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Abstract
The number of Science, Technology, Engineering, Mathematics (STEM) graduates has been increasing for years, yet the employment rate is still at a worrying level. The main reason for the unemployment rate among the graduates is a lack of English communication proficiency. Therefore, this paper discusses how far English language proficiency is essential for STEM learning and how to scaffold the learners' English competency in STEM. Document analysis was conducted to identify themes related to the aim. Based on the findings, vocabulary is an essential component for language learners. Some ways to scaffold English proficiency and competency in STEM are through relational thinking and straightforward methods, which are discussed in detail in this paper. This paper contributed to the field of STEM and ESL as an added value, whereby interdisciplinary research is possible. This paper enlightens the possibility of English for STEM as an important subject that could help graduates' future employability. Future research can look into creating modules integrating English with STEM as the first step in bridging the gap between the two disciplines. Researchers in both fields can look into the unexplored issues of STEM learners in preparing them for the future world.
Keywords: Communication, Competency, English as a Second Language (ESL), Science, Technology, Engineering, Mathematics (STEM), Vocabulary

Introduction

The STEM disciplines are cultures in which language and other ways of understanding the universe have developed to assist members in fulfilling their functions objectively and collectively (Lee & Stephens, 2020). STEM topics provide membership opportunities in societies of engineers, mathematicians, scientists, and other technical professionals and communities to conceptualize, interpret, analyze, and interact with the environment (Hoffman & Zollman, 2016). STEM students come from various choices of qualifications. Students can only learn the necessary new patterns of language and speech to learn STEM subjects through opportunities for participation in STEM disciplinary practices. Within STEM classes, the learning paths open to individual learners are shaped by the resources they are given to engage in STEM field activities and discourses (Hoffman & Zollman, 2016). In

Malaysian Education Blueprint 2013-2025, the focus on empowering STEM was clearly described as a constructive move to place Malaysia on par with other developed countries. There is a gap in limited research on the importance of mastering the English language for STEM education. Therefore, this paper discusses how far English language proficiency is important for STEM learning and how to scaffold their English competency in STEM. Undeniably, the number of Science graduates has been increasing, yet the employment rate is still at a worrying level (Jiea et al., 2019). Many Science graduates are jobless in Malaysia.

An article published by EduAdvisor on 26 August 2019 stated that over 290,000 students graduated from higher learning institutions each year. Unfortunately, 1 out of 5 graduates persists jobless with the mainstream existence degree holders. These graduates make up 55% of those who are without a job. Of 55% of unemployed graduates, 24.1% are from engineering, manufacturing, and construction degrees. Meanwhile, 11.3% of graduates are from the background of Science, Mathematics, and computing studies. Therefore, 35.4% of Science background students are unemployed in Malaysia. It has been found that the main reason for the unemployment rate among the graduates is due to a lack of English communication proficiency (Husin et al., 2016; Rafiq et al., 2019). Based on the Malaysian Education Blueprint (2015) report, specific surveys were conducted on workers in related industries to determine how students met their industrial needs. The recurring trend arising from these surveys was the shortage of English language skills among fresh graduates and employees (Hirsch, 2017; Rafiq et al.,, 2020).

Hence, there is a gap in limited research on the importance of mastering the English language for STEM education. Therefore, this paper would like to discuss how far English language proficiency is essential for STEM learning and how to scaffold their English competency in STEM.

Employability in STEM-related Field

Most employers expressed dissatisfaction with STEM students' conversation abilities (English, 2017). It ranged from failure in written and oral verbal exchange skills to presentational and other work-specific conversation competencies such as informal discussions, public speeches, and interviews. The problem is still emerging due to the lack of vocabulary for STEM presentations. The concept of English for Special Purposes (ESP) would obtain extra in engineering student education by concentrating on the learner's interest in the vocabulary and communication skills needed at the workplace (Mustafa, Nordin, & Embi, 2017). The qualities recognized by engineering students for English skills are fluency in the spoken language, fluency in written language, regional or national dialects, technical vocabulary, and scientific jargon (Rajprasit et al., 2015). Vocabulary information is an essential component for language learners since a constrained vocabulary in a second language hinders fruitful communication (Mofareh, 2015; Weng et al., 2016). According to Schmitt and McCarthy (1997), learners should carry dictionaries and not grammar books. It is evident from previous works that STEM vocabulary needs to be added in ESL to improve the students' presentation skills.

