

Preparing Students for Studying in a Non-Native Language in Math and Science

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Abstract

This study aims to study how language teaching affects the development of mathematical thinking in children learning a language other than their mother tongue through a mixed methodology based on interviews with teachers of math and science in Asia and the Middle East. Our primary goal is to see if the language of instruction in second-language immersion programs impacts the development of mathematical thinking. Therefore, we determine that the language of instruction only influences the development of the first abilities in the pupils' overall performance or specific areas. When mathematical thinking is established while teaching formal concepts in a non-native language, the analysis of variance and multiple regression results indicates how explicit the language of instruction is. The second language impacts the resolution of everyday difficulties, with pupils in first grade that have a language of instruction that matches their mother tongue being competent.

Keywords: Content and Language Integrated Learning, Non-native language, Mother tongue, Science, and Math.

1. Introduction

In the United States, at least 3.5 million children are limited in English proficiency (LEP). If schools do not offer special classes for LEP students, they are placed in a mainstream classroom where teachers provide appropriate and intensive tutoring and help. Immigrant English-language learners face many problems as they begin to think in a new language, and the problems stem primarily from linguistic and possibly cultural differences. The difficulty non-native English language students face develops from using a language they have not yet mastered to read, write, communicate, or use for thinking, problem-solving, explaining, and other academic purposes.

The term English language learner (ELL) describes students that come to school with limited or no English proficiency. ELLs first learn a language other than English in their home and community and then learn English as a new language. Most ELL programs recommend daily oral use of English until students achieve at least a minimum level of proficiency. Researchers assert that if students use the English

language, their oral proficiency will increase along with English sub-skills. Students at the UAE public schools begin to learn English language basics (phonics, numbers, colors, etc.) in the first grade. These public schools offer English language education for 45 minutes a day exclusively in the English class, while the remaining subjects are taught in Arabic. Typically, children of the UAE are not exposed to the English language before beginning formal schooling.

Academic research has sufficiently explored the influence of the language of instruction on teaching certain areas of knowledge, particularly mathematics and science. For example, Poulsen (2004) developed a study on the use of English in teaching processes with Hispanic students in the United States. Through mixed research, the author found that the use of English software impacts Hispanic students when learning each of their subjects. On the same research topic, Padrón (2004) explored how instructional approaches enabled Spanish learners to use their reading strategies in a second language. Padrón maintained that the language of instruction had a considerable impact on the learning of cognitive strategies for Spanish-speaking students. Finally, for the case of Italian-speaking students, Kolic-Vehovec and Bajanski (2006) analyzed the monitoring of comprehension and reading strategies in bilingual students in Italian schools in Croatia. They directly established that students' proficiency in Italian was not determined by the language of instruction but rather by superior reading skills.

In the United Arab Emirates (UAE), the debate on language as a means of instruction and teaching in certain areas has also occurred. For example, Gallagher (2011) explored the macro-factors and contextual variables that influence the bilingual education of students in Abu Dhabi schools. This study was presented to contribute to an informed discussion for creators of public policies on the sociocultural, linguistic, and pedagogical variables that affect bilingual teaching in different areas of knowledge. In his research, Gallagher (2011) found that acquiring knowledge in a second language was difficult in the UAE due to the linguistic distance between Arabic and English. Consequently, in Abu Dhabi, an educational reform known as "The New Model School" was promoted, which sought to provide analytical and problem-solving tools to students in areas such as mathematics and science while promoting Arabic and English as a means of instruction and assessment (Abu Dhabi Education Council, 2012).

This study aims to investigate how language instruction affects the development of mathematical thinking in children learning a language other than their mother tongue. Content and Language Integrated Learning (CLIL) allows educators to teach academic content and a foreign language and is commonly employed in schools in Malaysia and the Middle East. As a result, our primary goal is to see if the language of instruction in second-language immersion programs impacts the development of mathematical thinking. We argue that it can only influence the development of the first abilities in the pupils' overall performance or specific areas. When mathematical thinking is established while teaching formal concepts in a non-native language, the analysis of variance and multiple regression results indicates how implicit the language of

instruction is. The second language impacts the resolution of everyday difficulties with pupils in first grade that have a language of instruction that matches their mother tongue being competent.

