UNIVERSIDADE FEDERAL DO CEARÁ
CENTRO DE HUMANIDADES
DEPARTAMENTO DE ESTUDOS DA LÍNGUA INGLESA, SUAS LITERATURAS E TRADUÇÃO
CURSO DE GRADUAÇAO EM LÍNGUA INGLESA

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WHAT ARE THE POSSIBLE BENEFITS AND CHALLENGES OF INTEGRATING STEAM IN ESL CLASSES?

FORTALEZA
2024

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Trabalho de Conclusão de Curso apresentado como parte dos requisitos para obtenção do título de Licenciatura, junto ao Curso de Graduação em Letras Inglês da Universidade Federal do Ceará, Campus de Fortaleza.

Orientadora: Profa. Dra. Lídia Amélia de Barros Cardoso.

FORTALEZA

2024

Dados Internacionais de Catalogação na Publicação
Universidade Federal do Ceará
Sistema de Bibliotecas
Gerada automaticamente pelo módulo Catalog, mediante os dados fornecidos pelo(a) autor(a)

S238w Santos, Rúbia Cavalcante dos.
What are the possible benefits and challenges of integrating STEAM in ESL classes? / Rúbia Cavalcante dos Santos. – 2024.
24 f. : il. color.

Trabalho de Conclusão de Curso (graduação) – Universidade Federal do Ceará, Centro de Humanidades, Curso de Letras (Inglês), Fortaleza, 2024.
Orientação: Prof. Dr. Lídia Amélia de Barros Cardoso.

1. STEAM. I. Título.

CDD 420

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Trabalho de Conclusão de Curso (TCC) apresentado ao curso de Letras Inglês do Departamento de Estudos da Língua Inglesa, suas Literaturas e Tradução da Universidade Federal do Ceará, como requisito parcial à obtenção do título de licenciado em Letras-Inglês.

Aprovada em: 25/09/2024.

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AGRADECIMENTOS

O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001

À Profa. Dra. Lídia Amélia de Barros Cardoso, pela excelente orientação e valiosas sugestões.

Aos professores participantes da Banca Examinadora, Diana Costa Fortier Silva e José Aires de Castro Filho, pela atenção dedicada à minha pesquisa.

Aos colegas da turma de graduação, pelas trocas de experiência e apoio mútuo.

À minha mãe e irmã, por sempre terem me motivado e acreditado em mim.

Ao meu amado companheiro, por todo incentivo e apoio.

A mim mesma, por nunca desistir apesar dos desafios ao longo dos anos.

ABSTRACT

This research explores the integration of the STEAM approach into English as a Second Language (ESL) teaching in a public school in Fortaleza, Ceará. The study, conducted under the Residência Pedagógica Program at the Federal University of Ceará, aimed to evaluate the effectiveness of STEAM in enhancing critical thinking, collaboration, engagement, and creativity among sixth-grade students. Over three months, ten interdisciplinary lessons combining Art, Science, and Mathematics with English were implemented. Pre- and post-project questionnaires were administered to assess changes in students' perceptions of English. The findings suggest that STEAM approach not only supports language acquisition but also aligns with the educational goals outlined in Brazil's BNCC, fostering a more inclusive, student-centered learning environment. This study contributes to the understanding of how STEAM can be practically and effectively integrated into ESL classrooms, particularly within the public education system, and reflects on the challenges and successes encountered during the implementation process.

Keywords: STEAM; ESL; language teaching; residência pedagógica

RESUMO

Esta pesquisa explora a integração da abordagem STEAM no ensino de Inglês como Segunda Língua (ESL) em uma escola pública em Fortaleza, Ceará. O estudo, conduzido no âmbito do Programa de Residência Pedagógica da Universidade Federal do Ceará, teve como objetivo avaliar a eficácia da abordagem STEAM em aprimorar o pensamento crítico, a colaboração, o engajamento e a criatividade entre alunos do sexto ano. Ao longo de três meses, foram implementadas dez aulas interdisciplinares que combinaram Arte, Ciência e Matemática com o ensino de Inglês. Questionários pré e pós-projeto foram aplicados para avaliar as mudanças nas percepções dos estudantes em relação ao Inglês. Os resultados sugerem que o STEAM não apenas apoia a aquisição da língua, mas também se alinha aos objetivos educacionais estabelecidos na BNCC do Brasil, promovendo um ambiente de aprendizagem mais inclusivo e centrado no aluno. Este estudo contribui para a compreensão de como o STEAM pode ser integrado de forma prática e eficaz nas aulas de ESL, especialmente no sistema público de ensino, e reflete sobre os desafios e benefícios encontrados durante o processo de implementação.

