ACTRC

INVESTIGATING BEST PRACTICE IN MTB-MLE IN THE PHILIPPINES

PHASE 4 PROGRESS REPORT:

SCHOOL-RELATED FACTORS AND LEARNING OUTCOMES

Australian Aid

BEST Basic Education Sector Transformation

This is the final report on the ACTRC MTB-MLE research funded by the Department of Foreign Affairs and Trade, Government of Australia.

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Suggested citation for the report:

Pradilla, L. A., Metila, R., & Williams, A. (2017). *Investigating best practice in Mother Tongue-Based Multilingual Education (MTB-MLE) in the Philippines, Phase 4 progress report: School-related factors and learning outcomes.* Report prepared for Australian Department of Foreign Affairs and Trade and Philippine Department of Education. Melbourne and Manila: Assessment, Curriculum and Technology Research Centre (ACTRC).

ACTRC is a partnership between the University of Melbourne and the University of the Philippines, supported by the Australian Government

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ACKNOWLEDGEMENT

The MTB-MLE research team extends their gratitude to the Department of Education (DepEd) Central Office and its bureaus, DepEd National Capital Region Office, DepEd Region X Office, school administrators, teachers, and students who participated in the fourth phase of the study.

EXECUTIVE SUMMARY

The Philippines commenced its implementation of the mother tongue-based multilingual education (MTB-MLE) program as part of its comprehensive K to 12 education reform in 2012. Since program implementation, the Department of Education (DepEd) has supported research to determine how program implementation is taking place, to identify the good practices of schools for successful implementation, and to assess the effectiveness of the program through measuring student learning outcomes, among others. The previous phases (Phases 1 to 3) of the ACTRC MTB-MLE study looked at how schools and teachers implement MTB-MLE, and identified the best practices of teachers and schools in mother tongue (MT) teaching. Phase 4 of the study (as will be discussed in this report) focused on identifying factors that are associated with learning outcomes in literacy and mathematics. Data from earlier phases of the study helped establish the factors for consideration in this study.

This report discusses the school-related factors found to be associated with student learning outcomes in literacy and mathematics among 1,276 Grade 3 students in the National Capital Region and Lanao del Norte. Literacy and mathematics assessments in Meranao, Sinugbuanong Binisaya, and Tagalog were given to students towards the end of the school year in 2016. This cohort of Grade 3 students is the first to have undergone the complete K-3 in MTB-MLE national roll out.

The study is designed to answer the following questions:

1. What school-related factors are associated with a range of student learning outcomes in MTB-MLE across a sample of schools across the country?
2. Which factors have the greatest impact on learning outcomes?
3. Are there combinations of factors that have significant impact on student learning outcomes?

The factors explored in this study are as follows:

1. *Language used as medium of instruction* (MOI) refers to the language of instruction in the classroom. In this study, three languages used as MOI were chosen and reflected in the literacy and mathematics tests used: Meranao, Sinugbuanong Binisaya, and Tagalog.
2. *Match or mismatch between student MT and MOI* refers to the sameness of the MT of the student and the MOI used in the classroom. A match occurs when the MT of the student is also the language used as MOI in the classroom, while a mismatch occurs when MOI in the classroom is not the MT of the student.
3. *Training of teachers and school administrators* refers to DepEd-provided MTB-MLE professional development and school-based Learning Action Cell (LAC) sessions attended by MT teachers and school administrators in the past five years.
4. *Pupil-book ratio* refers to the number of Learner's Materials (LMs) in the MOI to which each student in a class has access.
5. *Gender* refers to information on whether a student is a girl or a boy, as provided by the classroom teachers in the Student Background Questionnaire.

A mixed methods procedure was employed to gather quantitative data on learning outcomes and qualitative data on the school-related factors. Schools were chosen based on the language mapping data from DepEd. Classes given the assessments were selected based on varying degrees of heterogeneity in student MT. ACTRC standardized assessment tests for Grade 3 were used in this study. They were developed based on the Grade 3 curriculum, translated and culturally harmonized by academics who are native speakers of the languages of the tests to suit the contexts where the tests were administered. A Student Background Questionnaire was designed to gather student

demographic data. A Questionnaire for School Administrator was developed to collect information on some school-related factors associated with MTB-MLE learning outcomes.

Phase 4 analysis of variance (ANOVA) results reveal that students whose MTs are regional lingua francas (LFs), such as Tagalog and Sinugbuanong Binisaya, performed better in literacy than those whose MT is a small local language such as Meranao. In the mathematics test, the difference was not sufficient to infer that students who took the test in one language did better than counterparts in another language. Overall, a match or mismatch between student MT and MOI does not significantly affect performance either in literacy and mathematics. However, when results were analysed by language, students in matched conditions assessed in Meranao and Tagalog performed better in literacy than their mismatched counterparts. For Sinugbuanong Binisaya, students in both conditions performed at the same level in both literacy and mathematics. An opposite result occurs among mismatched students in Meranao who performed better in mathematics than the matched students. As for gender, girls achieved relatively better literacy scores than boys but no statistical difference was found in mathematics learning outcomes.

As to school-related factors, training contributed to teachers' MT teaching skills and to school administrators' understanding of the MTB-MLE rationale to make the program more relevant to students. Different combinations of factors were found to explain variability in literacy and mathematics scores in the different languages.

Recommendations in this report are made in relation to policy development, planning and research in MTB-MLE.

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INTRODUCTION

The Philippines established the policy on Mother Tongue-Based Multilingual Education (MTB-MLE) in 2009, with implementation commencing in School Year (SY) 2012-2013 after a year of piloting. In 2013, the K to12 Program, which includes MTB-MLE was approved as Republic Act 10533, which provided legal status to MTB-MLE in the country.

As the program was implemented, the Department of Education (DepEd) has supported the conduct of studies designed to determine the general effectiveness of MTB-MLE. One such research is the Early Grades Reading Assessment (EGRA) Study which was conducted in 2014 and 2015 in selected regions in the country. The results of the 2015 Language Assessment for the Primary Grades (LAPG) also provided DepEd with data on the status of students' language skills across 19 mother tongues (MTs), Filipino, and English. While these studies used students' assessment data, other studies looked at what schools or teachers do to implement MTB-MLE. This was the focus of Phases 1 to 3 of the Assessment, Curriculum and Technology Research Centre (ACTRC) study on best practices in Philippine MTB-MLE.

In SY 2016-2017, it was five years since the program has been implemented, and the first cohort of students who received complete MTB-MLE Kindergarten to Grade 3 (K-3) education was at Grade 4. This was the most suitable time to conduct an assessment-based study on MTB-MLE for two reasons: the availability of a unique cohort – the first batch of students educated through complete K-3 MTB-MLE, and the timing – a period when the group has just completed MTB-MLE. Both cohort and timing give the study opportunities to provide feedback for the first years of nationwide MTB-MLE implementation in the Philippines, particularly by looking at patterns of learning outcomes for literacy and mathematics and determining any possible factors that may be associated with such variation.

In this phase of the study (Phase 4), the focus of investigation shifted to identifying factors that may be associated with different levels of student learning outcomes in literacy and mathematics. A sample of Grade 3 students whose entire schooling to the point of data collection was delivered through MTB-MLE was tested in selected medium of instruction (MOI) for literacy and mathematics skills using the ACTRC Grade 3 Literacy and Mathematics Tests. Data from earlier phases of the study were drawn upon to frame the factors for consideration in this analysis.

The study was undertaken to assist DepEd to understand how factors such as language used as MOI, matched and mismatched student MT and school MOI, teacher and school administrator training, pupil-book ratio, and gender might impact on the outcomes of MTB-MLE in the past five years of program implementation.

REVIEW OF LITERATURE

Literature in this area presents several factors associated with variable outcomes in MTB-MLE. These have emerged from the documentation of MTB-MLE projects in Asia, Europe, and Africa, including large-scale implementation in Botswana and Kenya, and small-scale implementation of a single language in specific communities such as the Lubuagan municipality in Northern Luzon, Philippines. Factors reported as influencing outcomes in MTB-MLE are described along with the nature of the evidence associated with them. Factors that are relevant to the Philippine context are identified, empirical data for these are presented, and factors emerging from other studies of assessment of MTB-MLE outcomes in the Philippines are reported.

FACTORS THAT INFLUENCE LEARNING OUTCOMES IN MTB-MLE

Discussion on the variability of MTB-MLE outcomes is usually presented in reports or articles on pilot projects and case studies published by international agencies such as UNESCO. Generally, the factors associated with variable program outcomes can be classified into the dimensions of Language, Instruction, Materials, and Program, which have been used in the first three phases of this study. Before considering these four dimensions, it is worth looking at gender and the extent to which this is related to learning outcomes in MTB-MLE.

Gender. This factor refers to how female or male students perform relative to each other. Of interest is whether MTB-MLE has been beneficial to both genders. Girls have been of interest because according to Benson (2005), they have experienced the greatest effect of inappropriate use of MOI compared to other disadvantaged groups. However, the literature does not consistently show that boys perform better than girls. In an evaluation of a bilingual program in Guinea Bissau and Niger (Hovens, 2002), student performance showed that girls benefit more than boys when the instruction uses a language they understand. It was also found that girls perform better than boys even in the monolingual setting when the language they were familiar with was used for assessment. A longitudinal study of MT and non-MTB-MLE programs in Cambodia showed girls perform significantly better than boys on reading assessments (Benson & Wong, 2015). In the Philippines, girls also performed better than boys across all assessment languages in LAPG and EGRA. The above studies identified the use of a familiar MOI as the reason for girls' better learning outcomes relative to boys. These anomalous results clearly indicate the need to focus on both boys' and girls' learning in MTB-MLE contexts.

Language. Factors about Language refer to the MOI and the language subject in the MTB-MLE program. There can be several variations of an MTB-MLE program depending on the number of implemented MOI, whether one only or several (see Metila, Pradilla, & Williams, 2016). Local studies that made use of assessments such as the EGRA studies that reviewed MTB-MLE evaluation (Pouezevara, DeStefano, Cummiskey, & Pressley, 2014, 2015), the national EGRA baseline study (National Institute for Science and Mathematics Education Development (NISMED), 2016), and the results of the 2015 LAPG (SEAMEO Regional Center for Educational Innovation and Technology (SEAMEO INNOTECH), 2015), revealed that student learning outcomes often vary across different languages used in the same program. Other Language factors that create variable learning outcomes include but are not limited to: the status of the MOI as a local language (LL), LF, regional or national language, and the level of standardization of the MOI.

