Research Article

American Journal of Science Education Research

Language Difficulties Amongst Year 7 Science Students in Samoa

Faguele Suaalii[1*] and Tepatasi Gray[2]

[1]*Senior Lecturer-Science education, Faculty of Education, National University of Samoa*
[2]*Postgraduate Diploma in Education-Faculty of Education, National University of Samoa*

[*]**Corresponding author:** Faguele Suaalii, Senior Lecturer-Science education, Faculty of Education, National University of Samoa. Email: f.suaalii@nus.edu.ws

Abstract

Within the Samoan context, education is seen as critical to furthering the national goal of having sufficient qualified citizens who can create opportunities within an increasingly more technical and market-orientated economy. Science education is seen as playing an important role in this, yet despite significant government investment student continue to experience difficulties due to the language(s) used in the classrooms and eventually, achievement in science continues to be a concern. This research focused on exploring the perspectives and experiences of both teachers and students in Year 7 science classroom in Samoa. The study involved students and teachers from one science classroom from one mission co-educational primary school located in the outskirt of Apia, the capital of Samoa. Participants' interviews were used to investigate participants' perspectives and experiences to learning and teaching of science in Samoa. Analysis of both common and distinctive ideas from the teacher and student participants revealed the difficulties that relate to complexities of languages used in the Year 7 science classroom in Samoa. The difficulties included 'the frequent use of Samoan language', 'using English language as the medium of instructions' as well as the 'abstract nature of the language of science'. Effective science teaching and learning strategies are needed in primary level in order to overcome the language difficulties that are found in the Year 7 classroom in Samoa.

Keywords: language difficulties, science education, teaching science, learning science.

Introduction

Language plays a critical role in education, serving as the primary means through which knowledge is communicated within formal and non-formal education contexts. The importance of language is heightened as it not only facilitates communication but also shapes the understanding and interpretation of scientific concepts [1,2,3]. Furthermore, such relationship between language and science education is particularly significant in multicultural and multilingual settings including Samoa, where students navigate the complexities of learning science through a language that may not be their native tongue [4.3]. In addition, "science has a language of its own … given the abstract nature of the concepts and the specialized jargon it uses" (Ministry of Education, Sports & Culture, 2011, p. 17) [5]. Therefore, language can be one of the pressing issues in science education, hence the topic of this research – Language difficulties amongst Year 7 science students in Samoa.

There has been an increasing interest in the central role of language in science education [6,7]. Such interest is a consequence, amongst other things, of studies drawing on social constructivism and the connections between language, culture of the people involved, and cognition.

Vygotsky (1978) suggests the importance of language in mediating thought. For him, language was basic to the development of thought: words are the means through which thought is formed. Furthermore, Wellington and Osborne (2001) indicate that "language development and conceptual development are extricable linked … and thought requires language and language requires thought" (p. 6). In this sense, there is a clear indication that thoughts (refers to the things you are thinking) is highly influenced by the language that is used for instruction.

English, as the official medium of instruction in Samoa education, poses challenges for Samoan students who may not have a strong command of such language. To gain a deeper understanding of this issue, it is necessary to examine the perspectives of local teachers and students on the teaching and learning of science with a focus on Year 7 classroom in Samoa. To investigate language difficulties in science education among Year 7 students in Samoa, it is essential to consider the role of native language and its influence on their comprehension of scientific concepts [8,9]. The perspectives and experiences of both teachers and students in this study provide valuable insights into the challenges and opportunities associated with teaching and learning of science in a bilingual context. By

understanding the impact of native language on science education, educators can develop more effective strategies to support students in their learning journey [10]. This investigation aims to shed light on the complex dynamics at play in a Year 7 classrooms and offer recommendations to assist numerous efforts by the Ministry of Education (MEC) to improve science education in Samoa in primary level. To achieve this, three questions will guide the implementation of this research:

1. What are the impacts of language on the teaching and learning of science in Year 7?
2. What is the role of language in the teaching and learning of science in Year 7?
3. What strategies to help solve the language difficulties in Year 7 science?

The findings of this research will inform educators about the effects of the current language of instruction in the teaching and learning of science in Year 7 classrooms in Samoa. It will provide evidence-based insights into whether teaching science using the students' native language can lead to better comprehension and retention of scientific concepts. Additionally, the research will offer recommendations for improving science education, tailored to the specific needs of Samoan Year 7 students. This includes the development of effective language policies, language strategies and language resources to support students in their learning of science. It will also empower policy makers to advocate for educational policies that prioritize language inclusivity and address the challenges faced by students in a multilingual science classroom.

Literature Review

This section outlines a selective number of relevant and more reliable literature for this particular study. With strict focus on science education in Samoa and the Pacific region, specific studies reflected in this section formulate the foundation of my literature review with special mention of other international literature where relevant.