This research seeks to assess how language learning affects children's mathematical reasoning development when they learn a non-native language. CLIL is an educational approach that educators commonly use to teach academic content and a foreign language simultaneously. The primary goal of the study is to determine whether the language of instruction in second language immersion programs affects how early formal mathematical concepts emerge. More specifically, if mathematics is taught in children's mother tongues and is unaffected by the language of instruction, math learning at an early age develops similarly. Otherwise, it can only have a limited or specific impact on the student's overall performance in terms of the development of the first skills. The first part of this text will present the literature review that guided this research. Then the methodological stance, results, and discussion will be described. Finally, conclusions will be provided.

2. Literature Review

Native Language Versus English

One debate that continues in the field of English as a Second Language (ESL) concerns whether language learners should be allowed to use their native language while learning English (Hermann, 2020). According to Hermann (2020), there are two sides in this debate. On the one hand, some scholars assert that allowing students to use their native language while learning English reports benefits (Alshayban & Alghammas, 2020). However, on the other hand, scholars explain that intensive use of the English language in classrooms for non-native English speakers also has benefits (Alam, 2019). As a result, what matters the most in this discussion is to determine if some exposure to the English language impacts the learning processes of non-native students.

Concerning the first stance of the debate, research supports that students that maintain their native tongue while learning English have the advantage of becoming bilingual (Kim et al., 2015). Furthermore, it is believed that students that continue to speak their native language have tremendous success in learning English and a lower dropout rate than those that speak only one language (Rao, 2019). As in the United States, many immigrant students learn rapidly, and their native language enhances their social and academic success (Hermann, 2020).

Regarding the second trend in this debate, research reports that non-native English learners that use this language in the classroom achieve more in terms of learning (Haghighi et al., 2019). Nonetheless, this statement depends on the English language learners' proficiency and the amount of exposure and interaction in English. As a result, the argument that non-native students may have better English skills if they speak English is relative since it depends on critical factors.

Studying and Performing in a Non-Native Language: Developing Proficiency

Developing proficiency in two or more languages may result in higher levels of metalinguistic awareness (Nshiwi & Jessner, 2021). This claim supports the belief that bilingual children have a more significant advantage than monolingual children because they know two or more languages (Filipi et al., 2015). In addition, advanced bilingual children have the experience of labeling the same conceptual system and the relationship between structure and meaning (Barac & Bialystok, 2011). Therefore, bilingual children may have more stable management of two languages, enhancing regulation functions.

English language learners must use cognitive and meta-cognitive skills for reading comprehension (Rabadi et al., 2020). For instance, in addition to fluent habitual word identification, skilled reading requires meta-cognitive knowledge, which includes a person's knowledge about his or her reading about different types of reading tasks and reading strategies. According to Cumming et al. (2005), there are three dimensions of language proficiency: conversational fluency, discrete language skills, and academic language proficiency.

Conversational fluency.

Conversational fluency is the ability to carry on a conversation in a classroom setting (Cumming et al., 2005). This fluency is gradually developed at an early age when the ELLs are allowed to converse in English with the teacher and with each other. In these conversations, students should be able to use high-frequency words, adapt the grammatical aspect of the language, and denote meaning supported by non-linguistic cues, such as facial expressions and gestures.

Cumming et al. (2005) noted that ELLs generally develop conversational fluency after a year or two of exposure to language in school or out-of-school environments. With increasing English oral proficiency, English language learners use strategies to communicate more effectively with others, reflect on their language, and demonstrate a more expansive repertoire of language skills, such as higher-level question forms.

Discrete language skills.

Discrete language skills reflect the specific acquisition of the language's phonological and grammatical aspects (Cumming et al., 2005). ELLs acquire these skills through direct instruction in formal and informal settings at an early age. Cumming et al. (2005) assert that these skills can be learned concurrently with conversational fluency and vocabulary development. As students mature, they learn writing skills, such as conventional spelling, punctuation, capitalization, and grammatical rules and their exceptions.

