus construct consisting of numerous sub constructs which relates to the claim of Brewster & Miller (2020), that MA is a '*multidimensional construct*' (Cumming & Riazi, 2000; Saalbach et al., 2013).

On another note, although anxiety is a hypothetical construct which means that it could not be directly measured through direct means such as observation, it must be noted that a mathematically anxious person manifests psychological symptoms when subjected to performing mathematical tasks (Hamza & Helal, 2013). Supportive of this, upon survey of literature, authors have noted that '*difficulty in thinking, extreme nervousness, an inability to focus on the instructor, a difficulty in concentrating, negative self-talk, and/or a general sense of uneasiness'* are some of the symptoms exhibited by individuals with math anxiety (Hamza & Helal, 2013). Relative to this, Kundu & Kar (2018), enumerated rapid heartbeat, feeling faint and trembling as manifestations of an individual with MA. Additional symptoms, as for Brady & Bowd (2005), are '*being uncomfortable in performing mathematical tasks in non-formal classroom situations, avoiding formal mathematical instruction whenever possible, poor test performance and the* *utilization of remedial instruction to little effect'*. Authors have noted that MA could be a result from negative math experiences. Hamza & Helal (2013), explained that experiences of being punished by their Math Teachers, receiving bad grades, and teachers who do not provide motivation are some examples this claim. This contention is supported by the study of Hembree (1990), who explained that negative experiences in mathematics instruction led to MA which is referred to as '*math abuse'*.

Definitely, despite the varied semantic and conceptual understanding and association of ideas of MA among researchers, a consensus among authors could be noted that MA, as a hypothetical construct, should be thoroughly understood and fully grasped. In fact, to bear cognizant of MA is essential and needed to enable modifications and refinements of teaching practices and of the educational system. Toward this end, contextualization of investigations on MA should be realized as in the case of this study which include conducted the investigation in the case of students taught in their L1 which are local languages of the Philippines – rarely the context of studies on the same construct (Aarnos & Perkkilä, 2012; Kargar et al., 2010).

Mathematics proficiency

The importance and need of gaining proficiency in Mathematics does not require repetition nor could ever be overemphasized. Undeniably, the significance of MP is both societal and economic (Cragg & Gilmore, 2014). Thus, it does not come as a surprise that MP is associated with many things such as academic and career opportunities Akinsola et al. (2007), economic vitality and social success (Awofala, 2017). These significance and gains linked with MP are speculated to be the drive behind efforts directed towards improving the teaching, for educators, and learning, for students, of mathematics – that the end result of the teaching-learning process is hoped to be the gaining, among learners, satisfactory level of MP. Hence, researchers have advanced claims relating to the importance of the mathematics subject and the mathematical skill. Adimora et al. (2015), maintained that the importance of mathematics is '*an indisputable fact*'. Therefore, researchers have warned about different troubles one may face when MP is poor such as functional difficulties Parsons & Bynner (2005), and serious consequences on performance in school (Marcelino et al., 2012).

Mathematical proficiency, for authors like Awofala (2017), *'is the quality of being skilled and exhibiting expertise, competence, knowledge, beliefs, and facility in doing mathematics and becoming proficient problem solvers with high productive disposition*'. Moreover, MP is broken down into 5 strands: Conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Cordova & Tan, 2018). Fredua-Kwarteng & Ahia (2015), explained the each strand as follows: conceptual understanding '*is about comprehension of mathematics concepts, operations, and their relationships*'; procedural fluency '*refers to the knowledge and skills to apply mathematical procedures flexibly and appropriately in accordance with the contexts*'; strategic competence '*is the ability to formulate, represent and solve mathematical problems*'; Adaptive reasoning '*relates to the capacity to explain things using logic, thought reflection, and justification*'; and productive disposition '*involves the* *development of positive attitude toward mathematics*' (Pein et al., 2015; Buxton et al., 2013).

Mathematics, language, and anxiety

Learning mathematics typically is realized with a language. Moses & Cobb (2002), discussed that learners' language is essentially important for the gaining of conceptual knowledge essential in decoding mathematical symbols and impacts performance in the said subject (Bailey et al., 2015). Indeed, learning mathematics is far from being simple as it is a complex process demanding a variety of knowledge including language in order to grasp mathematical ideas and have them correctly represented (Wilkinson, 2018). Thus, mathematics and language were perceived to be conceptually inseparable Martínez & Dominguez (2018), suggesting that the understanding of mathematics would prosper only via the use of a language (Lau et al., 2015; Lehrer & Schauble, 2000).

Language choice in teaching mathematics is a legitimate area of concern. It is noted that tension exists in classrooms where mathematics is taught in a language different from the first language spoken by the learners (Martínez, & Dominguez, 2018). It is then a logical supposition to make that if students in mathematics classes are taught and tested in a language that is not their native their scores and proficiency levels may not be a true measure of their abilities, but a reflection of their mastery of the language used as medium of instruction (Haag et al., 2013). However, the aforementioned claims are not without opposition. The investigation of Ismail et al. (2011), found that students are inclined to learn Mathematics in English. The study explained that the reason for this preference is the students' pre-university experience – Math was taught to them in English (Hartono et al., 2021; Slipchuk et al., 2021).

At this point, it is essential to note the claim of Jhingran (2005), cited in Alieto (2018), that learning concepts in a language learners yet to master is an improbable educational task especially among young ones. In relation to this, Abedi & Lord (2001), discussed that when assessment transpires in a students have poor or limited proficiency in, which in most cases is English, it becomes complicated, and far from being simple and easy; moreover, the language of educational assessment if often 'overlooked' (Gandara & Randall, 2019). At this juncture, it is argued that this complication brought about by the 'language issue' happens not only in the niche of assessment, but also in the whole teaching-learning process with respect to students learning mathematics during the early years of education. Therefore, the best way to teach mathematics specifically in the early years of education is through the use of learners' first language. This means that it is best to instruct children in their L1 (Mackenzie, 2009). Doing this would mean that pupils are spared from the trouble of learning a new language while understanding mathematics concepts.