The study by Varghese (2010) [11] reveals insights into the challenges and adaptations in the science education of second language learners in Samoan contexts. This study underscores the implications of language policy and teacher practices on the effective delivery of science education. The study delves into the current language practices in Samoan primary schools, aiming to inform the development of an inclusive language policy tailored for both primary and secondary educational settings. Stakeholder discussions suggested shifting to expose students to the English language as early as Year two rather than Year four. Such shift reflects the ideology

suggested by Cummins (1983) [12] of 'maximum exposure principle' which advocates for considerable second language instruction for students whose first language is the majority language.

The preference for English instruction stems from parents' belief that proficiency in English leads to improved employment prospects, despite the challenges it poses during classroom instructions—predominantly in English—and National Examinations which are always administered in English. Teachers often find themselves switching to using of Samoan words for better understanding and comfort, highlighting the gap between language policy intentions and classroom realities. Such irregularity of the use of a proper language is often identified as code-switching [13]. The students are presented with sentences or instructions consisting of a mixture of two or more languages with the hope that learning becomes more engaging.

Varghese (2010) [11] also stated that assessment practices in science education in Samoa have raised concerns regarding the focus on grading over constructive feedback. Basically, excellence in education involves students displaying the highest level of achievement as measured by exam results [14]. The teacher is often verbally measured (evaluated) based on these exam results [11,15]. However, effective formative assessments [11,16] could lead to improved learning outcomes, which are crucial for students who are second language learners. Assessments in Samoa education system are in English where the students face with challenges of regurgitating the content of the subject (assessed) as well as how to express their responses correctly using the specified language.

The study by Varghese (2010) [11] suggests that while language policy aims to bolster English proficiency for better future opportunities, there are significant challenges in its implementation, especially in the context of complex subjects like science. There is a need for more targeted teacher professional development and resources that address both language acquisition and content understanding for second language learners in Samoan classrooms.

Hawke (2015) [17] reports on the broader context of educational access and quality, notably concerning out-of-school children and the impediments to education they face, including language difficulties. He touches on the systemic issues in education that affect language learning, such as disparities in access and inclusivity. In Samoa, where cultural diversity and bilingualism are prominent, these issues are particularly salient. It is evident from the literature [18,19] that educational strategies and policies

must be inclusive and adaptable to meet the needs of all learners involved, including second language learners. Social constructivists believe that there are connections between language of the people involved and cognition. In this regard development and learning involves a passage from social contexts to individual understanding and that language is seen as basic to developing and mediating meaningful ideas. However, if the language use is unfamiliar the students are generally not so forthcoming with the expression of their ideas in front of their classmates [20] and may experience difficulties in understanding science concepts [21,22,23,24] during classroom assessments. In a multilingual context such as Samoa, linguistic capability in both the native language and the language of instruction (English) is fundamental to facilitating access to science education and improving scientific literacy.

The complex language demands of science can also exacerbate challenges for second language learners in Samoa This is because the students must grasp new terminologies and concepts while simultaneously developing proficiency in a second language. Such dual cognitive load [25] necessitates educational approaches that are linguistically sensitive and pedagogically sound. In fact, Boujaoude and Attieh (2008) [26] confirmed that problems in learning science include "the abstract and highly conceptual nature of science ... and teaching methods do not seem to make the learning process sufficiently easy for students" (p. 233). It is obvious that second language learners encounter considerable challenges in subjects such as science, where proficiency in the language of instruction directly impacts comprehension and academic performance. In this context, Alshammari (2022) [27] explores the reliability of achievement tests in predicting English language aptitude and indirectly informs the strategies for enhancing science education for second language learners. It is therefore important to explore the efficacy of achievement tests as predictors of language aptitude amongst English as second language learners in the Samoa Year 7 classroom. This inquiry is crucial where students may face additional layers of complexity in science education due to the bilingual education system's pressures as well as the frequent use of code-switching tactic in Samoa primary schools.

For second language learners in Samoa, the ability to perform well in science is intertwined with language proficiency. Given that achievement tests are a standard measure of academic success in Samoa [14], understanding their predictive power on language abilities is vital. If achievement tests accurately reflect language aptitude, they may serve as a tool for identifying students

who require additional linguistic support to grasp scientific concepts. The intricate relationship between language proficiency and science education is particularly evident in classrooms with second language learners. For instance, the study by Motloung, Mavuru, and McNaught (2021) [28] provides insights into how teachers navigate the complexities of teaching life sciences in English to students in South African township schools, where English is not the home language for most. Basically, the South African teachers are mandated to teach using English language, which imposes a significant burden on both teachers and students who are non-native speakers of the language. From their findings [28], it emerges that although teachers may hold certain beliefs about the efficacy of using English for instruction, their classroom practices often deviate from these beliefs. Teachers sometimes adopt strategies such as code-switching to bridge the linguistic gap, reflecting the adaptability required to facilitate learning amidst language difficulties.