Differential outcomes for different MOI. Local MTB-MLE assessment studies in the past five years have shown varied results for different MTs. The MTB-MLE Evaluation study that used EGRA in 2014 and 2015 investigated Maguindanaon, Iloko, Hiligaynon, and Sinugbuanong Binisaya. Results for the 2014 study demonstrated different performances of students for each MT. Speakers of Sinugbuanong Binisaya achieved the highest scores generally, while Hiligaynon speakers had highest comprehension scores for Grade 1. Iloko speakers showed largest variance in terms of score distribution and displayed the biggest disparity in terms of the performance of boys and girls, with girls greatly outperforming the boys. Speakers of Maguindanaon performed equally well in listening comprehension as speakers of the other languages, but performance in other sub-tests yielded several zero scores and lowest scores among the four languages. For some of these languages, reading performance was said to have been possibly influenced by the nature of the MT. For Iloko, for instance, oral reading fluency decreased when students read stories. The agglutinative nature of

Iloko was explained as a possible factor behind this result.[1] Maguindanaon had the highest correlation among sub-tests and this was believed to be due to the characteristics of the language, among other possible factors.

For the 2015 EGRA Follow-On study, results also showed differential outcomes for the four MTs. Maguindanaon speakers showed the lowest performance among the MTs. A comparison with 2014 EGRA results showed that all the MTs had an increase in the proportion of students who met regional benchmarks except for Hiligaynon where decreases for both Grades 1 and 2 were demonstrated.

LAPG 2015 results also manifested variable outcomes among the 19 MTs and Filipino and English. The data mining conducted for LAPG 2015 looked into the configurations that can be observed in the language performance of learners with the same first language but located in different regions. In short, this looked into any variable student performance that can be traced to the status of the MT, whether it is an LL or LF. Generally, it was found that students performed better if their MT was a major language or an LF compared to students whose MTs were local (or minority) languages. The pattern was clear for Hiligaynon, Ilokano, Maguindanaon, Meranao, Surigaonon, and Waray but not for Chavacano, Sinugbuanong Bisaya, Tagalog, and Tausug. Factors other than the LF could have led to this performance as it was shown that there were also several other groups of students who performed well even if their MT was an LL in their regions.

Use of MT MOI as assessment language. Research shows that using the MOI as a language of assessment affects student learning outcomes. A meta-analysis of literacy studies in developing countries reveals that MOI choice influenced student learning outcomes (Kim, Boyle, Zuilkowski, & Nakamura, 2016), while results of local studies on bilingual students' mathematics skills (Bernardo & Calleja, 2005) found that use of the students' MT as language of assessment led to students' good performance. In Phase 2 of this study, the use of a language that was not the students' MT for assessments and academic contests was reported by schools as a challenge (Metila et al., 2016). These data suggest that an investigation of MTB-MLE outcomes in the Philippines may find some different patterns of outcomes for different MOIs used.

Status of the MOI. Research also shows that the status of the MOI, whether it is an LL or LF, appears to influence students' learning outcomes. In the literature, the MT which is assumed to be the LL in most cases, is believed to be the 'ideal' MOI choice because it is assumed to be the child's strongest language (Ball, 2011). For instance, an evaluation of a bilingual program in Africa reveals that the MT, when an LL rather than an LF, fosters faster cognitive development (Hovens, 2002). However, current research reveals that successful outcomes can be achieved not only for an LL MOI, but also for an LF MOI. This is demonstrated by a study in India that found that an LF can also yield satisfactory learning outcomes as long as it is familiar to children (Pflepsen, Benson, Chabbott, & van Ginkel, 2015; Nakamura, 2014). In the Philippines, LAPG 2015 data show a trend that students whose MTs were LFs performed better than those whose MTs were LLs (SEAMEO INNOTECH, 2015). This pattern deviates from the conventional MOI choice presented in MTB-MLE literature which overwhelmingly prefers MT or LL use (Ball, 2011; Malone, 2010). Currently, there are eight LFs and eleven LLs in the repertoire of official MTs for MTB-MLE. DepEd has also encouraged the use of LLs in areas where an LF co-exists with LLs (DepEd, 2013). Given the potential effect of MOI

[1] "This may be explained by the agglutinative nature of the language, which causes words to become much longer in context because of markers that signal tense, possession, or other context cues." (p. 55)

status in producing different patterns of outcomes in MTB-MLE, it is worthwhile to investigate how MOI choices made by schools can affect the delivery of MTB-MLE.

Instruction. Studies on MTB-MLE have investigated learning outcomes in relation to pedagogic and content competence (Trudell, 2016), and teacher language proficiency (Pflepsen et al., 2015). For this study, the Instruction dimension involves the teacher's capacity to use the MOI, including his/her proficiency in the MOI and the target language. Recently, MTB-MLE researchers have emphasized the value of training on language proficiency for the MOI, arguing that instruction and explanation will not be deep and rich if teachers are restricted by their poor skills in the MOI (Kim et al., 2016). The teachers' language proficiency in the MOI and its possible influence on student learning outcomes has not been fully explored yet in Philippine MTB-MLE; there have been a few studies that looked at teacher confidence in their MT proficiency and teaching in the MT (Pouezevara et al., 2014, 2015; Metila et al., 2016). The second phase of this study (Metila et al., 2016) showed that teachers in linguistically diverse contexts (LDC) gave themselves a relatively high rating with regard to their proficiency in the MT MOI (.82), but still gave themselves a much lower evaluation (.62) for confidence in teaching in the MT. Since data were gathered in the initial years of program implementation, it was possible that the teachers' relatively low evaluation of their confidence was due to their perceived lack of experience in implementing the program. This contrasts with the findings for Index 1 for EGRA 2014 and EGRA Follow-On study (2015). The different results may be explained by the different samples and languages involved in the study, which indicate that program outcomes can vary depending on context and language.

For this phase, the focus is on student learning outcomes and not on investigating instruction (see reports on Phases 1-3). Due to the nature of this study, instructional factors are only indirectly discussed in relation to results about training and materials, which are two of the investigated factors in this study.

Materials. For MTB-MLE, the Materials dimension refers to the availability and reproduction of teaching and learning materials and the ways they are intended to be used. Specifically, factors about Materials refer to their availability or adequacy, quality, timely delivery and teacher training related to their use (Pflepsen et al., 2015; Kim et al., 2016). Among the factors mentioned, materials quality, timely delivery, and training are some of the factors that research has identified as influencing student learning outcomes.

Availability and awareness of materials. In the regression analysis for LAPG 2015 in the Philippines, the availability of MT textbooks was one of the strongest predictors for students' English overall performance, and "particular reading materials" like English textbooks and storybooks were a strong predictor of students' Filipino performance (SEAMEO INNOTECH, 2015). Findings for Index 2 of EGRA Evaluation of MTB-MLE (2014) which states that there was a wider distribution of materials in sampled schools appear consistent with the availability of materials found in the LAPG 2015 results. Such availability of materials seems to impact student performance in EGRA as well. A correlation of students' oral reading fluency and home- and school-related factors showed that students who had low assessment averages were those who did not have MT reading materials at home and did not read their MT books for math and/or reading. Conversely, students who had MT materials at home and who used their MT schoolbooks more often were more likely to belong in the top 25% of students in oral reading fluency (Pouezevara et al., 2014). The Follow-On study in 2015 which demonstrated general increase in the percent of students meeting benchmarks also showed an increase in the number of provided program materials.

Delivery of materials. Timely delivery of materials is also key as research shows that students in schools receiving books on time had higher student achievement (Kim et al., 2016). In the Philippines, this was an issue in early roll-out with incomplete and late materials deliveries reported in all the studied language contexts during Phase 1 of this study (Williams, Metila, Pradilla, & Digo, 2014).

Training for materials use. Research evidence also shows that better student outcomes are produced when materials supply is complemented by training on how they should be distributed and used (Kim et al., 2016).

Four years into the program, with initial materials delivery issues resolved, and major initiatives conducted for materials development in the national and local levels, and from DepEd and other non-government organizations (NGOs), it is worth seeing whether the range of available materials, specifically their availability, have an impact on student learning outcomes. EGRA and LAPG findings demonstrated that materials availability strongly predicted student performance in Filipino and English. Whether availability of MTB-MLE materials similarly predicts outcomes remains a question.

Program. Factors under this dimension relate to activities beyond classroom instruction, those concerned in the operational, organizational, and administrative processes for program implementation. Key program-related factors that have been identified in the literature include teacher recruitment, remuneration, and capacity development (Trudell, 2016; Pflepsen et al., 2015; Kim et al., 2016), curriculum-related factors such as choice of MOI, number of subjects, and time duration for each subject (Trudell, 2016; Pflepsen et al., 2015), leadership factors, stakeholder support, and others like infrastructure, costs, financing, scaling up, and sustainability (Trudell, 2016; Kim et al., 2016). These factors have been identified by experts as significant in MTB-MLE programs, but there is a dearth of empirical studies that demonstrate if these factors produce differential learning outcomes. Among the factors mentioned, researchers have investigated MOI choice (Nakamura, 2014), and teacher training as some of the factors that can produce variable student learning outcomes (Pflepsen et al., 2015).

Language of instruction. Program design involves the choice of language of instruction that can yield a match or mismatch between the student MT and the MOI in school. A match exists when the students' MT is the same as the MOI used in school, whereas a mismatch occurs when the two are different. Studies show that this match or mismatch is crucial since it can influence the effectiveness of an MTB-MLE program and consequently, student learning outcomes. The literature shows that a match is ideal since the language that should be used in teaching literacy and numeracy (UNESCO, 2016) should be the language that children know and comprehend (Hovens, 2002). In a review linking language policy to student learning outcomes of 21 African countries, it was found that using a language that is better known to learners results in enhanced learning compared to a language that is not well known to learners (Trudell, 2016). Data from the Southern and Eastern Africa Consortium for Monitoring and Educational Quality (SACMEQ) showed that a mismatch between student MT and school MOI can result in students being "negatively affected" when the MOI is unfamiliar to them (Kim et al., 2016) and such negative effect of mismatch is demonstrated by a decrease in test scores (UNESCO, 2016). In Iran, only 80% of Grade 4 students who took a test in the Farsi MOI but spoke a different MT reached basic reading comprehension level compared to 95% of Farsi speakers. In Honduras, 62% of Grade 6 students whose home language differed from the language of assessment learned reading basics, compared to 94% whose home language was also the language of the test (UNESCO, 2016). Given a mismatch, the similarity or differences of the MOI

and a child's MT could be small or great. Research shows that learning can still occur, but this is more likely when languages involved are similar or closely related (Kim et al., 2016).