As regards language and MP Barton & Barton (2003), remarked that language problem is one, if not the greatest, issue contributing to poor performance in Maths. With this, it is logical to believe that learners perform poorly if math education is realized in a language not understood or yet to be mastered by the learners. Along this line, it is essential to point out the claim of Jamison &

Matthews (2006), that language is an important pedagogical tool in learning mathematics. Interestingly, sharpening mathematics proficiency requires the learning of mathematics with understanding (Shafer, & Romberg, 1999; Romberg, 1999). Certainly, when children are taught mathematics in their L1 language, they are able to comprehend and learn better (Israel & Thomas, 2013). These contentions echo the call of UNESCO, in the year 1953, for the use of mother tongues (MTs) as LoIs, especially in the early years of education (Bull, 1955). This implies that language choices in education have an impact in the teaching and learning process, the school and community and more specially the students being served by the educational system (Gandara & Randall, 2019). By way of logic, if students are taught mathematics in a language they understand most, it is most likely that their anxiety lessens. This is because they could relate to what is presented, discussed and elaborated inside the classroom. Thus, because these claim are anecdotal , the need to provide empirical data with respect to this concern comes to the fore – especially in the case of local languages of the Philippines used as LoIs (Carey, 1987).

Related studies

Mathematics anxiety

Mathematics anxiety is a well investigated topic. Learners from different countries were sampled and investigated as such plays key essential role in national growth and development (Erden & Akgul, 2010). Studies were conducted among learners from different places such as Turkey Olmez & Ozel (2012), Nigeria Adimora et al. (2015); Erden & Akgul (2010); Samadzadeh et al. (2013); Lavasani et al. (2011), Austria Schillinger et al. (2018), North of Cyprus Karasel et al. (2010), China, Taiwan, and United States Ho et al. (2000), Canada Sokolowski et al. (2019), Northern Taiwan Chen (2019), Sweden Skagerlund et al. (2019), Egypt Hamza & Helal (2013), and Eastern India (Kundu & Kar, 2018). Noticeably, from this listing, studies on the same variables were not yet reported to be investigated in the country much to the knowledge of the researcher.

Moreover, studies were conducted across educational levels – among elementray graders Aarnos & Perkkilä (2012); Adimora et al. (2015); Chen (2019); Karasel et al. (2010); Olmez & Ozel (2012); Vukovic et al. (2013); Ho et al. (2000), high school learners Abbasi et al. (2013); Kundu & Kar (2018); Lavasani et al. (2011), and university students (Hamza & Helal, 2013; Brady & Bowd, 2005; Schillinger et al., 2018; Sheffield & Hunt, 2006; Skagerlund et al., 2019; Sokolowski et al., 2019). Remarkably, studies on MA have been conducted alongside other variables such as self-esteem and the personality of the teachers of the studnets Abbasi et al. (2013), intelligence and performance Schillinger et al. (2018), mathematical problem skills Karasel et al. (2010), gender, grade and perceived enjoyment Olmez & Ozel (2012), goal structure, self-regulation and math self-efficacy Lavasani et al. (2011), spatial processing Sokolowski et al. (2019), augmented reality Chen (2019), working memory and number processing Skagerlund et al. (2019), instructor's teaching style and course content Van der Sandt & O'Brien (2017), Socio-economic status and classroom climate (Adimora et al., 2015). Interestingly, MA has been investigated with various respondent types. It has been studied among elementary mathematics teachers Ramirez et al. (2018), STEM and social sciences students Rozgonjuk et al. (2020), rural and urban students Kundu & Kar (2018), pre-service teachers Brady & Bowd (2005); Van der Sandt & O'Brien (2017), and online marketplace workers (Maloney & Retanal, 2020).

With certainty, it could be declared that the listings given as regards different studies carried out to determine MA in varied and numerous contexts are limited and non-exhaustive. There are countless research works failed to be included in the survey; however, it is supposed that the present enumeration is enough to convincingly suggest that MA '*has multifaceted impact on mathematics education*' Brady & Bowd (2005), and is a critical factor to gain cognizant with accounting the intention and purpose of improving the teaching and learning of mathematics.

On measuring mathematics anxiety

Mathematics anxiety is a hypothetical variable. This means that such cannot be directly measured or determined. Hence, studies have utilized a research tool to determine and measure learners' MA. In the study of Olmez & Ozel (2012), the authors adopted the Math Anxiety Scale developed by Erol in 1989. The said tool is a Likert-type questionnaire consisting of 45 questions. The scale of response ranges from 1 for never to 4 for always. For the study of Keshavarzi and Ahmadi (2013), the Mathematics Anxiety Scale for Children (MASC) and Mathematics Anxiety Rating Scale – Short Form (S-MARS) were used to quantify respondents' MA. The research MASC contains 22 short phrases and developed considering the four dimensions:

- Mathematics evaluation anxiety.
- Mathematics learning anxiety.
- Mathematics problem solving anxiety.
- Mathematics teacher anxiety.

Moreover, in the study of Abbasi et al. (2013), a research instrument called Mathematics Anxiety Scale (MARS) was used for data gathering. In the study of Schillinger et al. (2018), the research tool named Abbreviated Mathematics Anxiety Scale (AMAS) was utilized. The instrument consists of 9 items characterizing mathematics situations which students encounter. Mathematics Anxiety is perceived to be of two facets – the learning math anxiety (with five items) and math evaluation anxiety (with four items). Additional example is the study of Karasel et al. (2010), which used a 45-item questionnaire named as Mathematics Anxiety Scale (MAS). The instrument was answerable with a four-point Likert scale.

Further example, on this regard, is the work of Olmez & Ozel (2012), which quantified the construct of MA through the adoption of the Mathematics Anxiety Scale (MANX) which is composed of 45 questions answerable by a 4-point Likert (1-Never, 4-Always). Additionally, the least number of points respondents could gain is 45 and maximum 180 – with those scoring high interpreted to have high level of anxiety. Furthermore, in Lavasani et al. (2011), the use of a research tool was the nominated approach in quantifying MA among 436 first-grade male students. The fourteen-item instrument was noted to be bidimentional, and is answerable with a scale ranging from 1 to 4. Additional to the list is the work of

Maloney & Retanal (2020), which investigated and measured the MA using the 9-item abbreviated mathematics anxiety scale. In the study, the respondents were required their extent of anxiety in varied mathematical situations. Certainly, other means could also be employed to measure MA. An example is the approach in the study (Aarnos & Perkkilä, 2012). The picture test was used to measure the variable. The said test consisted of 37 pictures grouped into six subject matters – human beings, culture products, toys and fairy-tale creatures nature and nature products, constructed environment , and mathematical issues.

In this section, it was clearly presented that means are available in quantifying MA; however, most of the studies conducted in this area have approached the process of measuring MA through the utilization of a research tool Sheffield & Hunt (2006), either developed or adopted. Definitively, it is remarked that the use of a research instrument is a legitimate manner of determining MA as supported by the enumerated studies. Building on this premise, this present investigation quantified the latent variable MA through the construction of a research tool through extensive research of literature.