The discussion above confirms the existence of language difficulties in education in many countries including those with well-developed education systems and financial supports. Samoa however, adopted formal education system during its colonial era and therefore there was so much international agendas involved. The curricula, teaching and learning methods, languages of instruction, assessment and evaluation methods and organisational cultures of schooling in Samoa continue in hegemonic forms, usually closely resembling those of their former colonial 'masters' [29,30]. Therefore, based on the discussion of the literature, this research is designed to explore the year 7 science classroom in Samoa to identify language difficulties amongst these students. Basically, the research tries to explore the demands of science education in linguistically diverse settings and the imperative of effective communication in fostering both scientific understanding and second language proficiency.

The study underpins social constructivist perspective, acknowledging that teachers' beliefs and classroom practices are shaped by their personal context and prior experiences. Learning in this sense is shaped by social interaction with peers or with adults [31,32]. The types and quality of social interactions between experts (adults or teachers) and learners can significantly impact learners' appropriation of knowledge [33]. The study also considers the precision and objectivity inherent in scientific language, which employs terminology derived from Greek and Latin, further complicating the task for second language speakers. This specialized vocabulary can be particularly daunting for English as a Second Language (ESL) speakers, including the teachers themselves.

Methodology

This research adopts a qualitative research method to collect and analyze data. The qualitative method is a type of research that provides a deep understanding of the problem by asking participants to share their experiences. Crewell (2007) [13] stated that qualitative research methods are valuable in providing rich descriptions of complex phenomena where people are often involved. As this study aims to invite teachers and students from a Samoan primary school, qualitative method is essential for this investigation as it sets out to explore their beliefs, their experiences, and personal perceptions about the chosen topic.

Research site and Participants

Due to time constraints for this investigation, one urban primary school which responded to the invitation in time, was selected to participate in this study. This primary school is a managed by mission organisation within Samoa. Students from a Year 7 science class was invited to participate, because this is often preparatory level/year for students to take final Year 8 level in primary school. This means that, if the students do well in Year 7, there is a high possibility that they will succeed in Year 8.

The research participants were purposively selected to include diverse perspectives, consisting of 2 teachers and 3 students. Confidentiality of the participants in the dissemination of the data were ensured by using codes (refer to tables 1 & 2).

Table 1: Teacher participants.

Teachers	Codes	Qualification	Years of teaching
1	T1	Postgraduate in Arts	23
2	T2	Bachelor of Education	2

Table 2: Student participants.

Students	Codes	Description of academic performance in school
1	S1	Average student
2	S2	In the top 3 high achievers
3	S3	At risk student

The interviews were conducted in an office at school to eliminate unnecessary noise and interruption from other students and to maintain the privacy and comfort of the research participants.

Methods of Data Collection

As the study seeks to explore the nature of language difficulties in Year 7 classroom in Samoa, it is important to utilize interview method to collect information. The restriction of using multiple data collecting methods is mainly due to time constraints allocated for this investigation. However, the significance of interviews consisting of open-ended questions for this research involves direct verbal interaction between the researcher and the research participants. The researcher is able to gain insights into participants' perspectives on the phenomenon under study [34,35]. Basically, interviews allow for in-depth exploration of individual experiences and perspectives, offering nuanced insights into the impact of language on research participants' learning of science lessons. During the interviews, follow-up questions will be used to allow the participant to provide further elaboration on given information that may need further clarification. These interviews allow for a detailed exploration of participants' experiences, perceptions, and insights regarding language in science education.

Interviewing to collect data as mentioned was recorded using a recording device upon the consent of the participants. This process of audio recording assists in saving time and not missing out on information given.

Data Analysis

Data collected from audio records of interviews were transcribed as the first step of the data analyses. The transcribing step provides an opportunity for the researcher to obtain a sense of the data collected by listening to the recordings as well as reading the transcripts. Once the data is transcribed and confirmed, the researcher begins to formulate groups/categories of familiar ideas to facilitate the development of relevant themes. The use of a thematic approach for this research involves searching for common threads that extend across the data received from the research participants (Stake, 2005). Steps for data analysis in this research is summarized in figure 1.
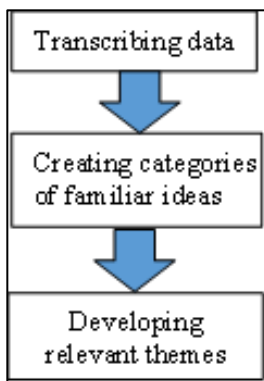
Figure 1: Steps of data analysis.

Findings & Discussions

Tables 3 and 4 provide a summary of the participants responses to the interview questions. The summaries highlight a variety of situations that are happening within the Year 7 science classroom. Some of which are reflected in the themes developed from the analysis.

Table 3: Responses from student participants.