In the Philippines, some schools have been documented to manifest mismatched student MT and MOI during the initial phases of this study. This conflict between MOI and language of assessment was also reported in the EGRA 2014 study where "Hiligaynon speakers" were ranked as the lowest performers but were later discovered to be non-MT speakers of the language for assessment which was Hiligaynon. In the same study, only 85% of sampled children for Iloko reported using the Iloko MT at home, and there was a report of one school where all sampled children were Kankanaey speakers but the school used Iloko MT and materials. In Phase 1, this particular challenge was observed in the small language context and LDC (Williams et al., 2014). Other related challenges are the accommodation of non-MT MOI speaking migrant students in the Tagalog context, and the mismatch between the students' MT and the language used in pedagogic materials. In Phase 2 of this study, 25% of schools in LDC used an LF, while 31% used at least one LL and one LF (Metila et al., 2016). The use of LF in the LDC implies a mismatch between the school's MOI and some students' MT that does not happen to be the LF MOI. The language diversity in the country makes it highly likely to have instances of mismatches where the MOI chosen is an LF. The literature has shown that an LF MOI can be an acceptable and effective option for students as long as it is a language that is familiar to them (Nakamura, 2014). This being the case, the effect that a mismatch has on student learning outcomes is worth exploring in order to inform decision-making regarding MOI choice and program design. Data from such investigation can enlighten school administrators and teachers on the effects that a chosen MT can have on students.

Teacher and school administrator training. This factor refers to other training-related aspects, such as content, quality, language used, materials and design, which the literature identifies to be potentially influencing student learning outcomes. MTB-MLE literature usually discusses training with reference to teachers as participants. Any training offered especially for school administrators is rare, if mentioned at all. One of the recent developments in local DepEd-organized MTB-MLE training is the attendance and involvement of school administrators.

Training is credited to have improved literacy instructional practices of primary grade teachers in the Philippines (Clark-Chiarelli & Louge, 2016) and Yemen (Kim et al., 2016). In Malawi and Kenya, training teachers in the use of scripted lessons designed to help teachers in executing reading lessons were deemed helpful as well (Kim et al., 2016). Discussions in the literature point out that MTB-MLE training content should not only develop pedagogical competence but also teachers' proficiency in the MOI in order to help them provide instruction in the MOI. In terms of training content, the literature proposes the inclusion of teaching in multiple languages (UNESCO, 2016), children's linguistic and cultural background, language development, and the use of pedagogical strategies and diagnostic assessment tools (UNESCO, 2016).

In the early stages of Philippine MTB-MLE implementation, some reported training challenges were the limited number of training participants in the Small language and Tagalog contexts, and the inadequate support for MT teaching that training provided in the Tagalog context (Williams et al., 2014). In Phase 3 of this study (Metila, Pradilla, & Williams, 2017), it was found that school administrators who underwent training contribute to the success of the program and they are able to plan and support MTB-MLE activities.

Since the program started, various professional development initiatives of DepEd and NGOs have taken place. Currently, MTB-MLE is supported by various training initiatives such as the Early Language, Literacy, and Numeracy (ELLN) training that uses pre-recorded videos of lectures that

teachers can view and study with the aid of prepared modules, and the Basa Pilipinas (Read Philippines) project of DepEd and USAID which aims to teach one million Filipino children how to read through an intervention providing teacher training and materials. The ELLN training also involves the participation of school administrators to improve their mentoring skills and knowledge on early literacy and numeracy (DepEd, 2015). With these major developments, it is timely to investigate possible association of MTB-MLE training with student learning outcomes.

To summarize, in terms of Program dimensions, results show that Language-related factors such as the language of assessment and instruction, and language status, as shown by the strong pattern between LFs and better performance in LAPG, can be related to student learning outcomes. In terms of program design, it has been observed among students who performed poorly in EGRA that there is a mismatch between their MT and the MOI in school (Pouezevara et al., 2014). Finally, findings in terms of student gender show that girls performed better relative to boys in literacy results, but there is no significant difference in their mathematics performance (NISMED, 2016).

The literature has presented various MTB-MLE factors that produce variable student learning outcomes. The complexity of the factors, and the varying and differential outcomes, make it difficult to identify the robust associations of these factors with learning outcomes. For this study, the factors for study are: the choice of MOI, assessment language, the possible difference between an LL and LF, the presence or availability of resources, teacher training, program design, specifically the match or mismatch between the student MT and the MOI in school, and student gender. The next part of this review presents how these factors figure in some national assessment results of learning outcomes in MTB-MLE.

LOCAL ASSESSMENT AND RESEARCH DATA ON MTB-MLE OUTCOMES

Some major assessments in the Philippines have produced data on MTB-MLE outcomes. In this section, we report the results of these assessments: EGRA, EGMA, and LAPG and identify the links between their results and some of the factors we have identified in the preceding discussion as relevant in the local context.

Early Grades Reading Assessment. This is an international literacy test that evaluates several reading domains: book and print knowledge, letter name knowledge, letter sound knowledge, initial sound discrimination, familiar word reading, non-word reading, oral reading fluency, oral reading comprehension, listening comprehension, and dictation. It has become the standard tool for baseline reading assessments, with over 100 countries using it for baseline collection, instructional target, system-wide diagnostic of reading difficulties, or evaluation of reading program (Gove & Wetterberg, 2011). EGRA generally uses the MOI (Trudell, 2016) and is orally administered by trained staff. EGRA has been administered to Grades 1 and 2 students in the Philippines to evaluate MTB-MLE effectiveness in 2014 and 2015 in four MTs: Hiligaynon, Iloko, Maguindanaon, and Sinugbuanong Binisaya (Pouezevara et al., 2014, 2015). In 2014, EGRA administration was funded by USAID and implemented by RTI International and EdData II. In 2015, Basa Pilipinas' Education Development Center (EDC) and DepEd joined in the implementation.

EGRA was also used for gathering national baseline data from Grade 1 pupils in SY 2015-2016. For the national baseline data, EGRA was adapted and contextualized using five languages: Bikol, Chavacano, Iloko, Sinugbuanong Binisaya, and Waray. Assessment was funded by USAID and implemented by EDC. Generally, national baseline EGRA results showed that there was much room for improving Grade 1 students' reading performance, considering the proposed EGRA benchmarks

set by some regions[2] and the goals of the K to 12 curriculum that every student should be a reader and writer at the end of Grade 1.

Early Grades Math Assessment (EGMA). This assessment is an adapted international test designed to measure students' primary numeracy and mathematics skills, particularly oral and rational counting, number identification and discrimination, missing number, addition level 1 and 2, subtraction level 1 and 2, word problems, and geometric pattern completion and geometric visualization. EGMA is an individually administered oral test. International standards and guidelines were followed in adapting the EGMA test administered to Grade 1 students in the Cordillera Autonomous Region, CARAGA, Regions V, VI, VIII, IX, and Autonomous Region in Muslim Mindanao at the beginning of SY 2015-2016. EGMA administration in the Philippines in SY 2015-2016 was funded by USAID and implemented by RTI International to measure the numeracy competencies of Grades 1 to 3 students in selected MTs over time. Results were intended to help in monitoring MTB-MLE implementation and numeracy programs in the early years.

Language Assessment in the Primary Grades (LAPG). This test is mainly a language assessment tool designed by DepEd National Educational Testing and Research Center to test domains such as: listening comprehension, vocabulary, reading comprehension, book and print knowledge, spelling, and grammar. LAPG was used to measure student language skills after a complete K-3 in MTB-MLE and was also the first system assessment that used English, Filipino, and the 19 official MTs, two of which are also used for this current study, Meranao and Sinugbuanong Binisaya. In 2015, LAPG was administered by public school teachers to 2,340,691 Grade 3 students all over the country to establish baseline data for Filipino and English and for correlating data with other system assessments such as EGRA and EGMA (DepEd, 2014).

Results. Overall, EGRA, EGMA, and LAPG results showed that considering the goals of MTB-MLE in particular and the K to 12 in general, student performance is not satisfactory in terms of literacy and mathematics skills. Data on the MTs that are involved in this study are presented when they are available.

Literacy assessment results. EGRA and LAPG assessment results are presented in this section. Note that the EGRA sample for investigating MTB-MLE evaluation was composed of Grades 1 and 2 students, while the national EGRA baseline study was composed of Grade 1 students. In contrast, LAPG is administered to Grade 3 students.

The two-year EGRA results for MTB-MLE evaluation (2014 and 2015) showed a big percentage of reported mismatches between the MOI and students' actual MTs, which reached 85% for Iloko. For the Follow-On study (2015), Hiligaynon speakers turned out to be the lowest performers in oral fluency (57%) but were discovered not to speak Hiligaynon, thus revealing problems of clearly identifying whether students' MTs are actually matched or mismatched to the MOI of the classroom. Sex-aggregated scores for these domains showed that girls always performed better than boys, with seven of the nine domains registering statistically significant differences.

For the national baseline assessment, EGRA scores for Sinugbuanong Binisaya, showed that speakers achieved 1.62 for book and print knowledge (out of a maximum score of 5), 16.90 for letter name knowledge (for a maximum of 100 correct letters per minute), 13.33 for letter sound knowledge

[2] These benchmarks are results of the benchmarking workshop organized by USAID's EdData II Project and Basa Pilipinas project on August 27, 2014.

(for a maximum of 100 correct sounds per minute), 5.70 for initial sound discrimination (out of maximum score of 10), 8.07 for familiar word reading (out of a maximum score of 20), 5.05 for non-word reading (out of a maximum score of 20), 7.98 for oral reading fluency (compared to a regional benchmark of 45), 30.21% for oral reading comprehension (compared to a regional benchmark of 80%), and 2.62 for listening comprehension[3]. The most striking results in terms of literacy are in oral reading fluency and oral reading comprehension skills. Oral reading fluency measured through correct words per minute was 7.90 (compared to the proposed regional benchmark of 45). Oral reading comprehension was 30.21% (compared to a proposed regional benchmark of 80%). That is, more than half of the students could not even read a single word and answer a single question.

In comparison with other assessed MTs, EGRA results for Sinugbuanong Binisaya are second to the lowest for both reading comprehension and fluency where Bikol ranked as highest among all five tested MTs. Sinugbuanong Binisaya demonstrated the highest performance for dictation (4.38), while its rank for the other domains is variable.

LAPG results for the languages used in this study reveal the following Overall Test Mean Percentage Score (MPS): 68.19 for Sinugbuanong Binisaya, 70.19 for Filipino, and 71.9 for Meranao[4]. For the reading comprehension domain, Sinugbuanong Binisaya got 56.66, Meranao 64.88, and Filipino 67.79. In terms of gender, females outperformed males for all languages. LAPG results also showed performance trends in terms of whether the students' MT is an LL or LF, showing favorable results for MTs which are LFs such as Hiligaynon, Iloko, Maguindanao, Meranao, Surigaonon, and Waray (SEAMEO INNOTECH, 2015). Results also demonstrated that materials like English textbooks and storybooks were strong predictors for student performance in English (SEAMEO INNOTECH, 2015).