Mathematics proficiency

Similar to MA, investigations on MP abound and have been conducted in all educational levels - elementary Henry et al. (2014); Perez, & Alieto (2018); Reardon, & Galindo (2007), high school students Barrett et al. (2012); Ramos et al. (2015), college level learners (Allen & Pappas, 1999). The conduct of studies across the three educational ladders underscores the importance of MP in all educational levels, and not only in one definite or limited phase of education. Contextualization of studies on MP abounds. Studies have accounted for numerous factors with the intention of effectively improving students' achievement in mathematics at school. Mathematics proficiency has been juxtaposed with variables such as family and community involvement Sheldon et al. (2010), reading comprehension level Ramos et al. (2015), family, school and teacher characteristics Qiu & Wu (2019), attitude, academic motivation , and intelligence quotient Moenikia & Zahed-Babelan (2010), peer interethnic relations Barrett et al. (2012), and computer-based tutorials (McDonough & Tra, 2017).

Moreover, on measuring mathematics proficiency, Cerbito (2020), established, in his study, that determination of MP could be realized simply by obtaining the mean score of the respondents in Mathematics in different rating periods. Moreover, in the study of Rambely et al. (2013), the same construct was accounted for through the use of the students' grades in mathematics. This is taken to mean that scholars have perceived grades as sufficient and reliable measure of learners' mathematics proficiency which explains their use across investigations. It is argued, however, that the grades of the students in the Math subject are composed of parts that do not necessarily reflect the students' mathematics proficiency such as the component project. Thus, the current investigation anchored the choice of using students' periodic examination results in two rating periods as determinants of the students' MP. From the enumerations presented, it could be inferred that investigations on mathematics proficiency are continuously performed to present a picture of understanding in a certain angle. Certainly, the present contextualization of the investigation which brings to the fore the salience of L1 use as LoI is novel endeavor especially when the indegenous Philippine languages are accounted for.

Gender in mathematics anxiety and proficiency

Globally, the 'gender dimension' is a ubiquitous factor in investigations conducted in the field of mathematics education (Awofala, 2017). This explains the inclusion of gender investigations of MA Hamza & Helal (2013); Abbasi et al. (2013); Ahmadi (2013); Kundu & Kar (2018); Olmez & Ozel (2012); Sokolowski et al. (2019), and MP (Hyde et al., 2008; Robinson-Cimpian et al., 2014). Surprisingly, despite the extensive investigations on the influence of gender on MA, findings remain inconsistent across studies (Zhang et al., 2019). This suggests that different studies found conflicting findings due to contextualizations realized in each. In a similar vein, Hamza, and Helal (2013), maintained that despite decades of investigation on the effect of gender in MA consensus remains elusive.

However, Sokolowski et al. (2019), forwarded the claim that a large body of investigation documented females to be more anxious as compared to males. The authors highlighted further that sex difference in anxiety is not simply caused by sex difference in math ability. Instead, the authors explained that math anxiety is '*rooted in sex-related differences in anxiety about or avoidance of spatial strategies in solving mathematical tasks*'. Another example is the investigation of Olmez & Ozel (2012), involving 128 boys and 116 girls, which found that females obtained lower MA as compared to male counterparts. In other words, there is a significant difference in MA across gender with male being more anxious than females.

Some empirical studies concluded that gender has a neutral effect on the MA of respondents. An example is the investigation of Keshavarzi & Ahmadi (2013), which unraveled that there is no statistical significant difference in the MA between the girl and boy respondents. Another example is the study of Abbasi et al. (2013), with 480 high school students which found that there exists no significant difference on the MA across genders. An addition to the list is the work (Hamza & Helal, 2013). One of the objectives of the study is to determine the influence of gender on MA of 330 respondents, 162 of which are males. The cross-cultural study concluded that the male and female respondents across countries (USA and Egypt) did not significantly differ in their level of MA. Additional investigation of a similar claim is the work of Kundu & Kar (2018), with 310 high school students that although the males were found to be of higher anxiety, as provided by the mean scores, the difference is not significant suggesting that gender is not a factor influencing difference in MA.

With respect to MP and gender, authors presented conflicting conclusions. However for Henry et al. (2014), gender has been found to significantly influence mathematics performance when early studies are accounted for. Intriguingly, Robinson-Cimpian et al. (2014), claimed that gender gaps in MP does not only exist , but also emerges early. However, Hyde et al. (2008), disclosed that for the general population of grades 2 to 11 learners the gender difference in mathematics proficiency no longer manifested which reflects the claim of the gender similarities hypothesis. This particular result supports the notion that gender difference in MP is non-existent. Along this line, it is important to note the discussion of Robinson-Cimpian, et al. (2014), that the analysis of Hyde et al. (2008), is at state level which means determining students' performance against state standards which may '*have suppressed gender gap*'. However, Lee et al. (2010), disclosed a different result. In their study 244 of children, with an average age of 61 months, no gender difference on MP was found contrary to the long-standing perception gender gap exists favoring the males.

Indeed, in this part of the study, it was established that gender effe ct on both MA and MP remain inconclusive even up to this date. Thus, the inclusion of gender as a factor to be considered in the investigation of the variables MA and MP remains a necessity to perform despite the abundance of the same in literature. It is argued that this study which is at the junction of three essential constructs (MP, MA, and the language of instruction) would provide a unique angle of looking at the role of gender. Therefore, in this respect, the investigation on widely studied variables (MP and gender, MA and gender) were brought in a new light.

Mathematics anxiety and proficiency

Mathematics anxiety is generally believed to stem from being weak at numbers (Hamza & Helal, 2013). This means that MA and MP are linked with each other, and the relationship between the variables is noted to be inversed. By way of inference, the negative influence of MA on MP has made researchers interested in the former as a topic of investigation. Hence, mathematics anxiety as a research construct has received increasing attention among researchers over the years (Dowker et al., 2016). It is believed that the landmark study which has started all the studies on math anxiety was that of Dreger & Aiken (1957), which investigated the so-called 'number anxiety'; moreover, investigations on this variable is believed to have started in the mid of 1950 (Brewster & Miller, 2020).

Moreover, mathematics anxiety has been associated inversely with mathematics performance of learners. It has been established that math anxiety is an affective construct negatively influencing mathematical performance (Ashcraft, 2002). Actually, for Kundu & Kar (2018), MA negatively impacts initial learning mathematical concepts and gaining of mathematical skills. This is confirmed in various studies. An example is the study of Zhang et al. (2019), which investigated the math anxiety–performance connection , and has confirmed that there exists a negative link between math anxiety and math performance. Furthermore, the study disclosed that the strongest negative link occurs among the senior high school group while weakest among the elementary group. Similarly, Aarnos & Perkkilä (2012), explained that mathematics anxiety is an affective construct influencing mathematical performance. The authors further claimed that MA roots from personal, environmental and cognitive factors.