Academic language proficiency.

Academic language proficiency is the knowledge and use of a few vocabulary words and the ability to read and write complex texts (Cumming et al., 2005). As students mature, they should be able to use professional vocabulary and abstract expressions that they rarely use in an out-of-classroom environment and put these words in

coherent, meaningful texts. In addition, students can understand and produce different texts for different purposes in various content areas.

Problems Students Encounter When Studying in a Non-Native Language

Students do not develop or acquire knowledge until they can put information into a context with a form and meaning (Ellis, 2019). Language is the means that students generally use to bring order and meaning to facts and experience, either by speaking, writing, or the inner monologue of thought (Rabiah, 2012). Therefore, teachers must consider how students learn and what they encounter when performing in a second language.

In addition, students may experience language shock and anxiety when adjusting to performing in a non-native language they do not speak or are not proficient in (Huang, 2012). This language shock may result in silence preference regardless of their desire to speak English fluently. Language is one's strength and a vital tool for communicating, telling jokes, and expressing one's ideas and feelings (Muhammad et al., 2018). Students often require several years before they understand everything said in their classrooms. When students share their ideas in a non-native language that is not yet mastered, they feel their basic language skills are in question. They believe they did not learn "correct" English, and their writing is adopted from their native colloquial language.

Moreover, when students are not confident in their language, they may experience frustration, anxiety, failure, and powerlessness (Tridinanti, 2018). Many students fear communicating unless they are confident of their statements' accuracy, fearing the instructor's negative evaluation or more competent students. Even though students may experience language anxiety and fear, some of them wish to participate and be able to read and write fluently.

Another critical challenge many ELLs face when struggling is trying to understand the curriculum and pedagogy, especially if it reflects a different writing style or heritage (Sharma & Sharma, 2022). While mature students may spend more time doing homework, completing tasks, reading, and reflecting on articles, ELL students may spend additional time translating and making sense of the textbook if they do not have the skill to read in that language (Haynes, 2020).

Teaching in a Non-Native Language

In some developing countries, such as the UAE, there is a shift toward using English in national universities. Students that graduated from public schools may not be prepared to use English for academic purposes. Therefore, instructors need to take into account the additional anxiety students may experience. Studying a non-native language requires conscious attention to the English language's grammatical, morphological, and phonological aspects (Gilakjani & Ahmadi, 2011). Exposure to a comprehensible academic language may not be enough and must be accompanied by understanding the relationship between the form and functions of the second language (Al-Zoubi, 2018).

For example, the research on bilingualism illustrates teachers' experiences working with ESL students. First, teachers can reduce the cognitive load while teaching English to non-native students (Suek, 2018). This entails choosing activities and assignments that allow students to draw on their prior knowledge and life experiences. If students can relate new information to their own experiences and use it in real life, rigid cognitive information will be meaningful. Teachers need to understand that older learners have more advanced cognitive skills (e.g., memory and analytical reasoning) and may be capable of drawing upon a more sophisticated linguistic and conceptual base than young children. In addition, older learners can take an active part in their learning process (Ruey, 2010). When teachers do not consider older learners' linguistic and cognitive strengths, it may interfere with their second language development (Fillmore, 1991).

Teachers can contribute to evaluating their own teaching strategies and approaches by considering the classroom environment, individual differences, background knowledge, and language proficiency. The best classroom environment is where the classroom is student centered (Ali, 2019). Here the student practices the language most of the time and is allowed to constantly share ideas. English language learning strategies should always promote understanding over memorization (Montaño-González, 2017).

Moreover, teachers are essential in reducing the cultural load for foreign, non-native speakers of English. Language is not strings of letters and sounds; language is a medium to transfer culture, religion, information, etc. For instance, UAE students may encounter difficulty adapting the concept of the American educational system if the course assigned textbooks to represent that system (Almazroui & Almekhlafi, 2012). Therefore, teachers have to tie textbooks to students' cultures and values. Teachers should provide examples from students' lives and experiences and not be limited to textbook examples and illustrations. Students tend to suffer at the beginning of their studies of a non-native language; they complain a lot, ask repeatedly for teachers that share their native language, and show signs of depression and anger. Therefore, teachers need to be aware of these symptoms and help students adapt to the new situation.