Vocabulary Development

People talk every day using terms and phrases that could have various definitions. To interact fluently with each other, people must have a standard comprehension of the meaning of the terms they use. Otherwise, the communication might fail to convey the actual definitions. Individuals who spoke utterly different languages might have great difficulty

communicating verbally because of the different words used for the same object. Communication clarification promotes communication, which may be the building block for greater comprehension, particularly in science and mathematics (Bicer et al., 2015). Vocabulary acquisition in science and mathematics classrooms is just like studying a foreign language. If students were exposed to a new term, they needed to teach the term and clarify its significance. Once this was achieved, the students could communicate with their peers and teachers meaningfully.

Developing a shared vocabulary within a topic is vital so that individuals can communicate with each other coherently and effectively. Developing vocabulary in the curriculum areas of mathematics and science was necessary for students to interact and appreciate more thoroughly the subjects they were studying (Bicer et al., 2015; Hatisaru et al., 2019). Vocabulary was also based on the previous vocabulary, with one term possibly reflecting a mechanism involving comprehension of different vocabulary terms with many other materials. For instance, the word "photosynthesis" reflected the mechanism of a plant generating energy from the sun, so it was essential to consider terms such as "chlorophyll," "organelles," and "chloroplasts" throughout that method. It is crucial to determine the best practices for teaching students vocabulary.

Achievement in fields of STEM education remains a barrier for many young learners. Such achievement gaps jeopardize the nation's science, economic, and manufacturing capabilities. Some of the frequently ignored fundamental qualities is a good understanding of STEM discipline-specific terminology. A robust and structured vocabulary is identified as a core component of success and retention in the STEM-based subject fields. Students will be motivated and embraced because they interact to understand mathematics and science and understand how to connect mathematically and scientifically (Li et al., 2019b).

The National Council of Teachers of Mathematics, USA (NCTM) has placed a renewed interest in developing effective mechanisms to increase access and equity in all classrooms of mathematics (Young et al., 2018). The Access and Equality Theory thus explicitly urges teachers to be more sensitive to students' contexts, views, cultural viewpoints, values, and expertise while planning and executing a mathematics curriculum and assessing its efficacy. Similarly, The National Council of Teachers of Mathematics, USA (NCTM) has continuously called for an expanded emphasis on mathematics academic vocabulary growth. Still, there is no information about creating STEM-specific vocabulary by teachers or even students in the different subject areas. There are very few tests, for example, for calculating just vocabulary comprehension in mathematics and the other regions of STEM material (Young et al., 2018).

Vocabulary Words/Phrases/Sentences Structure for Science

There are many ways to develop conceptual understanding in areas of STEM content, such as practicing the utilization of STEM vocabulary and modeling real life. Aside from that, conceptual maps or graphic organizers that often comply with general guidance for vocabulary creation in STEMS would be beneficial. The Basic Science vocabulary that every student needs to know from primary school is below. The students need to utilize the terminology in a natural dialogue with teachers and other students. Sometimes, students might find learning the concepts and the related language weird, but this could be done easily through a hands-on experiment. These terms are helpful when the students work with their science experiments at school. Table 1 shows vocabulary for the Science domain.

Table 1
Vocabularies for the Science domain

WORDS	DEFINITION	SENTENCES
Cause	Source of an action, phenomenon, or condition.	"The ball fell off here – what do you think was the cause for that?"
Data	A fact or data that is collected while conducting an experiment for references to analyze it.	"Let's collect some data so we can compare how far the ball travels on different ramp systems."
Effect	Transformative of a result or consequence of an action or other cause.	"I noticed that a little gap formed between it and the next one when you moved this ramp. I wonder what the effect will be on the ball when we try again?"
Experiment	A scientific procedure conducted to make a discovery, test a hypothesis or display a known fact.	"Now that we've created our hypothesis, what experiment can we create to test it?"
Hypothesis	An explanation based on limited evidence as an initial point for further investigation.	"What is your hypothesis for what will happen after putting the ball at the top of the ramp?"
Observation	The process of observing an experiment or process to gain information	"Tommy is going to test his hypothesis. Sara, why don't you and I make observations, so we can take notes and drawings of what happens!"
Pattern	A repeated method or design.	"I see that in your ramp system, there is one long, then one short, one long, and another short. What size ramp is next in this pattern?"
Predict	To say something about what will happen in the future.	"If I use the heavy ball instead of the light one, what do you predict will happen differently?"
Theory	a system of ideas intended to explain something, especially one based on general principles of the thing to be explained	"You think the ball will go up the ramp when we let go of it? That's an interesting theory. Why do you think that?"