Another supporting investigation is that of Sheffield & Hunt (2006), which enlisted 48 undergraduate students. The participants of the study were asked to complete three tasks : (1) math task only, (2) a letter recall task only, and (3) a dual task (the math task and letter recall task). The authors disclosed that the findings of the investigation is sufficient to conclude that MA directly impacts mathematical tasks, and further claimed that the effect of MA is most pronounced with complex tasks. In addition, the negative impact of MA is not only consistent, but also far-reaching (Vukovic et al., 2013). Certainly, it is something that should not be taken for granted nor be not given due attention especially by the members of the academic community. A similar finding was disclosed in the study of Ho et al. (2000), which focused on MA across samples of elementary graders from China, Taiwan, and the United States. As an essential consideration and influencing factor, numerous studies were conducted on MA aimed at contributing essential results and findings contributory to the pool of knowledge in the said respect. Illustrative is the longitudinal research of Vukovic et al. (2013), with 113 second to third grade students. The study concluded that MA is an important consideration teachers should not miss when examining differences in mathematical performance among learners.

Language and mathematics proficiency

Numerous investigations were conducted investigating the role of language in mathematics learning among children. An example is the study of Vukovic & Lesaux (2013), which involved 167 children with ages ranging from 6 to 9.Seventy-five of the total respondents are native speakers of English while a larger number are language minorities. In the study, it was found that language plays an influential role in the making meaning process children undergo in mathematics. Relative to this, the study of Prediger et al. (2018), difinitively pointed out that among the background factors language proficiency has the strongest connection to mathematics attainments of learners.

Most investigations on mathematics development, performance and proficiency were in the context of mathematics taught and learned in English whether among native speakers, English as second language learners (ESLs) and English as foreign language learners (EFLs). In other words, the most investigated language set alongside studies on MP is the English language. Supportive of the claim is the investigation of Henry et al. (2014), with 1200 elementary-grade students noted to be both culturally and economically diverse which investigated the predictive power of English proficiency on mathematics scores. Another is that of Fenoll (2018), which investigated the effect of English proficiency on mathematics test scores among immigrant children in the United States.

Additional is the investigation of Barrett et al. (2012), among 2113 non-native English speaking Latino and Asian learners in high schools in the United States which investigated the English proficiency of the respondents whether the same is a predictor of Mathematics Achievement. Extending the list is the research of Rambely et al. (2013), which investigated the relationship of math achievement and English proficiency among 118 students from the Faculty of Science and Technology. It is fitting to note that studies found that learners and teachers encounter difficulty in using English as a medium of instruction when teaching Mathematics. Substantiating this claim is the study of Foncha et al. (2016), which focused on the impact of English as a language of learning and teaching of Mathematics. The study found that both teachers and learners alike could hardly express themselves in English. In a similar vein, Jhingran (2005), noted that when schools do not use children's first language as medium of instruction , instead use a second language which is English in most cases, students are noticed to simply do rote learning which makes students disinterested in learning and going to school.

At this juncture, it is remarked that there is preponderance of literature on the relationship of language of instruction and mathematics. Some of the most current studies include that of Perez & Alieto (2018), which, using a descriptive-quantitative-correlational design, investigated elementary students' performance in mathematics when the same is taught in a local language, the *Chavacano* language. The study concluded that a significant positive relationship exists between respondents' proficiencies in the LoI and mathematics. Another investigation with, to an extent, provided a similar claim is the work of Espada (2012), among elementary grade children. The study found that learners educated in their local languages when learning mathematics performed better as compared to those instructed in English. However, it must be noted that studies investigating MP of learners when the same is taught in the L1 of learners remain to be scarce. Thus, this study is carried out to contribute to the limited pool of knowledge on the said area, and to contribute findings.

Methodology

Research design

The study employed a descriptive-quantitative-correlational research design employing the use of a survey research tool. Descriptive studies are investigations carried out with the purpose of determining the status of a phenomenon or phenomena Singh (2006), such as in the case of this study which intended to identify the MA and MP of the respondents. Addedly, this study is noted to be descriptive as the task of describing the phenomena involved in the processes of collecting, tabulating, and analyzing data (Calderon & Gonzalez, 1993). Further, the study intended to correlate the variables MP and MA with one another; thus, the investigation is noted to be correlational (Kendra, 2020). Likewise, the use of survey questionnaires was the nominated means of data gathering which is a common practice of quantifying latent variables, such as, in the case of this study, the MA and MP of the grade three pupils. Additionally, the use of research tools was opted due to efficiency and practicability, especially that the study involved a large sample size of respondents (Dillman et al., 2014). Moreover, the study is claimed to be cross-sectional as data collection was realized in a relatively short period of time and conducted 'one-shot' only (Setia, 2016).

Respondents

The respondents are the Grade III pupils, when during the conduct of the study, were enrolled in the identified school under Isabela City North District. To qualify as a participant of the study, the following inclusion criteria were set: (1) the respondent must be a grade III pupils of the participating schools; (2) the pupil is instructed in either *Chavacano*, *Bisaya*, or *Bahasa* Sug, and (3) the respondent is not a transferee from another school or class in which the language of instruction nominated is not his/her L1. However, one is ineligible for inclusion in the study if he/she is instructed in any of the identified languages (*Chavacano*, *Bisaya*, and

Bahasa Sug) but such is not his or her L1. Table 1 provides the frequency count of the respondents across ages cross-tabulated with gender and ethnicity.

Table 1
Distribution of the respondents across demographic profiles

Variables	Categories	Age 8	9	10	11	12	Total
Gender	Males	16	16	7	1	1	41
	Female	28	34	4	1	0	67
Ethnicity	Chavacano	10	19	5	1	1	36
	Bisaya	19	14	2	1	0	36
	Bahasa Sug	15	17	4	0	0	36

N=108

In total, 108 elementary-grade pupils were enlisted to form part of this study. The above table shows that the age range of the respondents is 8 to 12 with mean age equals to 8.76 (standard deviation = 0. 783). Moreover, females constitute the majority (62%) of the respondents. Furthermore, as regards gender and age, most of the females are aged 8, while there are an equal number of males aged 8 and 9. With respect to age and ethnicity, most of the *Chavacano* respondents are aged 9, and the same holds true with the *Bahasa Sug* pupils; however, as for the *Bisaya* learners, most were aged 8.