QUESTIONS	S1	S2	S3
1. What is your first language?	Samoan	English	Samoan
2. Do you like science? Why?	Sometimes. *(student asked if she can give her answer in the Samoan language).* Kele o kaimi ou ke le malama pe a faamakala mai e le faiaoga makou mea ia e fai. Seiloga a ua faasamoa mai ma fai gi makou experiments koa ou malamalama laia.	Yes, its my favourite subject. Science is interesting, I love it because its not boring and i get to do investigations for my research. I also like it kos we do different things and experiments.	Yes Because it's fun and i can do experiments. I learn new things pei o pageka ma kagaka lauiloa i le science pei o le kamaloa lea ga fai ai lau research o Isaac Newton and also I learn new things.
3. On a scale of 1-10 (poor – excellent), how good are you in English?	*(student said she doesn't understand the question, after translating and elaborating more on the question she finally answered with a laugh),* Miss ou ke iloa gagu ae le lelei kele. Maybe 5?	I would say 9 *(why not a 10 since it's your first language?)* Well I still make mistakes in English class.	I think 8
4. On a scale of 1-10 (poor – excellent), how good are you in Samoan?	8 E lelei lau faasamoa ae iai a isi upu faigaka ia au pei o upu ouke lei faalogo muamua ai.	Umm maybe a 2? *(are your parents Samoan?)* Yes my mom is but my dad's half-caste, his mom is Samoan but his dad is Australian.	I think… maybe 8 and a half
5. What language is used for your science classes?	English ae iai a isi kaimi e faasamoa ai e Miss ia makou malamalama ai.	English and Samoan *(is that okay for you?)* yeah… but when you speak Samoan I don't understand most of what you talk about. *(do you seek help?)* no *(why?)* cos I feel embarrassed some times and sometimes … scared *(scared?)* yes. *(scared of who?)* you (laughs nervously.	English and sometimes Samoan
6. What language is used in your home daily?	Faasamoa ae iai kaimi ou ke gagu ai i ou kei laiki ma lou Nana (laughs)	English but sometimes my mom speaks to us in Samoan.	Samoan but e iai a isi kaimi e fegagui ai lou kiga ma lou kama.
7. Is there a difference between learning/teaching science compared to other subjects? Elaborate on your answer.	Ia, o le science e kele a mea e fai ai. Kele a ga makou o i fafo e fai ai makou experiment e le pei o isi makaupu e gofo a ile poku ma fai	Yes. Science is more active and fun compared to other subjects. *(what do you mean?)* Well we get to go outside and explore, its nice and cool outside so its nice to walk around and study things.	Yes. O le science e fai makou experiments pe a maua gi mea e fai ai koe e fai makou team work ae o isi subjects kele a ga kusi meaaoga. Which is e ok a, ae ouke fiafia aku ile science.
8. What is the most difficult part of science for you?	E faigaka. Kele a kaimi ouke le malamalama pe a faikau makou notes. *(ae a pe a fai vasega e le faiaoga?)* Ouke malamalama a pe a oo i le kaimi lea e faasamoa mai ai ae faapalagi loa miss ia e kele a gou le iloa isi upu *(aisea?)* leaga e faigaka koe e fou.	It's the hard scientific words. *(why are they hard? Can you give an example?)* because they're long words and sometimes they're new words. *(can you give an example of these kind of words?)* Biodiversity and metamorphic	Ummmm o words kekele ia e fai ai kakou spelling test. *(e a upu na?)* Oka se faigaka, isi kaimi ouke fiu sue le meaning i le dictionary e le maua.
9. What do you suggest your teacher should do to help you overcome this challenge?	(laughs) magaia a pe aga faasamoa kakou science miss. Ouke seki a ile samoa ae kaumafai a ia lelei lau gagu, faimai lou Nana ouke koaga e faikau kusi e help i lau gagu. *(e te faitau tusi i le fale?)* leai, leaga e leai gi kusi, seiloga a ua ou alaku ma se kusi. Ae kele a ga le faikaua leaga e leai seisi e fai ma faikau kusi i le fale.	Maybe have a science dictionary that we could use in class or a list of the vocabulary stuck on the wall so we can practice them every day. It would be nice to have an actual science lab and some science textbooks that we could use for more information.	Magaia a ae fai kakou science experiments a leai makamaka laia ile Youtube. Kele a gou laku i le fale ae kago lou kiga faamakamaka ai au pe a leiloa faamakala mai.

Table 4: Responses from teacher participants.