Mathematics skills assessment. Sinugbuanong Binisaya is also one of the EGMA languages. Results show that a significant number of Sinugbuanong Binisaya speaking-students used English in counting in the different mathematics subtasks except in geometric pattern completion and geometric visualization. This language preference is an interesting point of inquiry as it may be indicative of the degree of standardization of Sinugbuanong Binisaya. This language got the highest percentage of zero scores in oral counting (0.31%), rational counting (0.31%), number discrimination (21.41%), and missing number (25.68%) subtasks. Sex-aggregated data show that there was no gender difference in the performance of girls and boys in all subtasks.

In all the assessments mentioned above, results of learning outcomes demonstrated differences from language to language, with some weak and strong patterns traced to the status of the MOI as an LF or LL (SEAMEO INNOTECH, 2015). These results suggest that languages function as sub-programs of a national program like MTB-MLE. This is one aspect of the program that is explored in our discussion of results.

In light of the presented findings, it is worth investigating different mother tongues to see the extent to which the same or different factors emerge as being related to differences in learning outcomes,

[3] There was no mention of the number of questions asked for this sub-test, but a sample test in the National Baseline Report prepared by NISMED (2016) featured three questions.

[4] The language is spelled variably in the literature. It is also spelled as Maranao and Maranaw. For this study, the spelling Merenao is used.

and to compare the strength of associations. The next section presents how these factors were captured in the design and literacy and mathematics assessments for this study.

METHOD

In this phase of the study, mixed methods were employed to identify the school-related factors associated with different learning outcomes. A quantitative method was employed in collecting assessment data from a sample of Grade 3 students. Literacy and mathematics assessment tools in the MT were given to Grade 3 students to measure their learning. An analysis of variance was conducted to determine significant differences between language conditions. The qualitative method included obtaining information on school-related factors that could be associated with learning outcomes. Questionnaires were filled out by students, teachers and school administrators to provide demographic and school data. The assessment scores and school data were analysed using regression techniques to identify the school-related factors that were associated with different learning outcomes.

This phase of the study aimed to answer the following questions:

1. What school-related factors are associated with a range of student learning outcomes in MTB-MLE across a large sample of schools across the country?
2. Which factors have the greatest impact on learning outcomes?
3. Are there combinations of factors that have significant impact on student learning outcomes?

FACTORS OF THE STUDY

Language used as MOI. Three languages used as MOI were chosen as languages of the literacy and mathematics tests used in the study: Meranao, Sinugbuanong Binisaya, and Tagalog. Meranao is a small language (local minority language) in Region X that is spoken by 776,000 people in the Philippines (Lewis, Simons, & Fennig, 2016). Sinugbuanong Binisaya, a large language (a local major language in Cebu province and an LF in some provinces in Visayas and Mindanao), has 15.8 million speakers in the Philippines (Lewis et al., 2016). Tagalog, the linguistic base of Filipino, is spoken by 21.5 million speakers in the Philippines (Lewis et al., 2016) with different varieties spoken in the National Capital Region (NCR), Region IV (CALABARZON) and Central Luzon. These three languages are used as MT MOIs in linguistically diverse schools and communities – Tagalog in NCR, and Meranao and Sinugbuanong Binisaya in Lanao del Norte.

Match or mismatch between student MT and MOI. The language used as MOI in class was the language of the assessments taken by the students for this study. A match between student MT and MOI occurs when the MT of the student is also the language used as MOI in the classroom and the language used in the assessments, while a mismatch occurs when MOI in the classroom is not the same as student MT.

Table 1 presents the target number of students for each condition, taking into account the MOI and match or mismatch in student MT and MOI.

Table 1 Distribution of the target number of students for each condition

Match or mismatch between student MT and MOI	Language used as MOI		
	Meranao	Sinugbuanong Binisaya	Tagalog
Match between student MT and MOI	200	200	200
Mismatch between student MT and MOI	200	200	200
Total	400	400	400

Training. In this study, training refers to MTB-MLE DepEd-provided professional development and school-based Learning Action Cell (LAC) sessions attended by MT teachers and school administrators. The number of training sessions attended by teachers and school administrators in the past five years was obtained for each school.

Pupil-book ratio. This refers to the number of Learner's Materials (LMs) in the MOI that each student in class has. This includes LMs in the following subjects: MTB-MLE, Araling Panlipunan, MAPEH, Edukasyon sa Pagpapakatao, Math and Science. A 1:1 pupil-book ratio indicates that each student in class has one LM written in the MOI for all subject areas mentioned thus, six LMs for each student.

Gender. This refers to information on whether a student is a girl or a boy. The classroom teachers provided this information in the Student Background Questionnaire.

SCHOOL SELECTION

DepEd regions with sufficient number of schools using the three MTs as MOI in Grade 3 were identified. To ensure that different types of schools were included in the sample, school size and location were also considered. Tagalog MOI was used in all schools in the National Capital Region (NCR) while Sinugbuanong Binisaya and Meranao were used as MOI in Lanao del Norte schools. Using the language mapping data from DepEd Learner's Information System (LIS), schools with a good number of students whose MT match or do not match the MOI were shortlisted. Copies of School Form 1 of the Learner's Profile were then requested from the schools to verify the information in the LIS and to gather data specifically on students whose MT do not match the MOI. Classes were selected based on varying degrees of heterogeneity in match between student MT and MOI. Reasons for disqualification were: mismatch in the reported MOI as recorded in the LIS and actual MOI used in the classroom based on interview with teachers, and anomalies in the number of students speaking a particular MT as a result of interview with school administrators and teachers. Contingent classes were also identified to replace the originally chosen class if it was disqualified for assessment. Once schools were verified to meet the necessary requirements for testing, assessment teams went to each school to conduct testing of the selected Grade 3 classes in SY 2015-2016. In cases where there were absences, no replacement students were added to complete the target numbers.

INSTRUMENTS

To measure student learning in literacy and mathematics against the national curriculum at the Grade 3 level, standardized assessment tests in the MT MOI were used. Grade 3 paper and pencil

tests aligned with the K to 12 curriculum were developed by ACTRC for the MTs covered in this study.

Since 2013, ACTRC has developed a range of Kindergarten to Grade 2 literacy and mathematics assessment tools in Meranao, Maguindanaon, Sinugbuanong Binisaya, and Tagalog through its research project, Longitudinal Study of Learning Achievement of Students in the Autonomous Region of Muslim Mindanao. The tests were developed to assess student learning based on the grade level standards in literacy and mathematics as indicated in the national curriculum. The tests were translated and culturally harmonised in the different MTs to ensure that the items are understood by and relevant to the students. The Grade 3 tests used for this study underwent the same process.

Appendix A presents a comparison of the ACTRC, EGRA, EGMA, and LAPG assessment tools.

ACTRC Grade 3 tests. The Grade 3 tests are multiple choice paper and pencil tests administered to the whole class. Each test is composed of 54 items and students were given 40 minutes to answer each test. The literacy test has the following domains: vocabulary, grammar, reading comprehension of narrative and expository texts, and study skills. The domains covered by the mathematics test are: number and number sense, geometry, patterns and algebra, measurement, and statistics and probability.

The core versions of the tests were in English. These were then translated into three languages: Meranao, Sinugbuanong Binisaya, and Tagalog by academics who are native speakers of the languages. The translated versions were then harmonized by Grade 3 MT teachers to suit the contexts where the tests will be administered.

Student Background Questionnaire. This questionnaire was designed to gather student demographic data particularly on the factors namely gender and student MT. This also contained information on the name, grade and section, and date of birth of the student. The students provided the first two information and then the classroom teacher completed the rest of the form. The questionnaire was in English.

Questionnaire for School Administrator. This questionnaire was developed to collect information on some school-related factors associated with MTB-MLE learning outcomes. It elicited the following: school profile, roles of languages used in the community, availability of MT materials, and training attended by school administrators and K-3 teachers. These school-related factors were found to be significant in MTB-MLE implementation in the previous phases of the study. The questionnaire was in English and accomplished by the school administrator.

DATA COLLECTION

To ensure standardized test administration in the different assessment sites, guidelines were observed for the selection of test administrators, test monitors and test venue for the pilot and research phases.

Test administrators and test monitors. Test administrators were native speakers of the test language that they administered. They were also educators with experience in testing and in dealing with students. There was one assigned test administrator for each class assessed. Test monitors were ACTRC staff members or representatives. They served as the contact persons for test administration concerns, fieldwork logistics, and arrangements with DepEd. There was one test monitor assigned for each school.

The test administrators and test monitors underwent a one-day training in test administration and monitoring which included an overview of the tests, tasks and responsibilities, and child protection policy.

Test venue. The school administrators and teachers were informed of the classes to be assessed and of the preferred testing set-up. The test administrator and classroom teacher ensured that only students whose names were in the class roster took the tests. While test administration was ongoing, the classroom teacher completed the Student Background Questionnaires outside the classroom.

Piloting. The assessment tools and questionnaires were piloted prior to use in the research phase. The piloting took place in the same areas where the research was conducted to check for inconsistencies in the language used in the tests, to check if the test administration protocol works, and to explore testing arrangements that will work best in different contexts. The piloting was also conducted to obtain psychometric characteristics of the tests for the review and modification of items, where necessary.

Research phase test administration process. An ACTRC test administrator distributed the student test booklets and read aloud the instructions before the start of each test. The literacy test was administered first, followed by the mathematics test. A five- to ten-minute break was observed in between the two tests. Test administration manuals for both tests containing a standard script that presents specific instructions on how to conduct testing were provided, and test administrators were instructed to follow it step by step. The students were made familiar with the format and symbols found in the test booklets and answer sheets before assessment started. Students were then instructed to read the questions and answer them silently and independently. The assessments for the three languages took a total of 16 fieldwork days to finish. For each class assessed, three hours was allotted for the preparations, assessments, and post-test administration tasks.

DATA ANALYSIS

The data collected in this phase of the study included assessment scores, demographic information and school data. Information from the questionnaires that were related to the factors of the study were converted into categorical data in preparation for data analysis using SPSS 24.

A factorial between groups analysis of variance (ANOVA) was used to investigate the effects of language used as MOI and match or mismatch between student MT and MOI on literacy and mathematics learning outcomes. After checking if assumptions were met, separate ANOVA analyses were conducted for literacy and mathematics data.

To determine the school-related factors associated with different learning outcomes, separate hierarchical multiple regression analyses (MRA) were employed for the literacy and mathematics data. Before interpreting the results of the MRA, several assumptions were tested and violations were checked. The assumptions for MRA were all met.