Vocabulary Words/Phrases/Sentences Structure for Technology

In a field of work or profession, technical vocabulary is primarily words or phrases used. Many educational disciplines require to have an accurate perception of technical vocabulary. Regularly, a specialized vocabulary is rehashed interior the specialized content, showing its significance (Husin et al., 2016). The proficient utilization of a word can be understood better by looking up the complete definition of the word, with all its employments, in a proper English vocabulary. A few specialized expressions are utilized open air within the instructional exercise zone with small trade in meaning. Table 2 shows vocabulary for the technology domain.

Table 2
Vocabulary for the Technology domain

WORDS	MEANING
Access	Access means entering and using a computer, website, or application in IT.
Analyze	The verb to analyze is used repeatedly in IT when it is essential to carefully study data, information, or even a technical difficulty.
Back up	Back up is how we keep a copy of data and files to ensure that it is safe from the virus on the computer.
Blog	In IT blog usually refers to a website where we can share our personal experiences, interests, and opinion.
Boot	The verb to boot features a special meaning in IT. It is regularly used within the phrasal verb to boot up, which suggests turning on a computer and preparing it for use.
Browse	The word browse is used in IT to find out information informally without being too complete.
Connect	The verb connect is often used to describe the action to create contact with the Internet or other gadgets such as a monitor and modem.
Download	To download may be a verb you will frequently listen to in IT to talk around to exchange information or data from a primary computer source to another gadget.
File	In IT, the noun file refers to information organized under a specific name and gathering data stored in a computer's folder.
Install	Install means to set up or make a computer or application prepared for use.
Log in	To log in alludes to the method where you enter certain data sometime recently you are permitted to get to web site or application.
Monitor	The monitor refers to the video screen used to view data on the computer.
Network	A network is defined as a system that connects computers and other devices such as printers that interchange data. An isolated office network is identified as an intranet.
Perform	How fast a computer can process information is what we call performing in IT.
Upgrade	Upgrade means to make your computer up to date with the newest software or hardware.

Vocabulary Words/Phrases/Sentences Structure for Engineering

Below is a list of words frequently used by engineers and designers. Students should be encouraged to use these words when communicating with their project team, writing up reports, and presenting their findings. Table 3 shows vocabulary for the engineering domain.

Table 3
Vocabulary for the Engineering domain

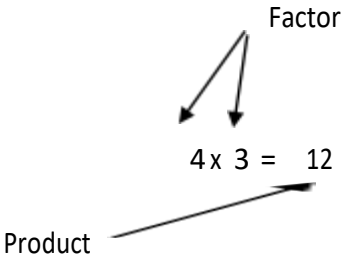
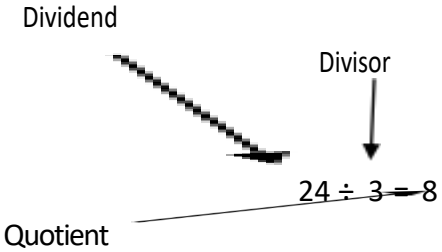
WORDS	MEANING
Accuracy	The quality of being near to the actual or desired value
Analysis	Breaking an object or process into smaller parts to examine or evaluate systematically
Argument	A persuasive defense for an explanation or solution based on evidence and reasoning
Assessment	An evaluation of the cost, quality, and/or ability of someone or something
Causation	The relationship between cause and effect
Claim	A response made to a question and in the process of answering that question
Communicate	To share information orally, in written form and/or graphically through various forms of media
Constraints	A limitation or condition that must be satisfied by design, including materials, cost, size, labor, etc
Design (v.)	To generate or to propose a possible solution; to create, fashion, execute or construct
Error	**Random Error** An unpredictable result from a consistent measurement process **Systematic Error** A predictable and consistent deviation from a value (actual or accepted) or a process
Evaluate	To determine significance
Function	A specific task that a system or part of a system performs or is intended to perform
Implication	A suggestion about or connection to a future outcome that is not stated directly
Inference	Forming an opinion based on known facts or evidence
Model	A diagram, replica, mathematical representation, analogy, or computer simulation is used to analyze a system for condition flaws, test a solution, visualize or refine a design, and/or communicate design features.
Plan (n.)	A systematic approach to solving a problem
Problem	A situation to be changed; a question raised for inquiry, consideration, or solution
Process	A series of steps that form a pathway to a solution
Prototype	A model that tests design performance
Reasoning	A logical, objective thought process based on data, information, and evidence to form a conclusion or judgment
Relevance	The capability of someone or something to help solve a problem
Reliability	The ability of a device, process, or system to perform an intended function without failure for a given time under specified operating conditions