QUESTIONS	T1	T2
1. *What is your first language?*	Samoan	Samoan
2. *Do you like science? Why?*	Yes. Science is an interactive subject. It can be fun when we teach it the right way and I know that this is the time my students participate in the most. It is time consuming to prepare lessons but to see the curiosity of the kids and their interest in the lesson, it makes it all worth it.	Kind of. I wish we had the resources to teach it. Science is hard when we do not have the resources to show the kids what we are talking about. You know, some concepts in science cannot be fully understood by mere words. They need to be shown to the kids and kids need to do and work with their hands to grasp the concept taught.
3. *On a scale of 1-10 (poor – excellent), how good are you in English?*	I would say 10 but then science is a different subject and it has its own language, now in science i would say my English in scientific language would be an 8. It's a never ending learning process and you cannot have it a 100%	7 and a half I would say. Ia o tatou o le gagana Samoa lava ona ole tatou gagana. Ia ae pau lea o le taimi e tautala ai I le igilisi o le taimi e omai ai i le aoga.
4. *On a scale of 1-10 (poor – excellent), how good are you in Samoan?*	8 I was born in Samoa but when I was in my teens my parents moved us to the States so that is where I started to lose the language. Thankfully, I returned when I got married and now I am learning the language again. I am fluent in the spoken Samoan but there are other aspects of the Samoan language i am still learning.	9. E lelei tele lau faasamoa aua foi o le gagana lea na faafailele mai ai le olaga i totonu o aiga. Na ota aoga mai foi lava o le gagana samoa o sa faaaoga ile tele o taimi. O le siosiomaga foi o le aiga, e tautala lava i le tatou gagana.
5. *What language is used for your science classes?*	English and sometimes Samoan. As you know we are an English speaking school so it is imperative we use English in our teaching. However, I try and explain in Samoan for the sake of the students who have a difficulty interpreting information in the English language.	I use English most of the time but e iai lava isi vaega o le curriculum e faigofie lava pe a faasamoa ona e iai taimi e oge ai le gagana igilisi ona faasamoa loa lea. Ia e taumafai foi a e faasamoa mo nai fanau oute iloa e malamalama tele i le gagana igilisi.
6. *What language is used in your home daily?*	I use a mixture of Samoan and English. It's good to make sure we keep our mother tongue alive in our children, I don't want them to go through what I did… you know losing my language but I also believe that it is very important that they are fluent in English because it is the language in schools and if we want them to succeed they need to be well versed in English whether they like it or not.	Ia o tatou o le gagana samoa lava. E iai taimi out e taumafai ai e nanu isi au fanau ona oute iloa e tatau ona faamasani e tautala i le gagana peretania. Amuia nei tupulaga ua mafai ona maua le avanoa e tautala ai i le gagana igilisi i le fale, ao la aso ia e leiloa e ota matua tautala faaperetania. Ia lea la e taumafai atu ai lava ia lava le iloa i le gagana peretania.
7. *Is there a difference between learning/teaching science compared to other subjects? Elaborate on your answer.*	Yes, science is an enquiry based subject. Kids need to think critically, be curious and ask questions all the time in order for them to understand concepts taught. Kids need to conduct experiments to test their ideas and beliefs. Unlike English and other subjects where you do the norms of writing and expressing and comprehension.	Of course, there's a big difference. Ole science e tatau ona lava lota iloa i le tele o terminologies e tatau ona faaaoga aua a fesili mai tamaiti ae la ua ota iloa tali atu iai.
8. *What is the most difficult part of science for you?*	I would say it's the lack of science resources to teach the lessons. As you know, we do not have a science lab and there is no science equipment for the teachers to use in their classes. That is where the need is for our school. We need resources to teach science. I try and make things work but science is different.	I would say o upu o le science. Tele o upu e faaaoga i le science e le oni upu e faaaoga i aso uma. Ia e oo lava ia te au, o isi upu lea faatoa ou iloa ina ua ou faiaoga ae ou te lei faalogo ai a au talu ona ou aoga.
9. *What do you suggest your teacher should do to help you overcome this challenge?*	Teachers can only do so much. It is an idea but its far-fetched…. To have a fully equipped Science Lab. Teachers have asked the Board for funding but nothing has happened. Maybe if we look for a way to fundraise ourselves, there are parents who will be more than happy to donate to a great cause. Sadly, the ministry does not support private schools as their priority is in developing the government schools. Like I said its like banging on a rock looking for help.	E tatau ona tele resources e faaaogaina pei o visual aids ma mea e fai ai experiments. Ia tate alofa lava i le fanau ona o le tele o taimi e leai ai ni experiments e mafai ona fai ona o le leai o ni mea e faatino ai. E tatau foi ona faamasani tamaiti ia faaaoga upu tetele nei i aso uma ina ia masani ai ma iloa uiga ma lona faaaogaina. Manaia foi le iai o ni tusi faitau science i totonu o potu aoga ina ia mafai e tamaiti ona maua avanoa e learn ai nisi mea fou ma faalautele lo latou iloa.

The analyses of the data presented in Tables 3 and 4 generated four themes that are relevant to the focus of this research investigation. Table 5 lists the four themes followed by a discussion of each with reference to the data collected from the research participants.

Table 5: Themes generated from the data analyses.

	Themes
1	Frequent use of Samoan language creates difficulties in primary science teaching and learning
2	English language is too difficult for students and teachers in primary level
3	Language of science is too difficult for Samoan students and teachers in primary level
4	Effective science teaching strategies are needed in primary level

Theme 1: Frequent use of Samoan language creates difficulties in primary science teaching and learning

The analyses revealed that the Samoan language was often used in the teaching and learning of science however it was considered challenging at times. Although there were times that the students gained some clarity about some science ideas when the lesson was translated into Samoan, the student participants still struggled with identifying and interpreting new and unfamiliar words. When it comes to explaining and responding back to questions and activities prepared, they were unable to transfer what they picked up using Samoan language into English as required (in the question & activity). Such difficulty is illustrated by Suaalii (2013) in his IEP model which looks at the effects of using different languages to introduce a topic, explore and discuss ideas as well as in testing/assessing the performance/ability of students in science.