On step 1 of the hierarchical MRA, language used as MOI was the first factor entered in the regression equation. On step 2, the variable match or mismatch between student MT and MOI was added to the regression model. This was followed by training in step 3, which included the number of MTB-MLE training sessions provided by DepEd and school LAC sessions facilitated and attended by school administrators and teachers. In step 4, pupil-book ratio, which refers to the ratio of pupils to available LMs in the MT, was added. This was followed by gender as the last variable entered in the model. Below is a summary of the regression model in analysing the overall scores for each test:

Step 1: Language used as MOI
Step 2: Match or mismatch between student MT and MOI
Step 3: Training (Teacher training, Teacher LAC sessions, School administrator training, School administrator LAC sessions)
Step 4: Pupil-book ratio
Step 5: Gender

In analysing the literacy and mathematics scores for each language used as MOI, four predictor variables were entered in the regression model:

Step 1: Match or mismatch between student MT and MOI
Step 2: Training (Teacher training, Teacher LAC sessions, School administrator training, School administrator LAC sessions)
Step 3: Pupil-book ratio
Step 4: Gender

RESULTS

This section first presents the profile of the study participants. This is followed by data on statistical differences in literacy and mathematics scores in terms of languages used as MOI, and match or mismatch between student MT and MOI. Lastly, regression results of school-related factors associated with different learning outcomes are presented.

PROFILE OF PARTICIPANTS

The sample was systematically drawn from two different parts of the country – NCR and urban and rural communities in Lanao del Norte, Mindanao. The data were also drawn from students learning in two large languages that are also regional LFs (Tagalog and Sinugbuanong Binisaya) and one small local language (Meranao).

The participating schools using Tagalog as MOI were located in NCR while schools using Sinugbuanong Binisaya and Meranao were located in Lanao del Norte. All schools were located in linguistically diverse schools and communities where at least two MTs are widely spoken in the community. Forty-eight percent of the schools were in urban areas. Table 2 presents the actual number of schools and students assessed in each of the three languages used as MOI.

Table 2 Number of schools, classes and students assessed in each language used as MOI

Language used as MOI	Number of Schools	Number of Classes	Number of Students
Meranao	8	11	334
Sinugbuanong Binisaya	7	13	462
Tagalog	6	14	480
Total	21	38	1276

A total of 1,276 students from 38 Grade 3 classes in 21 schools in NCR and Lanao del Norte were assessed for both literacy and mathematics. Around 52% of the students assessed were female. The ages of the students ranged from 8 to 16 years; the mean age was 9.85 years. Sixty percent of those assessed spoke an MT that matched the language of the assessments that they took. Table 3 presents the number of students in matched and mismatched conditions.

Twenty-three out of 38 (61%) teachers were native speakers of the MOI.

Table 3 Number of students whose MT matched or did not match language used as MOI

Language used as MOI	Number of students whose MT matched the MOI	Number of students whose MT did not match the MOI
Meranao	246	88
Sinugbuaong Binisaya	259	203
Tagalog	266	214
Total	771	505

STATISTICAL DIFFERENCES IN LITERACY

A factorial between groups analysis of variance (ANOVA) was used to investigate the effects of language used as MOI and match or mismatch between student MT and MOI on literacy learning outcomes. Table 4 presents the ANOVA summary table for literacy learning outcomes.

Table 4 ANOVA Summary Table for Match/Mismatch and Language using Literacy Scores as Dependent Variable

Source	Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
Match/Mismatch	3212.022	1	3212.022	36.156	.000	.028
Language	12753.958	2	6376.979	71.781	.000	.102
Match/Mismatch * Language	875.057	2	437.529	4.925	.007	.008
Error	112825.604	1270	88.839			
Total	3336554.37	1276				

Note: R Squared = .124 (Adjusted R Squared = .120)

The ANOVA revealed a statistically significant main effect for language used as MOI, F (2, 1270) = 71.78, $p < .001$, $\omega^2 = .097$, f = .33[5]. Looking into the differences in literacy performance in the three test languages, students tested in Tagalog (M=53.36, SD=11.07) achieved the highest scores followed by those tested in Sinugbuanong Binisaya (M=50.12, SD=8.65), while those tested in Meranao achieved the lowest scores (M=45.54, SD=8.41).

There was also a statistically significant main effect for match or mismatch between student MT and MOI, F (1, 1270) = 36.16, $p < .001$, $\omega^2 = 0.024$, f = 0.16[5]. Grade 3 students whose MT matched the MOI (M=51.01, SD=10.51) performed better than students whose MT does not match the MOI (M=48.81, SD=9.16); however, the size of the difference is small.

Furthermore, a statistically significant interaction indicated that the effects of match or mismatch on literacy learning outcomes depend on the language used as MOI, F (2, 1270) = 4.93, $p < .05$, ω^2 = .005, f = .07[5]. Simple effects analyses were used to examine the interaction between the variables, language used as MOI and match or mismatch. These analyses (as shown in Table 5) indicated that a match or mismatch between student MT and MOI has a statistically significant effect on literacy scores in Meranao, F (1, 1270) = 17.11, $p < .017$, and in Tagalog F (1, 1270) = 25.50, $p < .017$. However, match/mismatch does not influence literacy scores in Sinugbuanong Binisaya, F (1, 1270) = 1.35, *ns.* In Meranao and Tagalog, students whose MT matched the MOI have better literacy learning

[5] Cohen (1988) conventions for ANOVA indicate that effect size of f = 0.10 is considered small, f = 0.25 is medium, and f = 0.40 is large.

outcomes than students whose MT varied from the MOI. But for those tested in Sinugbuanong Binisaya, students with matched MT and MOI did not score any differently from students in the mismatched condition.

Table 5 Simple Effects of Match/Mismatch Condition within Language in the Literacy Test

Language		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Meranao	Contrast	1520.044	1	1520.044	17.110	.000	.013
	Error	112825.604	1270	88.839			
Sinugbuanong Binisaya	Contrast	119.952	1	119.952	1.350	.245	.001
	Error	112825.604	1270	88.839			
Tagalog	Contrast	2265.785	1	2265.785	25.504	.000	.020
	Error	112825.604	1270	88.839			

Note: Dependent variable: Literacy scores

Table 6 shows that test language has a statistically significant simple effect on literacy scores for students in the matched condition, F (2, 1270) = 52.23, p < .025 and mismatched condition, F (2, 1270) = 29.17, p < .025. Under the matched condition, students' literacy learning outcomes were highest in the Tagalog test (M=55.31, SD=12.10), followed by Sinugbuanong Binisaya (M=50.57, SD=8.83), and lowest in Meranao (M=46.82, SD=8.29). The largest mean difference in literacy learning outcomes is between Tagalog and Meranao (M_{diff} = 8.487) while the smallest difference is between Sinugbuanong Binisaya and Meranao (M_{diff} = 3.746). For the mismatched condition, literacy learning outcomes were highest among students who took the test in Tagalog (M = 50.94, SD = 9.10), followed by Sinugbuanong Binisaya (M = 49.54, SD = 8.40), and lowest in Meranao (M = 41.97, SD = 7.72). The largest mean difference in literacy scores is between Tagalog and Meranao (M_{diff} = 8.958). However, there was no statistically significant difference in the scores of mismatched students who took the Tagalog and Sinugbuanong Binisaya tests.

Table 6 Simple Effects of Language within Match/Mismatch Condition in the Literacy Test

Condition		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Match	Contrast	9280.248	2	4640.124	52.231	.000	.076
	Error	112825.604	1270	88.839			
Mismatch	Contrast	5183.184	2	2591.592	29.172	.000	.044
	Error	112825.604	1270	88.839			

Note: Dependent variable: Literacy scores

In addition, there was a statistically significant difference in the literacy learning outcomes for girls and boys. Grade 3 girls performed better than boys in the literacy test t(1272.799) = 7.013, p < .000, d = 0.39[6], 95% CI of the mean difference [2.78, 4.95].

Overall, the results indicate that considering the language used as MOI, students whose MTs are regional LFs (Tagalog and Sinugbuanong Binisaya) performed better in literacy than those whose MT

[6] Cohen (1988) suggests that t-test effect sizes of d = 0.20 can be considered small, d = 0.50 is medium, and d = 0.80 is large.

is a small local language (Meranao). Similar results were drawn from the students in both matched and mismatched conditions. However, looking into the interplay between the variables language and match or mismatch, data for students in the mismatched condition showed no difference in literacy performance between the LFs. Furthermore, for Sinugbuanong Binisaya, students in both matched and mismatched conditions had generally the same literacy performance. Both Tagalog and Sinugbuanong Binisaya are LFs in the areas where the assessments were conducted, and it can be assumed that the LF proficiency of students in the mismatched conditions influenced their performance in the test, to some degree. Considering gender as a factor, girls had higher literacy scores than boys across all languages.

STATISTICAL DIFFERENCES IN MATHEMATICS

The effects of language used as MOI and match or mismatch between student MT and MOI on mathematics learning outcomes were explored using factorial between groups ANOVA. The ANOVA revealed a statistically significant main effect for test language, F (2, 1270) = 10.24, p<.001, ω^2 = .014, f = 0.12[7]. Students tested in Sinugbuanong Binisaya (M=51.93, SD=11.54) performed significantly better than those tested in Tagalog (M=49.10, SD=8.54) and Meranao (M=48.58, SD=9.49). However, the size of the difference between groups is small. Moreover, there was no statistically significant difference in the mathematics learning outcomes of students in matched and mismatched conditions, F (1, 1270) = 2.25, *ns.* Table 7 presents the ANOVA summary table for mathematics learning outcomes.

Table 7 ANOVA Summary Table for Match/Mismatch and Language using Mathematics Scores as Dependent Variable

Source	Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
Match/Mismatch	218.121	1	218.121	2.252	.134	.002
Language	1983.152	2	991.576	10.240	.000	.016
Match/Mismatch * Language	3394.732	2	1697.366	17.528	.000	.027
Error	122981.813	1270				
Total	3317893.43	1276				

Interaction effect was statistically significant indicating that the effect of a match or mismatch between student MT and MOI was dependent on the language used as MOI, F (2, 1270) = 17.53, p<.001, ω^2 = .025, f = 0.16[7]. Simple effects analyses were also used to explore the interaction between language and matched or mismatched condition for mathematics learning outcomes. These analyses (as shown in Table 8) indicate that a match or mismatch between student MT and MOI has a statistically significant effect on mathematics scores in Meranao, F (1, 1270) = 25.98, p < .017, and in Tagalog, F (1, 1270) = 7.83, p <.017. However, similar to results in literacy, a match or mismatch between student MT and MOI did not influence mathematics scores in Sinugbuanong Binisaya, F (1, 1270) = 1.25, *ns.* For students tested in Meranao, students whose MT matched the MOI have lower mathematics learning outcomes than students in mismatched conditions (M_{diff} = -6.230, p < .001). For those tested in Tagalog, students in matched conditions scored higher in the mathematics test

[7] Cohen (1988) conventions for ANOVA indicate that effect size of f = 0.10 is considered small, f = 0.25 is medium and f = 0.40 is large.

than those in mismatched conditions (M_{diff} = 2.528, p < .001). And for those tested in Sinugbuanong Binisaya, students in matched conditions performed the same as those in mismatched conditions.