Reproducibility	The consistent ability of a tool to reproduce the exact measurement on a system under the same conditions no matter who operates the tool
Requirements	What the design must do; may be used in place of criteria
Scale	The relationship between the size of an accurate representation of an object and the actual thing itself
Simulation	The use of a model to learn how a device, process, or system will behave
Specifications (Specs)	A detailed written record specific to the criteria needed to solve the problem; the technical information about "what" is required to solve the problem but not "how" to solve it
Test (v.)	To determine whether a design, model, process, system, or theory meets the criteria as a possible solution
Uncertainty	Quantifiable doubt about a measurement result
Variability	The extent to which data points differ from each other; how far apart or how close together

Vocabulary Words/Phrases/Sentences Structure for Mathematics

Math vocabulary knowledge is an essential component of learning maths. Students need to learn and use appropriate vocabulary to communicate math thinking clearly (Bay-Williams & Livers, 2009). If we want students to precisely using the language of mathematics, it is essential that we model suitable language in context, both orally and visually. Resources such as a math word wall and/or math vocabulary book may provide scaffolding for bridging the gap between unstructured math language and structured math jargon as students participate in mathematical discoveries and experiences (Bay-Williams & Livers, 2009). Providing students with a personal mathematical vocabulary book means that they have accessibility to the language they need to improve mathematical writing skills further regardless of where they are in college. Like a personal dictionary, these books allow differentiation as students could add to their book the words they need and have them easily accessible at any time. Table 4 shows vocabulary for the Mathematic domain.

Table 4
Vocabulary for the Mathematics Domain

WORDS/PHRASES	**EXPLANATION**
Factor – An amount that we will use multiplication to get another figure.	
Product – the result of multiplying two factors together	
Dividend – the amount that you want to divide up (the first number in the equation)	
Divisor – the number you divide by (the number of groups), (the second number in the equation	
Quotient – the result or answer to a division equation	
Equality - two numbers, expressions, or equations have the same value	8 = 8 3 + 5 = 8 3 + 5 = 4 + 4
Order of Operations – the rules that say which calculation comes first in an expression	Think: Please Excuse My Dear Aunt Sally P – parenthesis ( ) E – exponent x2 M – multiplication x D – division ÷ A – addition + S – subtraction -

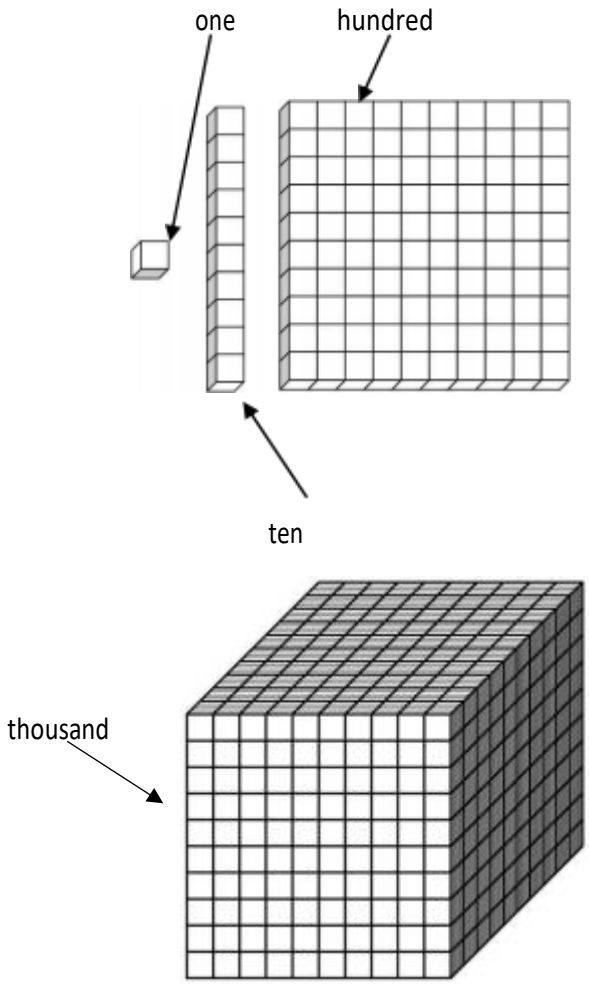
Base Ten – the decimal number system we use