Similarly, the teacher participants experienced the same challenge when Samoan language was used in their teaching of science. Only one of the student participants is a non-Samoan speaker, however, the rest of the research participants who are Samoan first-language speakers still expressed that they struggled with the use of Samoan language in science learning and teaching, even though Samoan being the dominant language at home. Basically, the teacher participants revealed that more than 80% of the science lesson spent discussing the ideas using Samoan language, however, the activities and follow up quizzes suggests nothing but to reteach the same lesson.

The use of Samoan language, however, considers the majority of the class who are Samoans, yet one of the student participants struggled to make sense of science ideas. During the interviews, the researcher had to translate the question a few times for S1 to understand and respond accordingly. According to S1, Samoan language is dominantly used at home, but she is encouraged to read to improve her English speaking, unfortunately no one at home to help with her English reading.

Theme 2: English language is too difficult for students and teachers in primary level

Despite the research being conducted at a school with an English-speaking policy, it is unfortunate that the almost 100% of the students are Samoans and they struggle to cope with English as it is the medium of instruction in all subjects except Samoan. Such policy requires all students to speak in English once they enter school compounds. During the interviews, the struggle to express themselves in English was evident from the beginning. For instance, S1 stated that:

"Kele o kaimi ou ke le malamalama ... seiloga a ua faasamoa mai ma fai gi makou experiments koa ou malamalama laia". – [Most of the time I do not understand unless it is explained in Samoan and if we do experiments then I understand].

In addition, S1 requested to translate the interview questions and if the answers could be given in Samoan (refer to table 3). Multiple translations were provided for S1 to fully comprehend the meaning of the question.

Although the school has a policy of English being the language of teaching and learning as well as speaking within school compounds, T2 assured that Samoan was predominantly used in their lessons to help the students understand the lessons:

"I use English ... but e iai lava isi vaega o le curriculum e faigofie lava pe a faasamoa ona e iai taimi e oge ai le gagana igilisi ona faasamoa loa lea. Ia e taumafai foi a e faasamoa mo nai fanau oute iloa e le malamalama tele i le gagana igilisi". – [I use English ... but other parts of the curriculum are easier in the Samoan language because there are times when my English is not enough, then I switch to Samoan ... translate in Samoan for the sake of the children who don't understand English].

It is evident from T2 that the frequent use of code-switching during the teaching of science was mainly due to limitation of English terminologies. Similarly, Motloung *et al,* (2021) [28] described that the adoption of such strategy by teachers was mainly to bridge their linguistic gaps. As a result, mixed sentences are used, English then followed by Samoan words, if the teacher is unable to locate or come up with the word (English) to complete what is orally presented (during discussions.

These findings support that English language is difficult, not only for students but teachers as well. This way of thinking reflects the foundation of the work of Vygotsky (1978) where the language of the people involved in the process (teaching and learning) is significant in mediating thoughts and thinking (knowledge). Unfortunately, it is not the case in this school, English is considered more important than the language (Samoan) of the teachers and students involved. Aligning teaching/learning practices with the language policy developed in this school creates some difficulties as revealed in this study. This leads to a constant reduction in the number of students who understand and gain interests in primary science and later school levels.

Theme 3: Language of science is too difficult for Samoan students and teachers in primary level

The data revealed that even though the research participants are fluent in both Samoan and (simple) English languages, they struggled with terminologies used in science lessons. Some of these terminologies are difficult to make sense although found in regular dictionaries. Such level of difficulties arises not only from the use of symbols to represent science concepts, but also the language that is used, in particular the technical and non-technical terminologies [24]. Basically, the students who learn science not in their first language face the problem of understanding both the scientific terminologies (technical terms) and regular explanation of the knowledge itself. Non-technical terminology on the other hand refers to terms that have one or many meanings in everyday language but with precise and sometimes different meaning in a scientific context.

Theme 4: Effective science teaching strategies are needed in primary level

In addition to the identification of language difficulties in the teaching of learning science, the research participants also shared various ideas and strategies that they prefer as remedies to the problem. For example, the effectiveness of doing experiments or hands-on activities during science classes. The research participants confirmed that significance of doing experiments to assist with the development of scientific knowledge and understanding. In addition, doing experiments encourage students to develop the language necessary to explain, discuss and formulate observations and conclusions. Frequent use of science equipment, materials (in experiments) as well as associated terminologies enable the students to familiarize themselves with the language of science and scientific explanations. Unfortunately, the implementation of experiments in this particular school was limited. As a result, students continue to face language problems and the development of science reduces.