Teachers can use academic vocabulary when working with non-native speakers. Typically, English language learners rely on the teacher to use English skillfully. Therefore, it is recommended that the teacher avoid using oversimplified vocabulary (Pikulski & Templeton, 2020). Instead, the teacher should deliberately model academic language by selecting terms and vocabularies to help the students learn the required academic language with appropriate context clues and other information to help English language learners acquire and practice this language (Institute of Education Sciences, 2014). Teachers should also consider using visual aids and technology means.

Likewise, teachers will always need to address ELLs' needs. Teaching older students in a second language differs from teaching them in their native language. Teaching

strategies and good instruction are insufficient in a second language (Hong, 2008). Teachers must understand older students' needs and the language demands of their subjects. Additionally, teachers need to allow the use of native language when needed.

Experiences of Countries in Teaching in a Non-Native Language

It is difficult to find relevant empirical data or well-developed theoretical models of adults studying English compared to bilingual children studying the same language (Hoff & Core, 2013). Teaching in English rather than a native language has long been controversial, and along with the controversy is the issue of limiting English when teaching mathematics and science (Panthi & Belbase, 2017). Some educators believe that if students are going to study English, it should not be perceived as students' first language in instruction. Arabic students are challenged by studying English at universities, which pushes them to memorize information rather than understand it. Most of these students, Abu-Rabia (2017) added, remain silent because they lack the keys to communicating and debating in another language.

Teaching university students in their native language brings life to academic performance (Abu Rabia, 2017). However, students that study in a non-native language must show great competence in that language before they find themselves in a situation where a considerable curriculum has to be digested in a language that is not native to them. The problem is that students cannot relate what they study to their lives or even to the information they previously studied in another language due to the underlying language specifics, which they are unfamiliar with.

Israeli Experience

English is a dominant language in Israel; it is widely used in all media means and in most university textbooks. Therefore, it is common to hear people speaking English in Haifa compared with other languages, such as Arabic or French. Abu-Rabia and Sanitsky (2010) investigated the anxiety level Israeli students experience when studying in English compared to Hebrew. This research raised the issue of anxiety related to foreign language learning. Abu-Rabia explained different anxieties, including anxiety students experienced when learning in a foreign language. This type of anxiety negatively impacted students' emotions, which plagued them with worry, physical insecurity, and the inability to engage in situational learning. This anxiety reflected difficulty coping with new assignments and tasks and was labeled facilitating anxiety. Foreign language anxiety, as research by Abu-Rabia and Sanitsky (2010) showed, was related to learners' self-expression. In sum, female students had poorer linguistic results than male students. Consistently, female students' anxiety levels were higher than male students.

Turkish Experience

For years, there has been a noticeable increase in social awareness of foreign language teaching and the efforts invested in it in Turkey (Öztürk & Aydin, 2019). Language education has gone through many changes and drastic upheavals over the years, with a great emphasis on the need for all students to become proficient language learners. These variations and adjustments in foreign language instruction in Turkey have

resulted in significant developments as well as a slew of issues. One of these issues is the selection of schools and the content of their programs.

In Turkey, children work hard after finishing compulsory elementary school to get into state or private secondary schools, where they have a one-year preparatory stage and participate in an immersion program. To be a student there, they must pass a centralized exam. These schools employ English as the teaching medium for mathematics, physics, and other academic topics. Other secondary schools that accept students after passing the central exam provide academic courses in Turkish and a four-hour-per-week English course. Since these students have a central university exam in Turkish, the disparities between these two systems have produced difficulties, such as students' attainment levels in disciplines such as mathematics and science. Thus, in the Turkish educational system, foreign language teaching has alternated between teaching academic courses in a foreign language and teaching a native language.