Palavras-chave: STEAM; ESL; ensino de línguas; residência pedagógica

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1 INTRODUCTION

The pursuit of an education that allows students to play an investigative role is not recent, nor can it be solely attributed to active methodologies. This integrated movement has been happening for over a century, and there are many educators, thinkers, and researchers who have dedicated themselves to rethinking the learning process, aiming not only to transmit concepts but also to develop critical thinking and other skills.

Meanwhile, in Brazil, there is a constant concern regarding the comprehensive education of students. Among the main goals of the Common National Curriculum Base (BNCC), for example, are the stimulation of critical thinking, the promotion of citizenship, and the formation of autonomous individuals capable of dealing with challenges and demands of the contemporary world, both locally and globally.

However, one of the greatest challenges in realizing these expectations is finding ways that are efficient in practice. When we think about accuracy, it makes sense that language teaching is also linked to the teaching of norms, structure, and grammatical aspects of the language in question, as they also play an important role. However, when we think about a teaching-learning process where the student, even without mastering the necessary grammatical rules to communicate with confidence, can also interact through the language, we envision a much more inclusive teaching approach, with its focus entirely on the needs of the student.

According to Paulo Freire (1996), "Teaching is not about transferring knowledge, but about creating the possibilities for its own production or construction." It makes a lot of sense, then, that in a classroom, the second language is used as a medium of instruction, providing a meaningful context in which the student can relate it to their individual and social experiences, while at the same time fostering their analytical and creative abilities.

In this regard, STEAM education appears to hold considerable promise in the field of second language acquisition, as it can contribute to addressing contemporary challenges. This approach facilitates the envisioning of an educational paradigm that, without abandoning academic excellence, also develops important competencies such as creativity, critical thinking, communication, and collaboration.

This research proposal was reporting my experience as an ESL pre service teacher in a project that integrated STEAM into the English classes of a public school in Fortaleza-Ceará. This project was developed through the Residência Pedagógica Program, in a partnership between CAPES and the Federal University of Ceará. The objective of this research was to

analyze whether STEAM approach can improve ESL students' performance in terms of strengthening their critical thinking, collaboration, engagement and creativity.

In order to obtain these data, this research had four objectives: 01. To design lessons integrating STEAM in the English classes 02. To survey the students regarding their perception of the project and in relation to the discipline (English). 03. To identify the achievements and challenges from my perspective as a Pre service English teacher.

2 RATIONALE

It is primarily in the importation of models that STEAM has been paving its way. Many educational technology companies have been creating products around the STEAM movement, taking advantage of the boom it is experiencing abroad and the opportunities that are still to come in Brazil. (BACICH; HOLANDA, 2020)

One difficulty that the STEAM education movement imposes on schools with fewer resources is the dissemination of the (false) idea that implementing STEAM is only possible in schools with more financial resources. The STEAM approach does not depend solely on robotics devices, 3D printers, and other expensive technologies with high maintenance costs. It is possible to develop STEAM activities using more accessible resources.

In Brazil, it is interesting to note an escalation in the STEAM movement in the public schools, primarily through partnerships between schools and education departments. However, it is important to highlight that this is still far from being fully incorporated into state policies, as is the case in the United States and Australia, for example.

In this sense, despite the promising proposal of integrate STEAM in ESL classes, the study conducted to develop this research revealed a lack of clarity on how STEAM can be implemented in the classroom, as well as reports on the potential challenges and benefits of using this approach in English language lessons, specifically in the public sector of basic education in Brazil.

Given the above, the research here proposed aimed to report my experience as a Pre service teacher while developing a project applying the STEAM approach in the English classes in a public school in Fortaleza-CE, through the Residência Pedagógica Program at Federal University of Ceará.

3 LITERATURE REVIEW

This chapter aims to contextualize and define the STEAM approach, highlighting its relevance and applicability in English as a Second Language (ESL) teaching. Initially, the chapter will present various definitions of the STEAM concept, with a primary reference to the book "STEAM em Sala de Aula" by Lilian Bacich and Leandro Holanda. Subsequently, a connection between STEAM and ESL learning will be established, drawing on theoretical references to demonstrate how these two areas are aligned.