The data also identified a need for teacher development in terms of improving language particularly English. It was obvious that the two teacher participants achieved first degree level from universities offering courses/programmes in English, but there was an element of difficulty in delivering science content to the students. The findings from this study therefore suggest that, perhaps the language use for the delivery of science (teachers) is problematic and confusing to the students. Their (teachers) lack in English language restricts them from conveying the correct science message using the proper words but divert using multiple English words (beat around the bush) and eventually shifts to code-switching. These tactics are simply an introduction of a new language that is differ from the languages which students speak at home [36].

In summary, the analyses show that Year 7 students are facing language difficulties in their science classroom. Basically, the language difficulty breaks the line of communication between the teacher and the student. On one hand, the teacher tries so hard to (i) think of the correct and proper English terminologies, and (ii) deliver the science content using a foreign language. On the other hand, the students are struggling to (i) make sense of the language presented to them, (ii) understand the science embedded in the language, and (iii) think of English words to express, respond to questions, activities or the school/national exams.

Conclusion

This study confirms that language difficulty exists in Year 7 science classroom in Samoa. Despite having well-documented policy, the research shows that the research participants faced many challenges. For students, the existence of language difficulties:

- prevents them from learning science effectively at primary level,
- causes more low achievement rates in science at primary level,
- creates more misunderstanding/misconceptions of scientific concepts at primary level,
- reduces the number opting for science in higher level,

For teachers, the existence of language difficulties:

- creates cognitive overload while thinking of appropriate terminologies to use,
- causes ineffective use of language and delivery styles,
- limits meaningful explanations of scientific concepts,
- restricts from employing effective teaching/learning strategies.

It is obvious from the study that language is the one of the most important aspects of science education. It is the key to communicating instructions and discussions on all aspects of science, in and out of the classroom. Without language, there is no science education. As a result, the implementation of science education as in this research investigation is considered very ineffective. This has impacts greatly upon our education system in a way that reduces the interests and perspectives of students and teachers in science. Basically, there seem to be no moving forward to the development of science in Samoa primary schools although, policies are in place and assistance for resources have been allocated.

The findings from this study also suggests that it is vital to consider professional development programs for teachers to in terms of language development. Ever since pre-colonization, colonization and post colonization of Samoa,

the influence of those western countries has impacted greatly not only upon the life but the education system in Samoa. One of those influences include the globalization of education, where English is the medium of instruction in formal education. Teachers therefore need to be equipped, strategically, academically as well as spiritually so that they are able to accommodate the needs of the students through science education. If the teachers (practitioners) are well versed with the language of instruction as well as the language of science, there is a possibility that science education become more meaningful and fun for all students in Year 7 in Samoa.

Acknowledgement

Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

Author contributions

The authors confirm contribution to the paper as follows: study conception and design: Faguele Suaalii. Tepatasi Gray. Author; data collection: Tepatasi Gray; analysis and interpretation of results: Faguele Suaalii. Tepatasi Gray; draft manuscript preparation: Faguele Suaalii. Tepatasi Gray. All authors reviewed the results and approved the final version of the manuscript.

References

1. Ramírez-Castañeda, V. (2020). Disadvantages in preparing and publishing scientific papers caused by the dominance of the English language in science: The case of Colombian researchers in biological sciences. https://doi.org/10.1371/journal.pone.0238372
2. Moore, F. M. (2007). Language in Science Education as a Gatekeeper to Learning, Teaching, and Professional Development. https://doi.org/10.1007/s10972-007-9040-0
3. Webb, P. (2010). Science Education and Literacy: Imperatives for the Developed and Developing World. https://doi.org/10.1126/science.1182596
4. Lee, O. (2001). Culture and language in science education: What do we know and what do we need to know? Journal of research in science teaching, 38(5), 499-501. https://doi.org/10.1002/tea.1015
5. Ministry of Education, Sports & Culture (2011). Samoa Primary School Curriculum: Science Years 1-8.
6. Brown, B. A., & Ryoo, K. (2008). Teaching science as a language: A "content-first" approach to science teaching. Journal of Research in Science Teaching, 45(5), 529-553. doi: 10.1002/tea.20255.
7. Mortimer, E., & Scott, P. (2003). Meaning making in secondary science classrooms. Berkshire: Open University Press.
8. Prophet, B., & Dow, P. B. (1994). Mother tongue language and concept development in science: A Botswana case study. https://doi.org/10.1080/07908319409525178
9. Huebner, T. (1989). Language and schooling in Western and American Samoa. https://doi.org/10.1111/j.1467-971x.1989.tb00435.x
10. Miqawati, A. H. (2022). Curriculum Adaptation in English Language Classroom. https://doi.org/10.25047/jeapco.v8i1.3880
11. Varghese, D. (2010). Science teachers' practices and the use of resource materials in teaching science in year eight classes in Samoa
12. Cummins, J. (1983). Bilingualism and special education: Program and pedagogical issues. *Learning Disability Quarterly*, 6(4), 373-386.
13. Creswell, J. W. (2007). Research design: Qualitative, quantitative and mixed methods approaches (2nd ed.). Thousand Oaks, CA: Sage.
14. Gwee S, & Saravanan, V (2018) Use of code-switching in multilingual content subject and language classrooms. *International Journal of Multilingualism*, 15(2), 117-134.
15. Ministry of Education Sports and Culture (2007) Education for all: Mid-decade assessment report, Samoa 2007. Apia, Samoa: Government of Samoa.
16. Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement. *Journal of public economics*, 95(7-8) 798-812.
17. Black, P., & Harrison C (2010) Formative assessment in science. *Good practice in science teaching: what research has to say*, 183-210.
18. Hawke A, Ed. UNICEF (2015) Fixing the Broken Promise of Education for All: Findings from the Global Initiative on Out-of-School Children.
19. Molbaek, M. (2018). Inclusive teaching strategies–dimensions and agendas. *International Journal of Inclusive Education*, 22(10), 1048-1061.
20. Hasan, M., Halder, U. K., & Debnath, D. (2018). Inclusive education and Education for all. *International Journal of Research and Analytical*, 5(3), 605-608.