Table 8 Simple Effects of Match/Mismatch Condition within Language in the Mathematics Test

Language		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Meranao	Contrast	2515.782	1	2515.782	25.980	.000	.020
	Error	122981.813	1270	96.836			
Sinugbuanong Binisaya	Contrast	121.521	1	121.521	1.255	.263	.001
	Error	122981.813	1270	96.836			
Tagalog	Contrast	758.054	1	758.054	7.828	.005	.006
	Error	122981.813	1270	96.836			

Note: Dependent variable: Mathematics scores

Furthermore, test language has a statistically significant simple effect on mathematics scores in matched, F (2, 1270) = 19.57, p < .025 and mismatched conditions F (2, 1270) = 12.28, p < .025 (as shown in Table 9). For students whose MT matched the MOI, mathematics learning outcomes was highest among those who took the Sinugbuanong Binisaya test (M=52.38, SD = 12.58), followed by those who took the Tagalog test (M=50.23, SD=8.85), and lowest among those who took the Meranao test (M=46.97, SD=8.78). Largest mean difference in mathematics learning outcomes is between Sinugbuanong Binisaya and Meranao (M_{diff} = 5.449, p < .001), while the lowest is between Sinugbuanong Binisaya and Tagalog (M_{diff} = 2.158, p < .001). For students whose MT did not match the MOI, mathematics learning outcomes is highest among those who answered the Meranao test (M=53.17, SD=9.93), followed by those who took the Sinugbuanong Binisaya test (M=51.35, SD=10.07), and lowest in Tagalog (M=47.70, SD=7.95). Mathematics scores were significantly different in Meranao and Tagalog (M_{diff} = 5.467, p=.000) and Sinugbuanong Binisaya and Tagalog (M_{diff} = 3.653, p=.000).

In addition, girls did not score significantly higher in the mathematics test than boys, t(1274)= -1.373, p = .170.

Table 9 Simple Effects of Language within Match/Mismatch Condition in the Mathematics Test

Condition		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Match	Contrast	9280.248	2	4640.124	52.231	.000	.076
	Error	112825.604	1270	88.839			
Mismatch	Contrast	5183.184	2	2591.592	29.172	.000	.044
	Error	112825.604	1270	88.839			

Note: Dependent variable: Mathematics scores

Overall, although a significant difference was found in the mathematics learning outcomes in different languages used as MOI, the difference was not sufficiently great to infer that students who took the test in one language did better than counterparts in another language. Also, when student mathematics performance in matched and mismatched conditions were analyzed, the scores between groups were found to be comparable. The same result was drawn for gender. However, there was an interaction in the effects of language used as MOI and match or mismatch between student MT and MOI. In the matched condition, students who were speakers of the LFs did better

than the LL speakers. But in the mismatched condition, those taught in the LL achieved higher mathematics scores than those taught in an LF MOI.

Summary. The statistical differences presented above indicate that language used as MOI plays a significant role in the acquisition of literacy skills. Specifically, students whose learning was assessed through an LF MOI performed better than those learning and assessed through an LL MOI. However, for mathematics learning, language does not seem to affect student performance.

Overall, a match or mismatch between student MT and MOI do not significantly affect performance both in literacy and mathematics. However, differential results were obtained when languages used as MOI were taken into account. In literacy, students in matched conditions assessed in Meranao and Tagalog performed better than their mismatched counterparts. For Sinugbuanong Binisaya, students in both conditions performed at the same level both in literacy and mathematics. An anomalous result is among mismatched students in Meranao who performed better in mathematics than the matched students and achieved the highest mathematics scores among all other mismatched students.

As for gender, girls achieved relatively better literacy scores than boys but no statistical difference was found in mathematics learning outcomes.

These three factors, together with pupil-book ratio and training, will be explored in the next section in terms of their collective and individual impact on student learning outcomes.

The following discussion presents the Phase 4 findings in relation to the two research questions:

1. What combinations of school-related factors have significant impact on students' literacy and mathematics learning outcomes in MTB-MLE in the Philippines?
2. Which specific factors have the greatest impact on learning outcomes?

Answers to the research questions will be presented separately for literacy learning outcomes and mathematics learning outcomes. This will be followed by sections for each test language and summaries of results.

SCHOOL-RELATED FACTORS ASSOCIATED WITH LITERACY LEARNING OUTCOMES

In combination, the five predictor variables - namely language used as MOI, match or mismatch between student MT and MOI, training, pupil-book ratio and gender - explained 24.6% of the variance in literacy scores, $R^2 = .246$, adjusted $R^2 = .241$, $F\ (9, 1266) = 45.88$, $p < .001$. By Cohen's conventions, a combined effect of this magnitude can be considered "large" ($f^2 = .33$). Table 1 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary.

In the final regression model, the five predictors significantly contributed to literacy outcomes with pupil-book ratio and gender uniquely accounting for 6% and 4%, respectively, of the variance in learning outcomes. When the training variable was split into its different components, only LAC sessions attended by school administrators was not a significant predictor of literacy learning outcomes. Also, it should be noted that the unique variances attributable to language used as MOI and match or mismatch between student MT and MOI diminished when the variables training and

pupil-book ratio were entered into the model. For language used as MOI, the decrease in unique variance was from around 9% in step 1 of the hierarchical MRA to less than 1% in step 5.

The results indicate that the interaction of training and availability of materials mediated the effects of the variables language used as MOI and match or mismatch between student MT and MOI on literacy outcomes. Whether students' MT was the MOI or not, the presence of well-trained teachers and school administrators and the availability of materials in the MOI made an impact on literacy learning outcomes. Moreover, a 1:1 pupil-book ratio predicted better performance in literacy and decreased the unique variance of training when it was added in the model. The availability of books written in the MOI is important for students to understand their lessons even if it is not their MT. It facilitates reading comprehension and familiarity of the MT terms used in language lessons.

Tagalog. In combination, the four predictor variables can explain 47.0% of the variance in Tagalog literacy scores, $R^2 = .47$, adjusted $R^2 = .462$, $F\ (7, 472) = 59.75$, $p < .001$. This is very large by Cohen's conventions ($f^2 = .89$). On step 2, training accounted for an additional 37.8% of the variance in literacy scores, $\Delta R^2 = .385$, $\Delta F\ (4, 474) = 79.16$, $p < .001$. Thirty-three percent in the change was accounted for by school administrator training. Also, when training was added in the equation, the match or mismatch between student MT and MOI became an insignificant predictor of literacy learning outcomes in Tagalog.

Table 2 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary for Tagalog literacy scores.

In the final regression model, pupil-book ratio and gender uniquely accounted for 3% and 2%, respectively, of the Tagalog literacy outcomes. With regard to the training variable, only school administrator and teacher training remained significant, and these uniquely accounted for 9% and 5%, respectively, of the variance in Tagalog literacy scores. However, an inverse relationship was found between teacher training and literacy scores (each unit of increase in teacher training resulted in a .58 decrease in literacy scores).

The results indicate that DepEd-provided training and availability of LMs in the MOI are strong predictors of Tagalog literacy outcomes. However, the reason for the decrease in literacy scores among students whose teachers attended more training is not apparent. On the other hand, the number of MTB-MLE training by school administrators greatly influenced literacy performance of students. The training could have enriched their understanding of the program which enabled them to plan for more effective MTB-MLE-related activities.

Sinugbuanong Binisaya. When the four predictors were combined, 16.7% of the variability in Sinugbuanong Binisaya literacy scores can be explained by the variables, $R^2 = .167$, adjusted $R^2 = .155$, $F\ (7, 454) = 13.05$, $p < .001$. In Cohen's conventions, $f^2 = .20$ indicates a small to medium effect size. In step 1, match or mismatch between student MT and MOI accounted for a .3% change in variance and is not significant. This indicates that whether student MT is the MOI or not, this does not predict literacy learning outcomes in Sinugbuanong Binisaya.

Table 3 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary for Sinugbuanong Binisaya literacy scores.

In the final regression model, training, pupil-book ratio and gender were significant; however, training and pupil-book ratio were highly correlated. Gender accounted for a 6% unique variance in Sinugbuanong Binisaya literacy scores.

Meranao. The four predictors accounted for 19.9% of the variance in Meranao literacy scores, R^2 = .199, adjusted R^2 = .182, F (7, 326) = 11.58, p < .001. In Cohen's conventions, f^2 = .25 indicates a small to medium effect size. However, the change in variance accounted for by pupil-book ratio was not significant. In short, the availability of LMs in the MT did not predict Meranao literacy scores.

Table 4 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary for Meranao literacy scores.

In the final regression model, only match or mismatch between student MT and MOI and gender remained significant, uniquely accounting for 5% and 3%, respectively, of Meranao literacy outcomes. However, training and pupil-book ratio were highly correlated and were not significant predictors of literacy scores.

Summary. Across the three test languages, different combinations of school-related factors were important predictors of variability in students' literacy learning outcomes. The presence of training as predictor was consistently found across languages. The results indicate that teacher and school administrator training influenced students' literacy learning outcomes. The training contributed to teachers' subject area knowledge and equipped them with the necessary pedagogical skills for MT teaching while it provided the school administrators the opportunity to understand the program and to devise ways to make the program more relevant to students.

Taking into account the change in variance that can be attributed to each factor in the regression model, the match or mismatch in student MT and MOI contributed the greatest change in variance in Meranao literacy scores. But for Sinugbuanong Binisaya, it was not a significant predictor of literacy outcomes, consistent with ANOVA results which revealed that Sinugbuanong Binisaya literacy scores were the same for students in both matched and mismatched conditions.

Moreover, pupil-book ratio did not contribute any change in variance in Meranao literacy learning outcomes but it is an important predictor for Tagalog literacy outcomes. The availability of and access to LMs in the MOI created opportunities for Tagalog MOI students to develop their reading and comprehension skills.

SCHOOL-RELATED FACTORS ASSOCIATED WITH MATHEMATICS LEARNING OUTCOMES

The five variables in the model accounted for 4.0% of the variance in mathematics learning outcomes, R^2 = .040, adjusted R^2 = .033, F (9, 1266) = 5.85, p < .001, with change in variance brought about by language used as MOI and training as significant but effect size is small.

Table 5 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary.

Tagalog. The four predictors accounted for 6.7% of the variability in Tagalog mathematics scores, R^2 = .067, adjusted R^2 = .053, F (7, 472) = 4.84, p < .001. This indicates a small to medium effect size based on Cohen's conventions. The change in variance brought about by gender was not significant.