Research instrument

The research developed MA instrument took inspiration and direction from existing questionnaires developed by previous authors (Mutodi, & Ngirande, 2014; Segumpan, & Tan, 2018). In addition, the instrument was answerable with a five-point Likert scale ranging from 1 (Never) to 5 (Usually). Furthermore, the instrument consisted of two parts. Part I is the demographic profile which solicited the following information: gender and age. Part II is the main Mathematics Anxiety Questionnaire (MAQ) composed of 12 statements and divided into three mathematical situations (during discussion, recitation, and test taking). In addition, the items in the instrument were translated into the L1 of the target respondents. Teachers who are speakers of the identified languages facilitated the translation of the instrument. The translations were checked and validated through enlistment of native speakers from each speaking group.

Validity of the developed questionnaire

Three experts were enlisted for validation. All of which are primary grade teachers of Isabela City Division whose mother tongue is either *Chavacano*, *Bisaya*, and *Bahasa Sug* with at least a master's degree in Education. Table 2 presents the weighted score of the different items as rated by the validators.

Table 2
Validation results

No	Statements	Mean	Interp.
	DISCUSSION		
1	I am afraid to ask my math teacher about a concept which I do not understand well.	1.0	Accept
2	I feel stressed in listening to the discussion of concepts during math class.	1.8	Revise
3	I feel stressed listening to another student explain a math problem.	1.4	Accept
4	I am afraid to be called to discuss math solutions before the class.	1.0	Accept
5	I am having a hard time composing questions to be asked to teachers during discussion.	1.0	Accept
6	I have a hard time in following teachers' presentation of mathematics lesson.	1.4	Accept
7	I am uneasy about going to the board in a math class for it is difficult to understand.	1.4	Accept
	RECITATION		
1	I feel confident in answering teachers' questions related to math problems.	1.2	Accept
2	I am afraid to give an incorrect answer during my mathematics class.	1.0	Accept
3	I am afraid to give an explanation to a math solution.	1.0	Accept
4	I cannot ask any question about what I did not understand in mathematics.	1.4	Accept
5	Listening to a teacher explaining the steps in solving Mathematics.	1.4	Accept
6	I am always worried about being called on in math class as I find it difficult to understand.	1.0	Accept
7	I feel stress in answering during class recitation.	1.4	Accept
	TEST		
1	I feel confident when taking a mathematics test.	2.4	Reject
2	I don't know how to study for math test for I did not understand.	1.4	Accept
3	I fear math tests more than any other kind for it is difficult to solve.	1.2	Accept
4	I am afraid to give incorrect answers.	2.6	Reject
5	I panic when I read word problems.	1.8	Revise
6	I am worried about taking math test that I may not comprehend the mathematics questions.	1.4	Accept
7	I got nervous when taking math test as I may misinterpret Mathematics problems.	1.2	Accept

Scale: 1.0 to 1.66 – Accept; 1.67 to 2.33 – Revise; and 2.34 to 3.0 – Reject

Noticeably, for the statement under discussion, only 1 item needs to be revised. However, for items under recitation, all statements were accepted. For items in the section of test taking, two statements were rejected, and 1 item needs revision. In consideration of the validation result, it was decided that only five items should be included per section of the research tool; hence, only the following statements were included for drafting of the questionnaire for reliability testing are as follows: for the discussion section, items 1, 3, 4, 6, and 7; for the recitation section, items 1,2,3,5, and 7; for items under testing (or during test) section, items 2, 3, 5, 6, and 7.

Reliability of the MAQ

The questionnaire was pilot tested to a total of 90 grade three pupils who did not form part of the sampling frame. Equal distribution across ethnic grouping was ascertained. Table 3 shows the distribution of the respondents, enlisted in the pilot testing of the instrument, cross tabulated across demographics.

Table 3
Distribution across demographics

Variables	Categories	Ages						Total
		8	9	10	11	12	13	
Gender	Male	11	22	2	2	1	1	39
	Female	24	21	4	2	0	0	51
Ethnicity	*Chavacano*	14	15	1	0	0	0	30
	Bisaya	11	10	4	4	1	0	30
	Bahasa Sug	10	18	1	0	0	1	30

From the data presented in table 3, it could be noticed that the age range of the respondents enlisted for the pilot testing is 8 to 13 with mean age equals to 8.84 with standard deviation of 0.95. Moreover, the most numbered males are aged 8, and the same holds true with respect to females. With respect to ethnicity, most of the *Chavacano* are aged 15 which also is the case for those who reported to their ethnic grouping as *Bahasa Sug*. On another hand, the most number of *Bisaya* are aged 8. The data collected from this administration of the exam was analyzed using Cronbach's Alpha test. From the 15 items, three were removed bringing the final total number of items of the questionnaire to only 12 to increase the reliability to 0.698 which suggested that the research tool is of '*acceptable*' internal consistency (George & Maller, 2016). For the section discussion, four statements were retained (items number 1, 2, 3 and 4). For the section recitation, three items were kept (items 2, 3, and 5). For the section during test, all of the five items were saved for the final drafting of the questionnaire.

Ethical considerations

Parents were communicated with respect to the intention of having their respective son/daughter enlisted in the study. Parents who have decided to have their respective son/daughter participate were asked to sign an informed consent form. Concerned parents were informed about the nature of the investigation. It was also discussed among them that participation is voluntary, and that replies gathered from the students would be lumped together along with other responses and in no way would any child' s answer be identified. Moreover, parents were informed that they could have their son/daughter withdraw from participating in the study at any given time without providing any reason, and that should they decide to not allow their child to continue answering the survey form there would be no consequences for such action. Finally, students were also asked whether they wanted to participate or not; therefore, there were cases when the parents approved that their son/daughter participates, but said the children were not enlisted as they did prefer not to participate.

Data gathering procedure

Before data gathering, the proposal was first submitted to the Ethics Committee of the University for Clearance. Upon approval and release of ethics clearance, the researcher requested permission through a formal letter addressed to the schools Division Superintendent's Office. Upon approval of the request, a transmittal letter was attached to letters sent to the parents of respective students and principals of the participating public elementary school. Learners, allowed to participate in the study, were first oriented that participation in the investigation is purely voluntary in nature and that they may withdraw at any time without giving any reason. Moreover, the researcher explained to the learners that no additional points would be given to those who participated in the study, and no deduction would be provided to those who wished to not to take part. The distribution of the research instrument was done personally by the researcher with the assistance of the Grade III teachers to guarantee strict compliance on the directions provided in the tool, ensuring accurate collection of data as well as an assurance of immediate and early retrieval of the questionnaire.