One – single unit in the base ten system

Ten – a group of 10 in the base ten system

Hundred – a group of 100 in a base-ten system

Thousand – a group of 1,000 in a base to the system

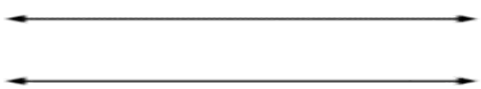


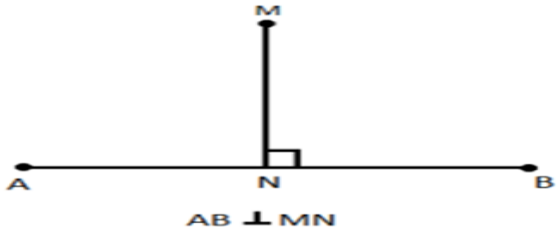
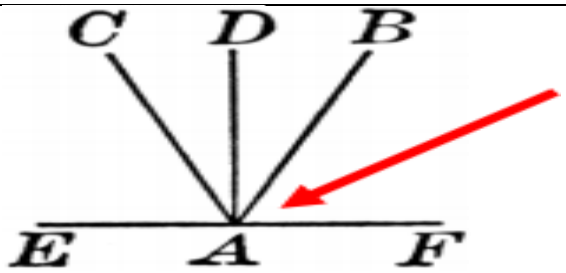
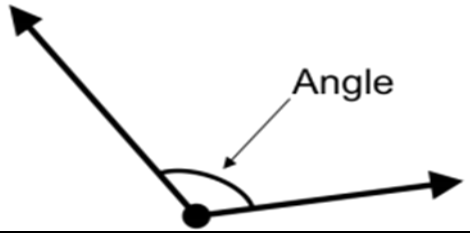
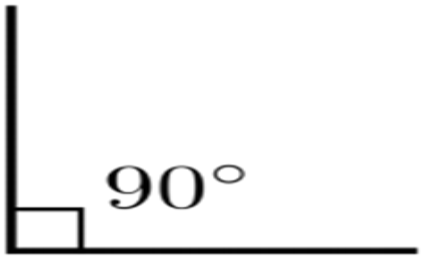
Period – each group of three digits separated by commas

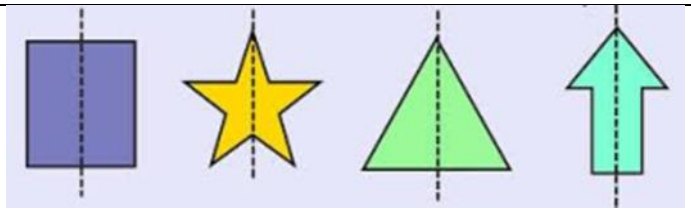
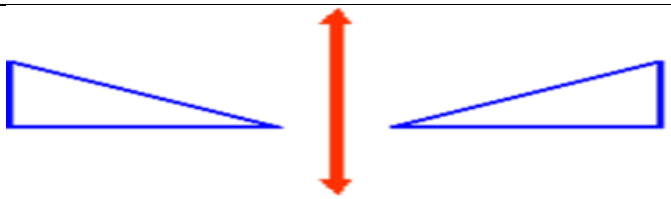
123,456,789