Experience in Spain

Bilingual education systems exist in various countries, including the United States, India, and Spain, and consist of doing a significant portion of the instruction in a language other than the student's native tongue. While the economic benefits of learning a second language are well understood, the possible effects on other areas have gotten far less study. For instance, in Madrid, Spain, there is a bilingual program that incentivizes learning processes in English, French, and German (Comunidad de Madrid, 2020). From 2004 to 2005, the city of Madrid launched the program in 15 schools with bilingual initiatives.

Experience in India

As a means of instruction, bilingualism in India obstructed the educational process, causing emotional instability in students and impeding their moral development. In addition, bilingual education obstructed creativity and created an ill fit between pupils that were not acclimated to specific cultural groups. Therefore, the solution was to recognize that Indian education today is neither Indian nor educational. English should not be taught in primary school but rather at a later level in secondary school. It should be considered a second language, with the vernacular serving as the primary medium of instruction. The current system, centered on English instruction, has received a fair trial and failed.

Malaysian Experience

Malaysia took the bold step of readopting the English language as a medium of instruction for mathematics and science in January 2003 to ensure that Malaysians can keep up with scientific and technological development, which is primarily recorded in English, and to provide opportunities for students to use the English language and thus improve their proficiency in the language. The educational policy in Malaysia is in line with recent discoveries and understandings in second language learning, which place a premium on meaningful, intelligent input. In this situation, teaching mathematics and science in English provides a rich framework for authentic language

use and hence acts as a focal point for developing English spoken language and literacy. However, while this approach may appear desirable and progressive, it alters the dynamics of mathematics and science teaching and learning in Malaysian classrooms.

3. Methodology

The existence of a connection between mathematics and language is undeniable. However, how, when, and in which tasks does language have a more direct impact? To answer this question, it is necessary to delve into the various levels of language acquisition, not just to rely on the surface benefits or drawbacks of bilingual education but to also determine how much the development of mathematical thinking can be hampered if it is taught in a second or non-native language.

As a result, it is critical to emphasize the distinction between Second Language Learning (SLL) and Second Language Acquisition (SLA) as well as how these notions influence the activity of confronting new knowledge and learning spontaneously. Acquisition, as a natural and unconscious process, is similar to the phenomenon of learning a first language. Sequential bilingualism can be identified as a result of linguistic immersion in an educational program or as submersion in a communicative setting where the child lives among native speakers. When it comes to language learning, we should not be fooled by second language (L2) instruction as it has been done in many educational settings utilizing traditional approaches and a concentration on memorizing vocabulary.

As a result, educators may teach math and science in a combination of the mother tongue and the target language. Studies have revealed that giving lessons in the mother tongue or first language has no negative impact on the development of the second language. Nonetheless, the use of mother tongue instruction must be limited and selective since a constant reliance on translation may not only harm the learners' language development but also discourage them from speaking the target language. The goal of teaching math and science in English can then halt. Nevertheless, when English teachers' competence is questioned, what else can we expect from math and science teachers? These teachers, who are not language specialists, will face the dual challenge of transferring content and language. Will they be able to cover their topic thoroughly and efficiently?

As a result, to comprehend the work at hand, we must first comprehend these teachers' views, knowledge, attitudes, and readiness to teach mathematics and science in English. What instructors know and can do has an impact on all of the essential activities of teaching. Moreover, multiple studies have emphasized the importance of teachers in influencing student behavior. With this in mind, this research aims to find out these teachers' reactions to using English as a medium of teaching, their difficulties when using English in the classroom, and the provision of language assistance programs.

CLIL is a teaching style that seeks to teach pupils language skills and subject simultaneously (Marsh, 2012). The Common European Framework of Reference (CEFR) (2021) is the inspiration for concerns relating to language teaching and learning in Europe, and it is consistent with teaching/learning environments that integrate language and content. In Italy, the recent Upper Secondary School Reform mandated that the CLIL technique be used in many schools, including the *Licei* and *Istituti Tecnici* (Cinganotto, 2016). Furthermore, the new Initial Teacher Training Act includes a CLIL module for future teachers, regardless of the subject they teach. However, until now, there has been no theoretical reflection on concerns surrounding the implementation of the CLIL technique in schools. Consequently, it has not been carried out in Italian schools.