Data analysis procedure

To enable computation and analysis of the data gathered through the questionnaire, the following procedures were observed: For the determination of the MA of the respondents, the responses in each item were coded (1 for Never, 2 for Seldom, 3 for Sometimes, 4 for Often, and 5 for usually). Afterwards, responses across respondents in each item were computed for average. The weighted scores in each section of the questionnaire (discussion, recitation and during test) were determined. Subsequently, the scores for each section were calculated to determine the mean score. Additionally, to give interpretation to the computed mean, the following scale range developed through employment of equal interval was employed: 1.0 to 1.79 – Negligible Level of Anxiety, 1.8 to 2.59 – Low Level of Anxiety, 2.60 to 3.39 – Average Level of Anxiety, 3.40 to 4.19 – High Level of Anxiety, and 4.20 to 5.0 Very High Level of Anxiety. To determine the MP of the respondents, the mathematics grades for two rating periods were computed for average. The scores are given interpretation through the use of the scale adopted from Ronda (2012), viz: Below 75% (Beginning[B]), 75% to 79% (Developing [D]), 80% to 84% (Approaching Proficiency [AP]), 85% to 89% (Proficient [P]), and 90% and above (Advanced [A]). For the demographic information disclosed by the respondents, the following coding schemes were used : for gender, 1 for male and 2 for female; for Ethnicity, 1 for *Chavacano*, 2 for *Bisaya*, and 3 for *Bahasa Sug*.

Results and Discussion

Mathematics anxiety of the respondents

To determine the MA of the respondents, the responses on the research tool were first coded in a spreadsheet. Afterwards, the raw data were analyzed using descriptive statistics (mean [M] and standard deviation [SD]). Table 4 presents the analysis.

Table 4
Respondents' mathematics anxiety

	M	SD	Interpretation
During Test	3.16	0.54	Average Level of Anxiety
During Recitation	3.10	0.58	Average Level of Anxiety
During Discussion	2.85	0.70	Average Level of Anxiety
Overall Anxiety	3.05	0.43	Average Level of Anxiety

Scale: 1.0 to 1.79 – Negligible Level of Anxiety, 1.8 to 2.59 – Low Level of Anxiety, 2.60 to 3.39 – Average Level of Anxiety, 3.40 to 4.19 – High Level of Anxiety, and 4.20 to 5.0 Very High Level of Anxiety.

The table shows the MA of the respondents. The analysis of the data provides that the respondents, on the average, experience an average level of anxiety (M-3.05, SD-0.43). This means that even in the early stages of education, specifically in grades 1, 2, and 3, learners are already experiencing mathematics anxiety; further, the anxiousness the young learners experience, although not at an alarming level, is at a level that educators should be cognizant about. This result reflects the claim of Wilkinson (2018) that mathematics learning goes beyond being simple.

Furthermore, among the three educational activities, the pupils are most anxious when taking mathematics exams (M-3.16, SD-0.54) while they experience the least anxiety when listening to teachers' discussion (M-2.85, SD-0.70). This suggests that mathematics tests not only conjure anxiety, but is also perceived to be a dreaded thing among learners, both young and old. Further analysis of the data disclosed that none of the learners were noted to have negligible levels of anxiety nor were those who reported to have very high levels of anxiety. Moreover, 14% were found to have a low level of anxiety, 66% were noted to have an average level of anxiety, and 20.4% were identified to have high levels of anxiety. From the data, it is supposed that math anxiety is experienced even among young learners. To detail the extent of anxiety learners' experience, descriptive analysis was conducted across the items of the research questionnaire. Table 5 shows the analysis.

Table 5
Analysis of responses across items in the questionnaire

No.	Statements	M	SD	Interp.
	DISCUSSION			
1	I am afraid to ask my math teacher about a concept which I do not understand well.	2.62	0.90	Average Level of Anxiety
2	I feel stressed in listening to the discussion of concepts during math class.	2.70	1.06	Average Level of Anxiety
3	I feel stressed listening to another student explain a math problem.	3.03	1.07	Average Level of Anxiety
4	I am afraid to be called to discuss math solutions before the class.	3.04	0.94	Average Level of Anxiety
	RECITATION			
1	I am afraid to give an explanation to a math solution.	2.88	1.02	Average Level of Anxiety
2	I am afraid to give an explanation to a math solution	3.50	1.05	High Level of Anxiety
3	I am afraid to give an incorrect answer during my mathematics class.	2.93	1.07	Average Level of Anxiety
	TEST			
1	I don't know how to study for math test for I did not understand.	2.66	0.90	Average Level of Anxiety
2	I fear math tests more than any other kind for it is difficult to solve.	3.00	0.89	Average Level of Anxiety
3	I panic when I read word problems	3.13	0.91	Average Level of Anxiety
4	I am worried about taking math test that I may not comprehend the mathematics questions.	3.50	0.84	High Level of Anxiety
5	I got nervous when taking math test as I may misinterpret Mathematics problems.	3.53	0.90	High Level of Anxiety

Scale: 1.0 to 1.79 – Negligible Level of Anxiety, 1.8 to 2.59 – Low Level of Anxiety, 2.60 to 3.39 – Average Level of Anxiety, 3.40 to 4.19 – High Level of Anxiety, and 4.20 to 5.0 Very High Level of Anxiety.

From the table above, it could be noticed that, out of the twelve mathematical situations, the respondents reported to have experienced, on the average, high level of anxiety in three math circumstances – During Recitation [item number 2 '*I am afraid to give an explanation to a math solution* (M-3.50, SD-1.05)] and during test [items number 4 '*I am worried about taking math test that I may not comprehend the mathematics questions*' (M-3.50, SD-0.84) and 5 '*I got nervous when taking math test as I may misinterpret Mathematics problems*' (M-3.53, SD-0.90)]. It could be inferred that two of the items relate to understanding or comprehending math questions, while the other one about having to explain a solution or answer. On another hand, the least anxiety-provoking situations for the respondents are during discussion item number 1 '*I am afraid to ask my math teacher about a concept which I do not understand well*' (M-2.62, SD-0.90), during test item number 1 '*I don't know how to study for math test for I did not* *understand'* (M-2.66, SD-0.90), and during discussion item number 2 '*I feel stressed in listening to the discussion of concepts during math class*' (M-2.70, SD-1.06). It should be noted that two of the least rated items are mathematics situations during discussion, and the other one comes from math situations during test taking.