Millions	,	Thousands	,	Ones
123	,	456	,	789

Parallel Lines – two lines that never meet and are always the same distance apart



Perpendicular Lines – lines that intersect each other at a right angle, 90°	
Intersecting Lines – lines that cross each other; they have a common point	
Vertex – a point where two or more straight lines meet	 Point A is the vertex point of all the lines.
Angle – the amount of turn between two straight lines that have a common endpoint which is the vertex	
Right Angle – an angle whose measure is precisely 90°	
Fraction – an expression that represents part of a whole	

Symmetrical – one side is exactly like another if you flip, slide, or turn it	
Reflection – an image or shape as seen in a mirror looks as if it is flipped over a line of symmetry	

ESL in STEM Education

Learning STEM subjects involves learning support to use the discourse structures in which information is introduced and addressed in each field of study. It is necessary to note that the curriculum studied in STEM subjects cannot be isolated from the language with which the material is delivered (Husin et al., 2016; Li et al., 2019a). There is no language-free material; language application constantly poses approximate material, and maximum content demonstrations involve some use of language, even with multiple modal meaning-making tools. This language knowledge means students must engage in STEM contexts and events to learn the language of STEM subjects. Perhaps it is most evident that language differs by content. Learning STEM subjects includes broadening the meaning-making ability of students by language. To interact effectively with instructional learning, students must expand their repertoire of language abilities acquired throughout the initial years of education and explore in what way language is used to create sense, address concepts, convey knowledge, build value and construct detailed texts across disciplines (Husin et al., 2016). ESL learners will not be able to get the STEM subject region targets or writings without understanding the specialized vocabulary inside each category. In this manner, content-area instructors and ESL instructors need to work together in instructing STEM vocabularies.

The English language is vital for enhancing educational accomplishment by elevating conversational capacity and may never be overemphasized. Students who have problems in their English communication often experience difficulties learning science and mathematics in English. When students' English language ability is good, it will eventually influence the educational performance of such students overall (Rafiq & Hashim, 2018). Nevertheless, when the students' English proficiency is lacking in any academic setting, it will profoundly affect their overall academic performance. According to Adegboye (1993), the absence of proficiency in English is one of the issues donating to negative performance in Science and Mathematics. It is proven in a research conducted by Aina et al. (2013) that competency in English considerably determines academic performance. The revelation above seems to be that mastery of the English language is much significant even in students' academic performances, mainly when it comes to the subjects of Science and Technical, which entails the acquisition of skills mainly in laboratory and workshops.

Scaffolding STEM Learners' English Language Competency

Studies have proposed many curriculum models for mathematics and science to allow students to transcend the obstacles to learning modern, content-specific vocabulary. Two specific definitions for teaching approaches to improve the vocabulary of science and

mathematics have been defined for this review. The first strategy was on relational thinking, and the second centered on more straightforward methods. Contextual teaching approaches help students experience the mechanisms and acts that required students to construct a visual picture beyond the language. Using a relational mathematical teaching model, Miller and Gildea (1987) enabled students to consider how mathematical terms were used in a mathematical context. Contextual learning could help students develop images of the meanings of the word and thus create a deeper understanding of the term. Several specific imaging-based approaches may help students create visual representations of the scientific terms being presented, making it easier to remember and recognize the definitions of the related vocabulary words.

According to Monroe and Orme (2002), neither conceptual nor direct vocabulary teaching alone was adequate for students to establish a mathematical vocabulary. Still, these two methods of instruction would complement one another. Inside a lecture, language would be deliberately incorporated so that analytical thinking was not trumped by merely memorizing new terms (Bay-Williams & Livers, 2009) using the best accessible tools. In conclusion, the perspective is that the best way of teaching vocabulary is to combine direct and contextual learning. Specific instruction concentrated on fewer hands-on in-class interactions than relational learning and demanded that students participate in non-traditional education. Vacca and Vacca (1996) indicated a need to teach essential mathematical terms by direct guidance. Science vocabulary teaching methods have included using text cards, word lists, graphic organizers, and word games. In learning new vocabulary, establishing a good vocabulary basis at a young age and continuing to foster new vocabulary mastery through literacy-based interventions could be beneficial (Cohen, 2012).