Table 6 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary.

Sinugbuanong Binisaya. The combination of four factors accounted for 11.8% of the variability in SB mathematics scores, $R^2 = .118$, adjusted $R^2 = .104$, F (7, 454) = 8.65, $p < .001$, with training and pupil-book ratio contributing to a significant change in variance.

Table 7 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary.

Meranao. The combination of the four factors accounted for 12.2% of the variability in Meranao mathematics scores, $R^2 = .122$, adjusted $R^2 = .104$, F (7, 326) = 6.50, $p < .001$, with the matched or mismatched condition and training contributing to a significant change in variance. Match or mismatch in student MT and MOI was the only significant predictor in the final regression model, uniquely accounting for 7% of the variance in Meranao mathematics scores. A mismatch predicts higher Meranao mathematics scores ($\beta = .265$).

Table 8 in Appendix B presents the coefficients of determination (R^2) and change in R^2 and F values for each predictor on each step of the hierarchical MRA model summary.

Summary. Across the three test languages, training attended by teachers remained a significant predictor of mathematics learning outcomes, similar to results in literacy. Gender did not predict learning outcomes, supporting the ANOVA results for mathematics. Different combinations of factors could explain variability in mathematics scores in the different languages. For Tagalog, training and pupil-book ratio mediated the effects of the match or mismatch between student MT and MOI on learning outcomes, while for Sinugbuanong Binisaya, the two factors though significant in the regression model, were highly correlated with each other. For Meranao, the matched/mismatched condition remained to be the greatest predictor of mathematics scores with the mismatched condition predicting better performance than the matched condition.

DISCUSSION

The fourth phase of the project aimed to identify the school-related factors associated with different learning outcomes to better understand the dynamics of Philippine MTB-MLE as a nationwide education reform. The discussion that follows is structured according to the factors of the study.

LANGUAGE USED AS MOI

The literature shows that there are differential student learning outcomes for each language used as MOI (SEAMEO INNOTECH, 2015; Kim et al., 2016). Phase 4 ANOVA results of this study reveal that for literacy learning outcomes, students whose MTs are LFs, such as Tagalog and Sinugbuanong Binisaya, performed better than those whose MT is an LL. This is consistent with the Phase 1 finding that the status of the language used as MOI is a significant factor in MTB-MLE implementation, such that languages with standardized orthographies and more intellectualized academic register are more prepared for use in MTB-MLE (Williams et al., 2014). The same trend is shown in LAPG 2015 (SEAMEO INNOTECH, 2015). However, for mathematics learning outcomes, the language and its status do not seem to matter much in the learning of mathematical operations and skills.

It must be noted that the assessments in this study were conducted in linguistically diverse areas in NCR and Lanao del Norte. It was the teachers who determined the students' MT and MT proficiency of students was not assessed when the assessments were conducted. Regarding the status of the MOI in the community, it was the school administrators who determined whether the language is used only among speakers of the language (an LL) or if it is used among speakers of different MTs as a shared language (an LF). In addition to the language mapping data used as the

schools' basis in choosing the MOI, the languages were also designated by DepEd as official MOI in the areas.

The use of an LF MOI (Tagalog in NCR schools and Sinugbuanong Binisaya in some Lanao del Norte schools) was perceived by schools as a practical choice for program implementation. Tagalog and Sinugbuanong Binisaya, two of the largest languages in the Philippines in terms of the number of speakers, extend their utility even outside the community and are not limited to the use of their native speakers. Regional varieties of these languages exist, so much so that the proficiency of a non-native speaker from an area where the language is used for wider communication among diverse language groups is comparable to that of a native speaker from an area where these languages are also considered as LLs. Thus, the status of the MOI in the community has implications for the number of students who will be taught in their actual MTs, the availability of language proficient teachers who can handle the MT classes, the MT materials needed for instruction, and the quality of MTB-MLE program and activities that will be implemented in schools. Further, these have significant consequences on the learning outcomes of the students, as the study revealed.

Choosing between an LL and an LF has practical consequences and it requires an understanding of the rationale behind MTB-MLE to make informed choices (Metila et al., 2016). In this study, the choice of an LF MOI over an LL seems to have no substantial negative implications in student learning outcomes, and this can be because the chosen LF MOI is indeed a language that students are also familiar with, and it may be very similar in structure to other students' MTs. The better literacy performance of students taught in the LF compared to the LL, whether it matched their MTs or not, shows that an LF MOI offers some benefits even for those whose MTs are not LFs. Although this contradicts the principles of MTB-MLE of using the child's MT and promoting LLs, the results of the study and the literature demonstrate that the LF, as long as it is a language that children understand (Pflepsen et al., 2015; Nakamura, 2014) and is widely used in the community, seems to pose no threat in the learning achievement of pupils. In both literacy and mathematics learning outcomes, students taught and assessed in Tagalog and Sinugbuanong Binisaya, performed significantly better than those taught and assessed in Meranao. However, a contradictory result was found among mismatched students in Meranao – they performed better in mathematics compared to matched students. Similar results were found in LAPG 2015 but the reasons for this are not clear.

This finding has implications in the MOI that schools in linguistically diverse contexts will choose. The use of an LF as MOI may not only be regarded as a temporary MOI while the LLs in the community are further developed for educational use. Through time, the LF variety could be considered as a local language in the area due to its pervasive use in the community and the proficiency level acquired by speakers of the language. Also, although this finding supports the use of an LF MOI in LDCs, as recommended in DepEd's MTB-MLE guidelines (DepEd, 2012), this has negative implications for the development of the LL as a language for formal education and in the promotion of the use of the LL for cultural pride and development.

Based on the regression results in this study, regardless of the status of the language used as MOI, favorable student learning outcomes can still be expected in the MTB-MLE program, provided that teachers are trained in MTB-MLE and MT materials are available for each student to use. In cases where students cannot be taught in their MT for some reasons, the school should ensure that teachers are well trained in MTB-MLE pedagogical strategies, so that students could effectively learn in the MOI. Also, it is important for school administrators to undergo MTB-MLE training for them to be able to understand the rationale of MTB-MLE and to be better equipped in the planning of MTB-MLE-related school activities. In addition, the availability of MT reading and learning materials for the

students ensures that their exposure to the MT is maximized. As it is assumed that MTs which are LFs are more likely to have available resources for the program, there is a greater challenge for MTs which are LLs to produce instructional materials. Thus, further technical assistance in materials development in the LL can lessen the difficulty among teachers (Metila et al., 2017).

MATCH OR MISMATCH BETWEEN STUDENT MT AND MOI

The results of this study reveal that the overall learning outcomes in literacy and mathematics of students in both matched and mismatched conditions are comparable. However, in the literacy test, when outcomes were analysed by test language, students learning in an LF MOI in both conditions performed better than those taught in an LL MOI. This indicates that the use of an LF MOI seems to benefit the students even if it is not their MT. Students' comprehension of the vocabulary and reading passages in the literacy test does not seem to be influenced by the degree to which their MT matches or does not match the language of assessment, as long as it is an LF that they understand. Based on the results of the sample in this study, students' proficiency in the LF, whether it is their MT or not, seems to pose an advantage in their literacy performance when they are taught in an LF MOI. But for those taught in an LL MOI, students whose MT does match the MOI are worse off even if their MT is an LF. In such a case, the LL could be a heritage language that is spoken only by a specific group of people and is not used in the community to communicate with non-speakers of the language; thus, mismatched students do not develop expected proficiency in the LL.

In mathematics, students learning in an LF MOI in matched conditions performed better than those learning in an LL MOI. However, the opposite is true among students in mismatched conditions. Based on informal interviews among teachers in schools using Meranao as MOI, classroom instruction involved the translation of lessons in the mismatched students' MT which is Sinugbuanong Binisaya, for most of them. Perhaps this benefitted the students in understanding the mathematics concepts and word problems in Meranao.

The previous discussion shows that match or mismatch between student MT and MOI is greatly influenced by the status of the language used as MOI. However, for Sinugbuanong Binisaya MOI, students in both conditions performed the same in both literacy and mathematics tests. This is further supported by the regression results which showed that for students taught in Sinugbuanong Binisaya MOI, the matching or not of the student MT and the MOI does not predict literacy and mathematics learning outcomes. In schools where Sinugbuanong Binisaya MOI was used, even students in mismatched conditions were proficient in the MOI which is a regional LF in that area. It is possible that the LF proficiency of students in a mismatched condition could have been comparable to those in the matched.

Although the literature shows that a match between student MT and MOI is the preferred way of learning among children (UNESCO, 2016), this does not seem to be true among LF proficient students in our sample, especially in areas where the LF is widely used in the community. Perhaps students gain LF proficiency and fluency through constant communications with community members who use the LF in communicating with people who speak different MTs. Also, the negative effects of a mismatch between student MT and MOI is mediated by the availability of training and materials written in the MOI. When teachers and school administrators are trained in MTB-MLE pedagogy and LMs in the MOI are available for student use, mismatch in student MT and MOI does not seem to matter anymore.

TEACHER AND SCHOOL ADMINISTRATOR TRAINING

In Phase 2 of the study, it was reported that the influence of the training attended by teachers is evident in the pedagogical strategies that they adopt for classroom use, the type of learning and reading materials that they use for teaching, and their implementation of the program (Metila et al., 2016). The transfer of knowledge and skills that they learned from the training to classroom teaching could be an explanation on why training is a significant predictor of positive learning outcomes, except for a contradictory finding for Tagalog that student performance decreases with more teacher training.

Regression results for Meranao MOI showed that the training received by teachers and school administrators may not have been enough to impact literacy learning outcomes. Based on an informal interview with DepEd supervisors, they reported that division and district trainings specific to MTB-MLE implementation have not been well placed in the DepEd region. Also, LAC sessions on MTB-MLE were not yet conducted despite the memorandum from the Central Office. The lack of DepEd-provided training on MTB-MLE could have been one of the reasons why training was not a significant predictor of Meranao learning outcomes.

For Tagalog, training was the strongest predictor of literacy learning outcomes. However, the relationship between teacher training and literacy outcomes was negative. The training content may have created confusion among Tagalog MOI teachers. Phases 1 and 2 of the study reported that teachers in the Tagalog context had confusion on spiraling for the Mother Tongue subject and Filipino subject due to similarities in both language subjects (Williams et al., 2014; Metila et al., 2016).

It is crucial to provide adequate and appropriate training to teachers and school administrators as implementers of the program. Their knowledge and understanding of the program can be strengthened through participation in relevant training. This could increase teachers' confidence in teaching in the MT and school administrators' appreciation of the program. Their learning from the training, when translated to classroom teaching and school planning, can greatly affect the way pupils learn, and the formation of a school culture for the integration of MTB-MLE.