21. Chin, C. (2007). Teacher questioning in science classrooms: Approaches that stimulate productive thinking. Journal of Research in Science Teaching, 44(6), 815-843. doi: 10.1002/tea.20171.

22. Asabere-Ameyaw, A., & Ayelsoma, S. J. (2012). Language proficiency and science learning. In A. Asabere-Ameyaw, G. S. Dei, K. Raheem & J. Anamuah-Mensah (Eds.), Contemporary Issues in African Sciences and Science Education (pp. 55-61): SensePublishers.

23. Gayle, A. B. (2000). Teaching science to English-as-second-language learners: Teaching, learning and assessment strategies for elementary ESL students. Department of Teaching, Learning and Teacher Education. Retrieved from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1018&context=teachlearnfacpub

24. Kim, T. L. S., & Wai, M. C. (2007). Language development strategies for the teaching of science in English. Learning Science and Mathematics, (2), 47-60. Retrieved from http://www.recsam.edu.my/lsm/2007/2007_4_TLSK.pdf

25. Johnstone, A. H., & Selepeng, D. (2001). A language problem revisited. Chemistry Education Research and Practice, 2(1), 19-29. doi: 10.1039/B0RP90028A

26. Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive load theory (Vol. 1). New York, NY: Springer

27. Boujaoude, S., & Attieh, M. (2008). The effect of using concept maps as study tools on achievement in chemistry. Eurasia Journal of Mathematics, Science & Technology Education, 4(3), 233-246.

28. Alshammari, S. R. (2022). Checking the Reliability of English as a Second Language Learners' Aptitude: The Use of Achievement Tests as Predictors. Arab World English Journal, 13 (2) 3-16. DOI: https://dx.doi.org/10.24093/awej/vol13no2.1

29. Motloung, A., Mavuru, L., & McNaught, C. (2021). Teachers' beliefs and practices when teaching life sciences using their second language. Education Association of South Africa, 41(Supplement 1), S1-S15. https://doi.org/10.15700/saje.v41ns1a2005

30. Puamau, P. (2005). Principles and processes of educational planning in the Pacific. In P. Puamau. & B. Teasdale. (Eds.), Educational planning in the Pacific: Principles and guidelines (pp. 24-44). Suva, Fiji: The University of the South Pacific.

31. Meleisea, M. (1987). The making of modern Samoa. Traditional authority and colonial administration in the modern history of Western Samoa. Suva, Fiji: Institute of Pacific Studies of the University of the South Pacific.

32. Driver, R., Asoko, H., Leach, J., Scott, P., & Mortimer, E. (1994). Constructing scientific knowledge in the classroom. Educational Researcher, 23(7), 5-12. doi: 10.3102/0013189x023007005.

33. Duit, R., & Treagust, D. F. (1998). Learning in science -- From behaviourism towards social constructivism and beyond. In B. J. Fraser. & K. G. Tobin. (Eds.), International Handbook of Science Education Part One. Dordrecht, The Netherlands: Kluwer Academic.

34. Cobb, P., & Bowers, J. (1999). Cognitive and situated learning perspectives in theory and practice. Educational Researcher, 28(2), 4-15. doi: 10.3102/0013189x028002004.

35. Merriam, S. B. (2009). Qualitative research: A guide to design and implementation. San Francisco, CA: Wiley and Sons.

36. Patton, M. Q. (2002). Qualitative research and evaluation methods (3rd ed.). Thousand Oaks, CA: Sage.

37. Hampden-Thomson, G., & Johnston, J. S. (2006). Variation in the relationship between nonschool factors and student achievement on international assessments. Retrieved from http://eprints.whiterose.ac.uk/72575/1/Non_school_factors.pdf

38. Strevens, P. (1972). Technical, Technological and Scientific English (TTSE). Retrieved from https://eric.ed.gov/?id=ED071460 on 06/06/2024.