This research focuses on a linguistic method, a text-linguistic approach, used to examine various types of classroom dialogue. Apart from a few papers, we can only refer to studies about unusual teaching contexts, such as bilingual schools and multicultural classrooms. In these situations, pupils are taught in an L2, although the educational goals differ from CLIL teaching, sometimes dramatically. The typical classroom language is an L2 solely for students in the bulk of the disciplines described above, and it is utilized to teach all topic subjects.

While respondents' most commonly listed abilities are learner needs, engagement, and topic literacy, it is surprising that evaluation/assessment is not a vital issue for them. Insufficient collaboration between math and language teachers and a lack of prior CLIL teaching experience are the key reasons why planning, multimodal teaching, learning, collaboration and reflection, context, and culture are not given enough attention.

We will now provide thoughts on the three areas the teacher will most likely target to see if there is a link between them. They are the most frequently discussed topics and demonstrate the importance of L2 in the teaching/learning process and how language influences content. As a result, we provide a model in the next section to account for any differences in language use in math lessons in L2 compared to arithmetic lessons in the original language.

CLIL teaching is difficult for students. Learners' demands are primarily defined by two points of view: seeing L2 as a barrier and seeing the need to change how the language is utilized. It would be perplexing for many students, and studying necessitates focus, which is required to comprehend the language. The L2 is an issue in the two replies above. However, below, the need for adjusting the language is used: The capacity to communicate in terms that students can understand is a requirement. This requirement is linked to another area of expertise: interaction.

Regarding interaction, teaching mathematics in a foreign language could be a beneficial barrier to avoiding misunderstandings since the L2 is acknowledged as a valuable barrier to preventing misunderstandings. On the other hand, teachers and students need to be more careful with their language use, which should include a

more rigorous and synthetic use of mathematical terminology, and teachers should be more concerned about the difficulty of mathematics and its teaching. Nevertheless, despite the prospect of combining language with symbols, it can also be seen as a formidable barrier to overcome; despite the universal symbolism of mathematics, language would be a barrier.

4. Results

Problems in Using English as a Medium of Instruction

This research found that lecturers' biggest drawback was explaining ideas in English. One teacher responded, "My students cannot perceive concepts once I justify ideas. I want to use Bahasa Melayu. They perceive simple directions in English. Nonetheless, it is tough to create them to perceive science ideas in English." Further, 85.2% of the respondents indicated that they had issues explaining ideas in English, and 81.8percent admitted to victimization in Bahasa Indonesia.

Another participant of this study explained, "What am I to do? I even must use BM; if not, however, am I to end the syllabus?" The purpose of introducing English is because the medium of instruction within the teaching and learning of arithmetic and science is mainly to assist students in keeping up with the developments in science and technology by making it attainable for them to access this info that is exceptionally obtainable within the West Germanic language.

This research found that lecturers' biggest difficulty was explaining ideas in English. Science and mathematics teachers are typically aware of this need and are working to make it a reality. On the other hand, some of these teachers believe they lack the requisite language skills to teach English. As a result, continuous content-specific language input is required for these teachers' personal language development. Because these teachers play such a significant role in modeling appropriate language habits in their classes, mastering the language elements of their subject matter becomes critical. This is in line with what various academics have said about the need to address teachers' own language development with programs, which should focus on in-depth language education, cultural diversity, and knowledge adaptation to training.

Challenges Encountered in the Classroom

There was a difference between general English and the language of mathematics and science, according to 70.5 percent of the respondents. As a result, 65.4 percent of respondents said it was difficult to participate in class discussions in English. Responding to students in English is also an issue, according to 73.1 percent of respondents. Furthermore, 73.1 percent said they had difficulties creating reports and developing instructional materials in English. Interviews with the respondents revealed that many teachers are unsure of the linguistic characteristics of their content area.

Other issues raised by the respondents were the ministry's textbooks and multimedia courseware. The textbook was criticized for being too brief, with insufficient examples

and descriptions, and so being ineffective, particularly for LEP (Low English Proficiency) students. The multimedia courseware was also said to be unsuitable for LEP students because the language used to present the content was incomprehensible. "The CDs are fantastic," one respondent said, "but my pupils do not understand, so I have to stop and translate for them."