Teachers help pupils construct language competencies every day when they inquire about questions and facilitate conversations. STEM explorations are a notable setting for developing children's lexicon. As they interact in STEM activities, teens do what scientists and engineers do—they observe, investigate, inquire about questions, measure, plan, and build—as they do, they can utilize the identical vocabulary that scientists and engineers use. Teachers can motivate this language improvement through the STEM lexicon in daily interactions with pupils in the classrooms. Some of the ways to practice STEM vocabularies in classrooms are as follows:

- Model STEM vocabulary utilization (e.g*., let us check it out; let us do an experiment; let's see what Nicole does; you've expected the flashlight to slide*).
- The label acts for kids. Point out when children observe, predict, interact, analyze, build, prepare, examine, create, illustrate, use, solve a problem, and communicate with their senses (e.g., *Claudio puts a leaf in the water. Do you predict it is going to sink or float? Observe what is going to happen*).
- Incorporate vocabulary with STEM before, during, and after events. The more kids hear the words, the better they know what the word means and can use them themselves.
- Access digital capitals and tools to simplify STEM vocabulary achievement.
- Learn vocabulary over the modeling of real-life situations. Organize virtual experiments, mini-experiments, virtual field trips, and real-life makeover situations.
- Practice graphic organizers or i-Thinks that produce meaning and understanding. Have students rehearse labeling and create diagrams of vocabulary concepts. These tools help practice cause-and-effect relationships.

- Assist students in making ESL STEM mini dictionaries of the lesson terms. Make them draw or paste a picture of the word's meaning, write the part of speech, create a list of synonyms, write the definition of the word, use the word in a general sentence, and then use the word in a STEM-focused sentence.
- The use of videos and interactive resources online and on mobile apps would be beneficial to guide vocabulary understanding.

Besides, STEM-related activities can be conducted through fun learning materials such as crossword puzzles, word searches, and digital vocabulary word cards. STEM vocabulary should be taught in subjects to make it more meaningful and understandable. Studies have shown that children would learn a language at best if it is taught in meaningful contexts of practical use and that for young learners in school, the meaningful contexts are based on the subjects' matter. As has been examined, language plays an essential part in STEM education. The language of science is exceedingly complex and requires students' accurate understanding of exceptionally specialized vocabulary to carry out a common logical assignment. In past research by Crowther et al (2011), he discussed The Blended or Tiered Approach. It is the consideration that students have a precise understanding of the specialized vocabulary required to carry out logical assignments. In the paper, the Blended or Tiered Lexicon approach was expressed in terms of the 5E (Engagement, Investigation, Clarification, Elaboration, and Assessment) lesson plan.

The blended or tiered vocabulary approach has been categorized into a three-tier framework. The primary level comprises 8000-word families that include little or no directions in school, which may be named procured vocabulary. The next level contains 7000 high-frequency word families utilized in educational settings. Lastly, level 3 has words with an awful recurrence that are often restricted to particular spaces and considered highly academic and content-based. It can be seen that the three-tiered gathering of vocabulary may be a promising direction for instructors in science classrooms. The approach was practical and appeared as a measurable design in students' learning and maintaining level 3 vocabulary. Recently formalizing instructive vocabulary has helped the students transition from ordinary language to scientific language, utilizing stage one and two terms.

Conclusion

In conclusion, this paper would like to discuss how far English language proficiency is essential for STEM learning and how to scaffold the learners' English competency in STEM. Vocabulary is a crucial factor in language, communication, and education. When pupils understand and use words such as comparing, predicting, planning, investigating, designing, and observing, it helps them engage more utterly in STEM learning, increasing their overall vocabulary. Learners gradually learn phrases as they hear and use words in distinctive contexts. They continually deepen their grasp of phrases in parallel with associated concepts. Thus, learning STEM vocabularies in ESL classrooms is essential to expand understanding, especially when it comes to new knowledge.

Throughout the research, using a common language to communicate is unavoidable. While English has achieved its reputation without a genuinely democratic process, having a standard communication mode allows for a wider reach and more profound understanding that eventually leads to scientific progress. English as a science and technology language will continue as the world moves towards the Industrial Revolution 4.0. The entire community is encouraged to focus more on English and Science, Technology, Engineering, and Mathematics (STEM) education in schools to equip students to be better prepared for the future.

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