PUPIL-BOOK RATIO

The literature shows that timely delivery of materials in schools predicts student learning outcomes (SEAMEO INNOTECH, 2015; Kim et al., 2016). LMs written in the MT is the main resource material of students in the MTB-MLE program. These are provided by DepEd for all students based on their MT. However, the late delivery of LMs in schools has been reported by schools since Phase 1 of the study (Williams et al., 2014). In Phase 4, among the schools that did not report a 1:1 pupil-book ratio, the reason provided is the non-delivery of materials even though it was already towards the end of the school year.

The number of LMs in the MT available for distribution among students is a crucial factor in literacy learning outcomes. Phase 4 data showed that the availability of LMs written in the MOI for individual student use is an important mediating factor especially when paired with teacher and school administrator training in MTB-MLE. The LMs serve as the students' guide in learning the MOI which could be a language in which they are not proficient in. However, for Meranao, the availability of LMs did not ensure better literacy outcomes among Meranao students. The supply of LMs may not have been enough for distribution to all students or the materials were not delivered on time that the use of LMs was not maximized and adequately used for instruction. DepEd could create a mechanism in which LMs can be provided to students at the beginning of the school year.

GENDER

Results of this study were consistent with Philippine EGRA and EGMA studies and LAPG results. The better literacy outcomes of girls compared to boys were also found in LAPG results (SEAMEO INNOTECH, 2015) and the EGRA study, while the EGMA result of no gender difference in mathematics outcomes (NISMED, 2016) was similar to this study's findings. Although girls did better in literacy compared to boys, no concrete explanation can be offered at this point and it cannot be assumed that boys performed poorly in the literacy test.

Classroom instruction should ensure that girls and boys are treated fairly and appropriate pedagogical interventions should be delivered, targeting the specific developmental needs of each student regardless of gender. Also, constant monitoring of variations of results between girls and boys should be conducted to prevent significant differences from emerging.

CONCLUSIONS

MTB-MLE is described as a program in the K to 12 curriculum with factors that are common across languages used as MOI such as training provided to implementers and MT materials provided to teachers and students. However, the varying patterns of outcomes between different MOI mean that there are grounds to consider each language as a sub-component within the larger MTB-MLE program.

Phase 4 of the study gathered assessment data from 1,276 Grade 3 students in 21 schools in NCR and Lanao del Norte and the findings reveal that different combinations of school-related factors namely language used as MOI, match or mismatch between student MT and MOI, teacher and school administrator training, pupil-book ratio, and gender are associated with literacy and mathematics learning outcomes.

First, the language used as MOI and its status in the community impact literacy learning outcomes. In this study, students learning in an LF MOI performed relatively better than those learning in an LL MOI. The choice of an LF as MOI that the students speak and understand appears to have a positive effect on students' literacy learning outcomes, even for students whose MT does not match the LF MOI. The LFs chosen as MOI by the schools have attained a status of prestige among community members due to their prevalent use in the community and the perceived practicality of the use of the LF in other domains of society. Thus, it is reasonable to assume that the LFs are familiar to the students, and understood and spoken by them such that their proficiency in the LF could be similar to their MT proficiency. On the other hand, the implementation of the use of an LL MOI in formal education needs to be explored further to understand the dynamics of teaching and learning in the LL. The assessment data gathered in this study was helpful in establishing the impact of the use of an LL or LF, but how the LL is being used for classroom instruction needs to be looked into.

Second, a match or mismatch between student MT and MOI does not influence literacy and mathematics learning outcomes especially when teachers and school administrators have attended relevant MTB-MLE training and when books in the MOI are made available to students. Maximizing students' exposure to the MOI through access to learning and reading materials and using developmentally appropriate classroom instruction and activities acquired in MTB-MLE training facilitate learning in the MOI even in cases where the classroom MOI does not match the MT of some students.

RECOMMENDATIONS

The following recommendations are made based on the findings of the study. The recommendations are presented per study variable for policy development and planning and further research.

LANGUAGE USED AS MOI

For Policy and Planning

Provide support for LLs, particularly on factors that research identifies as bolstering advantages of LF use. The study has shown that an LF MOI had no substantial negative implications. Nevertheless, circumstances where the use of LLs or LFs are preferred should be identified, and guidelines for the use of an LF MOI in different circumstances should be provided.

For Practice

Provide feasible alternative programs for non-LF speaking students in schools where the LF is used as MOI. The study has found that there remain a number of students who are non-LF speakers in contexts where an LF MOI is used. Although DepEd guidelines recommend an MT immersion activity for these students, a more practical and feasible recommendation should be provided to allow such students to experience MT immersion and development.

For Research

Conduct similar investigations in other smaller languages and in other language contexts (e.g. linguistically homogenous contexts) in order to determine the extent to which patterns of outcomes are similar or contrasting for the different MOIs in MTB-MLE.

MATCH OR MISMATCH BETWEEN STUDENT MT AND MOI

For Policy and Planning

Ensure that as far as possible students are allocated to classes that use their MT as MOI. If this is not the case, teachers should be trained and equipped with appropriate pedagogical and language strategies. Also, mismatched students should be provided with LMs in the MOI and remedial lessons should be provided if necessary.

For Practice

Ensure that teachers use the declared MOI for instruction and that adequate MT immersion is used in classes where an LF MOI is used.

For Research

Explore the relationship between match or mismatch between student MT and MOI and learning outcomes in other smaller languages. Future research can investigate if the inherent benefits of a match between student MT and school declared MOI can be overpowered or mitigated by challenges, particularly those that come with the use of small languages like LL MOI. It would be interesting to know if the potential of an LL as MOI is watered down by non-language related factors such as availability of materials and teachers who can speak the LL MOI.

TRAINING

For Policy and Planning

Conduct monitoring and evaluation of training to ensure that design and materials used follow the guidelines provided. Look at strategies for maximizing professional development of teachers. Teachers should also attend training specific to MTB-MLE.

For Practice

Ensure that teacher and school administrator training on MTB-MLE are implemented.

For Research

Investigate the impact of ELLN LAC sessions on learning outcomes. Moreover, investigate whether different types of training have differential impact on learning outcomes.

PUPIL-BOOK RATIO

For Policy and Planning

Ensure that materials in the MOI should be widely available for student use. Set the target to 1:1 pupil-book ratio on DepEd-provided Learner's Materials written in the MOI.

For Practice

Ensure that students have access to as many MT materials as possible and that their use is maximized at home and in school.

GENDER

For Policy

Schools should monitor patterns of achievement of girls and boys in different areas of learning.

For Practice

Monitor end-of-year achievement results of girls and boys. Schools should monitor patterns of results for girls compared to boys to prevent imbalances in developing strategies where imbalances emerge.

For Research

Conduct further exploration of the relationship between gender and learning outcomes.

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APPENDICES

APPENDIX A: COMPARISON OF ASSESSMENT TOOLS

	ACTRC Literacy Test	ACTRC Mathematics Test	EGRA	EGMA	LAPG
Nature of test	Multiple choice paper and pencil test	Multiple choice paper and pencil test	Orally administered test	Orally administered test	Multiple choice paper and pencil test
Mode of administration	Whole class administration	Whole class administration	Individual administration	Individual administration	Whole class administration
Domains	Vocabulary Grammar Reading comprehension of narrative and expository texts Study skills	Number and number sense Geometry Patterns and algebra Measurement Statistics and probability	Listening comprehension Oral reading fluency passage Oral reading comprehension Book and print knowledge Letter name knowledge Letter sound knowledge Initial sound discrimination Familiar word reading Non-word reading Dictation	Oral counting Rational counting Number identification Number discrimination Missing number Addition level 1 Addition level 2 Subtraction level 1 Subtraction level 2 Word problems Geometric pattern completion Geometric visualization	Listening comprehension Vocabulary Reading comprehension Book and print knowledge Spelling Grammar

APPENDIX B: HIERARCHICAL MODEL SUMMARIES

Table B 1 Hierarchical MRA Model Summary for Literacy Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.093	.093	65.57**
2	.117	.024	33.91**
3	.147	.030	11.06**
4	.207	.060	96.06**
5	.246	.039	65.66**

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**$p < .001$.
Predictors: Step 1: Language used as MOI, Step 2: Match/mismatch, Step 3: Training, Step 4: Pupil-book ratio, Step 5: Gender

Table B 2 Hierarchical MRA Model Summary for Tagalog Literacy Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.039	.039	19.19**
2	.424	.385	79.16**
3	.453	.029	25.32**
4	.470	.017	15.05**

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**$p < .001$.
Predictors: Step 1: Match/mismatch, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender.

Table B 3 Hierarchical MRA Model Summary for Sinugbuanong Binisaya Literacy Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.003	.003	1.61
2	.092	.089	11.16**
3	.110	.018	9.00*
4	.167	.058	31.38**

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**$p < .001$.
* $p < .01$.
Predictors: Step 1: Match or mismatch between student MT and MOI, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender.

Table B 4 Hierarchical MRA Model Summary for Meranao Literacy Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.065	.065	22.91**
2	.169	.104	10.31**
3	.169	.000	.034
4	.199	.030	12.25*

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**$p < .001$.
* $p < .01$.
Predictors: Step 1: Match/mismatch, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender.

Table B 5 Hierarchical MRA Model Summary for Mathematics Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.022	.022	14.04**
2	.022	.000	.006
3	.038	.017	5.56**
4	.038	.000	.082
5	.040	.001	1.87

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**p < .001.
Predictors: Step 1: Test Language, Step 2: Match/mismatch, Step 3: Training, Step 4: Pupil-book ratio, Step 5: Gender.

Table B 6 Hierarchical MRA Model Summary for Tagalog Mathematics Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.022	.022	10.59*
2	.055	.034	4.22*
3	.064	.009	4.64*
4	.067	.003	1.28

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
* p < .01.
Predictors: Step 1: Match/mismatch, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender.

Table B 7 Hierarchical MRA Model Summary for Sinugbuanong Binisaya Mathematics Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.002	.002	.912
2	.083	.081	10.06**
3	.118	.035	17.94**
4	.118	.000	.013

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**p < .001.
Predictors: Step 1: Match/mismatch, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender.

Table B 8 Hierarchical MRA Model Summary for Meranao Mathematics Learning Outcomes

Model	R^2	ΔR^2	ΔF
1	.084	.084	30.41**
2	.116	.032	3.00*
3	.117	.001	.47
4	.122	.005	1.82

Note. R^2= R Square. ΔR^2 = R Square Change. ΔF = F Change.
**p < .001.
*p < .05.
Predictors: Step 1: Match/mismatch, Step 2: Training, Step 3: Pupil-book ratio, Step 4: Gender

ACTRC is a partnership between the University of Melbourne and the University of the Philippines, supported by the Australian Government