Voices of Teachers

Teachers of mathematics and science are both aware of and enthusiastic about the need for a change in the medium of instruction. Nevertheless, these teachers appear to be struggling not just with their language limitations but also with controlling their students' language development concerning their subject area. The current language assistance approaches fall short of their expectations. As a result, actions must be taken to assist these educators in their efforts to teach science and mathematics in English. One approach to examine is to improve the language skills of the instructors. Teachers may be obliged to participate in language transition programs to improve their language skills. However, these transition programs should not be led by English language specialists but by subject matter specialists in science and mathematics. Teachers will not only be exposed to the English language in general but will also be watching it in action in these programs.

5. Discussion

It is not easy to learn and teach a second or third language. Teachers and students struggle to cope with the language policy, which mandates they teach or learn a foreign language. Language is undoubtedly essential for transferring knowledge and skills during the learning process and cannot occur efficiently if the language of instruction becomes a barrier for the students.

According to evidence from various studies and experiments, bilingual education programs are successful in several nations worldwide and can improve primary education in underdeveloped nations. Also, bilingual education has pedagogical benefits like addressing educational quality issues by fostering successful literacy acquisition, biliteracy, and practical elements, including greater motivation and self-esteem.

Code-switching is essential to change people's minds about code-switching in bilingual classrooms. It is also a normal communicative response among teachers and learners since they share a common home language. Sadly, code-switching has been viewed as a sign of linguistic and pedagogic inadequacy rather than a genuine communicative approach. On the other hand, the reasons for code-switching appeared to be very comparable to those described in other postcolonial situations in Africa and Asia.

Teachers also utilize translation as a coping method, which typically increases the time required for learning. The lesson is slowed by repeating everything in the instruction language and then the home or first language. Students pay little attention to the first language spoken since they know they will be provided a translation in their

language. The desire to enhance language ability in teaching language will be futile, especially since translation will require additional time.

Another barrier to bilingual education is insufficient preparation for pre-service and in-service instructors to teach in multilingual classrooms. It is challenging to teach and learn mathematics and science in a language that is not the learner's native tongue. Learning mathematics and science, as previously stated, has features similar to learning a language, as both fields require a certain register, set of discourses, and conceptual and abstracted forms. Teachers that are involved are frequently described as having a dual task in which they must teach both language and content at the same time. On the other hand, learners must contend with learning both the new mathematics and science language and the language of instruction.

Additionally, learners must master the formal language of each subject, distinct from everyday language, to learn mathematics and science. The learning challenge in this context becomes a three-dimensional dynamic. It involves simultaneous access to the learning language, mathematical or scientific discourses, and classroom discourses. Teachers in science and mathematics classrooms using a second or third language have obstacles in encouraging pupils to transition from their casual spoken language to formal written mathematics or science language. In most mathematics and scientific schools, informal and formal languages, including spoken and written forms, are employed.

Learning mathematics and science, however, entails more than just switching from spoken to written language. As previously stated, students must also negotiate meaning through various forms of multimodal representation. They must comprehend, integrate, coordinate, and translate information from one modality to the next. This feature may be more challenging in second or third language math and science courses. Teachers then have another responsibility to help students grasp multimodal representations while still completing other tasks they have already encountered in teaching second language mathematics and science.

6. Conclusions

The improvement of math and science teachers' language proficiency and their capacity to integrate language and content must be a priority in teacher training programs. Additionally, training should aid aspiring teachers in building a toolkit of instructional activities and efficient strategies to help their students understand scientific language and subjects that are cognitively demanding. Math and science curricula are to be supported with supplementary materials designed for English language learners. Finally, ongoing research needs to be conducted, and in light of research data and results, adjustments must be applied. Additionally, schools must arrange extracurricular activities to support students. For future studies, this study would pave the way for conducting long-term research that would enable researchers to better understand how math and science are learned in a second language and the ramifications that has on all academic years.

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