Mathematic proficiency of the respondents

For the determination of the MA of the pupils in this study, their scores in two periodic examinations were gathered and computed for the weighted mean. Table 6 gives the analysis

Table 6
Respondents' mathematics proficiency

	M	SD	Interp.
1st Grading	65.0	17.16	Beginning
2nd Grading	66.64	16.79	Beginning
Overall Math Proficiency	65.82	15.12	Beginning

Scale: Below 75% (Beginning[B]), 75% to 79% (Developing [D]), 80% to 84% (Approaching Proficiency [AP]), 85% to 89% (Proficient [P]), and 90% and above (Advanced [A])

Table 6 shows the MP proficiency of the respondents. From the table, it could be gleaned that, in general for both rating periods, the respondents' MP is described as '*Beginning*' as provided by the result of the descriptive analysis. Moreover, the overall MP of the respondents is characterized to be at the lowest level (M-65.82, SD-15.12). This implies that the respondents are poorly performing in mathematics. Detailed analysis of the data provides that the lowest MP is 33.5% while the highest is 95%. This means that the scores of the respondents are polarized. Simply put, the score range is wide which is supported by the high SD score of 15.12. In addition, it is disclosed that the majority of the respondents (71.6%) obtained a MP below the accepted standard, 5.6% are of '*Developing*' MP (75% to 79%), 10.1% are of MP described as '*Approaching Proficiency*' (80% to 84%), 4.7% are noted to be '*Proficient*' (85% to 89%), and 8.3% are determined to be '*Advanced*' (90% and above). It could be inferred that a large fraction of the respondents are lagging behind in terms of the development of their MP. Addedly, it could be said that although there are students who are able to attain satisfactory levels of MP, these students are a small margin of the sampled population. The result is alarming because, to an extent, mathematics proficiency is a predictor of success in life. Hence, by implication, the learners lagging behind are faced with great challenges and missing opportunities. Additionally, this finding does not only give a clear picture of the students' level of MP, but also raises a red flag about a concern that needs to be attended to.

Mathematics anxiety across gender and languages of instruction

To determine whether a significant difference on the MA of the respondents exist across gender and languages of instruction (LOIs), the responses on the MA questionnaire were coded, and the mean scores in each item were computed.

Afterwards, the mean scores in each item of the instrument were calculated for the overall mean. In addition, the variables gender and LOIs were coded, and appropriate statistical tools were employed to analyze the data. Table 7 presents the analysis. Included in the table is the mean score (M), standard deviation (SD), description (Desc.), significant value (Sig.), and interpretation (Interp.)

Table 7
Math anxiety between male and female respondents and across LOIs

Variables Dependent	Independent	Categories	M	SD	Desc.	Sig.	Interp.
Math Anxiety	Gender	Male	3.04	0.38	Average Level of Anxiety	0.882	Not Significant
		Female	3.03	0.50			
	Languages of Instruction	*Chavacano*	3.04	0.51		0.014*	Significant
		Tausug	2.95	0.30			
		Bahasa Sug	2.95	0.30			

Scale: 1.0 to 1.79 – Negligible Level of Anxiety (NLA), 1.8 to 2.59 – Low Level of Anxiety (LLA), 2.60 to 3.39 – Average Level of Anxiety (ALA), 3.40 to 4.19 – High Level of Anxiety (HLA), and 4.20 to 5.0 Very High Level of Anxiety (VHLA). *Significant at alpha = 0.05

The t-test analysis for the determination of the significant difference on the MA of the respondents across gender provides that the females (M-3.03, SD-0.50) experience, on the average, lesser MA as compared to their male counterparts (M-3.04, SD-0.38) in the study. This specific result contradicts with the claims of early research that females were generally of lesser MA as compared to males Olmez & Ozel (2012); Sokolowski et al. (2019), however it must be emphasized that the difference noted is not statistically significant which corroborates with the findings of prior studies Abbasi et al. (2013); Hamza & Helal (2013); Keshavarzi & Ahmadi (2013); Kundu & Kar (2018), which avowed that gender has a neutral effect on MA or is not an influencing factor resulting on the difference on MP between males and females. Hence, the null hypothesis that there is no significant differences on the MA of the respondents across gender categories could not be rejected. Hence, it is supposed that the absence of significant difference is due to the fact that both male and female respondents were subjected to similar mathematics experiences. Interestingly, with respect to the LOIs, the one-way ANOVA analysis shows that the respondents taught in *Chavacano* experienced the highest MA (M-3.04, SD-0.51), while those instructed in *Bisaya* and *Bahasa Sug* exhibited a similar extent of anxiety (M-2.95, SD-0.30) identified to be lesser compared to the former.

In addition, the difference is noted to be significant (p-value = 0.014 < α = 0.05). This means that there is a significant difference on the MA across languages of instruction. The data was subjected for further analysis. To determine which group of respondents significantly differed with which group, Tukey test was employed. Table 8 shows the analysis.

Table 8
Tukey analysis on respondents' MA across LOIs

Between Groups		Mean Difference (I-J)	Sig.	Interpretation
I	J			
Chavacano	*Bisaya*	0.253	0.03*	Significant
	Bahasa Sug	0.254	0.29*	Significant
Bisaya	*Bahasa Sug*	0.001	0.98	Not Significant

*Significant at α = 0.05

The table presents the Tukey analysis of the data which discloses that there is a significant difference on the MA of the respondents instructed in *Chavacano* with those instructed in *Bisaya* (p-value = 0.03 < α = 0.05) and those taught in *Bahasa Sug* (p-value = 0.29 < α = 0.05) with learners having Chavacano as LOI in learning mathematics experienced higher MA as supported by the mean score difference [*Chavacano* and *Bisaya* (0.253), *Chavacano* and *Bahasa Sug* (0.254)]. This means that although the three groups were instructed in their respective mother tongues, those educated in *Chavacano* appeared to experience ,significantly, higher MA. Along this line, it must be discussed that the teachers of the learners instructing in *Chavacano* are not native speakers of the language.

This is perceived to be the reason for the result. It is noted that this case in which a teacher instructs in a local language as medium of instruction, and that the said language is not his/her L1 nor does he/she have high proficiency with is common (Alieto, 2018). This highlights one essential concern that students must not only be considered in the teaching of L1 and in the use of the same as LoI, instead teachers should be considered as well. Addedly, the result reflects the concern that if the teacher handling mathematics class does not speak the language used as a medium students tend to exhibit more anxiety when compared to those educated by teachers who speak the language of instruction. It is supposed that the struggles faced by the educator in delivering the lesson in a language yet to be mastered and these struggles evoke not only troubles for the teachers, but also anxiety for the learners.

Mathematics proficiency across gender and LoIs

To determine whether a significant difference on the MP of the respondents exists across gender and languages of instruction (LoIs), the respondents weighted scores in the two periodic exams in math were computed and given an equivalent percentage. In addition, the variables gender and LOIs were coded, and appropriate statistical tools were employed to analyze the data. Table 9 presents the analysis. Included in the table is the mean score (M), standard deviation (SD), description (Desc.), significant value (Sig.), and interpretation (Interp.)

Table 9
Math Proficiency between male and female respondents and across LoIs

Dependent	Variables Independent	Categories	M	SD	Desc.	Sig.	Interp.
Math Proficiency	Gender	Male	64.49	17.55	B	0.505	Not Significant
		Female	66.63	13.50	B		
	Languages of Instruction	*Chavacano*	65.82	15.12	B	0.750	Not Significant
		Tausug	64.40	14.77	B		
		Bahasa Sug	67.13	8.51	B		

Scale: Below 75% (Beginning[B]), 75% to 79% (Developing [D]), 80% to 84% (Approaching Proficiency [AP]), 85% to 89% (Proficient [P]), and 90% and above (Advanced [A])

The above table presents the MP of the respondents across the dichotomous variable gender and the polychotomous LoIs. The t-test for independent sample analysis discloses that there is no significant difference in the MP between the male and female respondents (p-value = 0.505 > α = 0.05). Although the females (M-66.63, SD-13.5) were found, on the average, to have higher MP than the male (M-64.49, SD-17.55) counterparts in the study, the difference is not statistically significant. This implies that gender is not a factor influencing significant differences in MP. This particular finding counters the earlier claim of Robinson-Cimpian et al. (2014), that there is gender gap in MP, and that the same emerges in early years of education. However, the conclusion of Hyde, et al. conflicts with that of Robinson-Cimpian and supports the result of this study that gender difference in MP is non-existent.

With respect to MP across LOIs, the statistical tool one-way ANOVA was used. From the analysis, it could be noted that learners whose L1 is *Bahasa Sug* and are taught in the same language when learning math are the ones with highest MP (M-67.13, SD-8.51) score, following next are the learners having *Chavacano* (M-65,82, SD-15.12) as their L1 and coming last are the learners with Tausug (M-64.40, SD-14.77) as L1; however, the difference is identified as not statistically significant (p-value = 0.750 > α = 0.05). This means that the MPs of the respondents do not significantly differ across languages of instruction. Additionally, as inferred from the data, the respondents despite instructed in their first languages remain to poorly perform in mathematics. The result, to an extent, does not reflect the finding of Perez & Alieto (2018), when they found that students taught in a local language, the children's mother tongue, performed satisfactorily in mathematics. This is not taken to mean however that L1 instruction is not a viable means of improving students performance mathematics; instead, this should be taken to mean that there are things to consider in the successful implementation of the mother tongue use in teaching mathematics such as the development of much needed instructional material supporting instruction, teacher training in the use of mother tongue as LoI among others (Burton, 2013).

Correlation: respondents' mathematics proficiency and anxiety

To determine whether a significant relationship exists between the respondents Mathematics Anxiety and Proficiency, the data (MA and MP) were analyzed with the of the parametric statistical tool known as Pearson Product Moment Coefficient, also known as Pearson r. Table 10 displays the analysis. Presented in the table are the variables, p-value [also known as significant value (sig.)], and interpretation (interp.).

Table 10
Correlation: respondents' math proficiency and anxiety

Variables		*p*-value	*r*-value	Interp.
Mathematics Anxiety	Mathematics Proficiency	0.030*	-0.21	Significant

*Significant at alpha = 0.05

Table 10 shows the relationship between the mathematics anxiety and mathematics proficiency of the respondents. The analysis provides that there is a significant correlation between the variables as provided by the p-value = 0.030 which is less than α = 0.05. Moreover, the relationship is identified as inverse as provided by the negative r-value. This means that the respondents with high MA are the ones with low MP. Conversely, the respondents with low MA are the ones with High MP. Addedly, the relationship between the variables is characterized as 'low correlation' (r-value = -0.21). The finding is in consonance with theclaim of Ashcraft (2002), that MA , an affective construct, negatively affects mathematics performance which is very much similar to the contention of Kundu and Kar that MA negatively impacts learning of initial math concepts and skills. Moreover, the result confirms what Zhang et al. (2019), claimed that there exists a negative link between MP and MA. In addition, this finding among elemnetary grade students is reflective of the research work of Ho et al. (2000), in which elementary students in countries like China, Taiwan and the United States experience MA which is associated with the poor mathematics performance of young learners. Essentially, this result of the study provides an understanding that students, even in the early years, experience anxiety in dealing with numbers and operations, and that this anxiety should not be neglected by parents and educators as this negatively impacts learners' performance in mathematics. Thus, it is further inferred that students' low MP could be a result of an emotional response which is not considered not given due regard inside the classroom.

Conclusion

With respect to the findings of the study, it could be claimed that the respondents are performing poorly and are needing remediation in mathematics. The respondents were taught mathematics in their L1; however, the MP of the respondents is not reflective of the claim that mother education facilitates learning of concepts and skills. It must be noted along this line that this finding should not be used to mean that mother tongue education is inappropriate, considering that it is believed to be promising reform in the Philippine Educational System. Additionally, the existence of MA even among young learners is confirmed. Anxiety towards numbers and mathematical operations are evoked specially true during test taking of learners. Furthermore, gender was determined to have a neutral effect on both MA and MP. Addedly, the LoIs impact MA, but the researcher conjects that this is not due to the language per se, but due to the fact that the teachers teaching the math subject in Chavacano are non-native speakers of the language or are yet to master the LoI. Finally, this study has confirmed the negative relationship between the respondents' MP and MA.

Recommendation

The following recommendations are made:

- First, teachers must be cognizant of the construct known as MA as such is a 'hidden' affective factor influencing student's participation, involvement and eventual performance in mathematics. Teachers must endeavour on finding means to realize mathematics activities in a manner that does not evoke high anxiety among learners.
- Second, teachers teaching subjects in the mother tongue should be, as much as possible, speakers of the medium of instruction. Most of the investigations highlight the importance of having students taught in their language; however, this study focused on shifting the spotlight – towards the teachers. This study inferred that teachers who are not proficient in the LoI are confronted with challenges, and these difficulties in instruction means teachers are having hard time instructing with the purpose of lessening, if not removing anxiety, especially that mathematics is perceived as a difficult subject.
- Next is that teachers should be supported with training on how to present lessons in mathematics using local languages. This is essential as most of the educators in the fields have not had training on the teaching of mathematics in the mother tongue. The absence of the sets of training is believed to have caused teachers to struggle, and when teachers struggle in presenting lessons, students too struggle in learning these lessons.
- Finally, logistic support in forms of books, worksheets among others written in the local languages would facilitate the learning of concepts. The use of local languages (which are the L1) of the learners should be in the full package of the educational process. Meaning, the L1 should not be used as the language of instruction only, limited in the sense that the teacher when discussing uses the L1 of the learners; instead, the resource materials should also be in the L1 of the learners.

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