3.1 What is STEAM?

During the study conducted to write this research proposal, various definitions related to the STEAM approach were found. To obtain a more precise definition, the book "STEAM em sala de aula" written by Lilian Bacich and Leandro Holanda will be used as a reference.

This term, originated as “STEM” in the United States by combining the initials of the fields of Science, Technology, Engineering, and Mathematics, is currently considered an educational movement adopted in many educational systems around the world, adapted to the social, cultural, and educational specificities of each locality. Over time, it has been realized that the integration of arts in the educational context also plays a significant role in the development of skills and competencies that are essential in the 21st century, such as creativity, imagination, critical thinking, artistic expression, and interdisciplinary approaches.

The integration of the five disciplines mentioned above in English classes values multidisciplinarity in the classroom, allowing a context in which students can use real-world issues and their previous knowledge, aiming for an education that also develops important skills such as creativity, critical thinking, communication and collaboration (BACICH; HOLANDA, 2020).

One of the strengths of STEAM lies in transdisciplinarity, that is, the connection of different areas of knowledge. However, this connection should be understood beyond these areas. According to Vasquez, Sneider and Comer (2013), When we talk about STEAM in education, there is no single, specific methodology for promoting the integration of the acronym's constituent areas. This approach is not a curriculum; it is a way of organizing and promoting learning. It is not something that can be added through an activity, but rather activities that will help students see relevance in what they learn.

When considering this approach to structuring and promoting learning, it becomes apparent that many STEAM activities consist of brief challenges aimed at fostering

construction, where students are invited to apply their knowledge in the areas involved in the acronym to develop a solution, typically focused on a real-world context.

3.2 STEAM and ESL learning

It is important to mention that no single methodology or strategy can transform education. However, language teaching methodologies have generally accepted the notion that language teaching is more effective when learners are presented with meaningful language in context, and the integration of ESL learning with curriculum content is now broadly accepted as supportive of second language learning. (SHORT, 1998).

Teaching a language is a complex task which needs to be centered in the learner's perspective. Halliday suggests that, "first, the learner must 'experience' the language being used in meaningful ways, either in its spoken or written form; and secondly, the learner must himself have the opportunity of performing, of trying out his own skills, of making mistakes and being corrected" (HALLIDAY, 1964).

According to Halliday, one way to develop basic language skills is by "experiencing" them, that is, encountering them in use in real situations and associating certain activities, people, or topics with the foreign language. This happens when the foreign language is also the medium of instruction (HALLIDAY, 1964).

In this way, it becomes evident that considering prior knowledge and the reality that students are inserted in an ESL classroom is a factor that benefits learning, as it makes it more intuitive and familiar. Involving students in a meaningful context using language as an intermediary can make the class more dynamic, as the focus is not just the language or the teacher, but also the students' own life experience and interests.

Furthermore, to further increase engagement and encourage the use of the language in an ESL classroom, it is necessary to provide subsidies and alternatives that enable interactions and attempts on the part of the student. In this context, in addition to working on what students already know, one of the instructional supports that the teacher can use is to provide scaffolding for the needs and tasks that students are not yet able to accomplish on their own. According to Gibbons (2002), "Learners need to be engaged with authentic and cognitively challenging learning tasks."

> From a language-teaching perspective, then, the curriculum can be seen as providing authentic contexts for the development of subject-specific genres and registers (…) Prior knowledge or familiarity with a topic greatly facilitates language comprehension and language learning. (GIBBONS, 2002, p. 119)

In this sense, the proposal of STEAM in English teaching is promising as it enables students to have a more comprehensive education, in which they can acquire language skills while exploring concepts and practical applications related to science, technology, engineering, arts, and mathematics. Furthermore, it aligns with the foundations of the BNCC, which advocates for more engaging and relevant learning, preparing students to face real-world challenges that require STEAM competencies and English communication skills.

4 MATERIALS AND METHODS

To conduct the research, prior to the implementation of the STEAM project, a questionnaire was applied for 33 students from the 6th grade of a public middle school located in Fortaleza-CE. The questionnaire served as data collection on their opinions regarding the English subject and the classes, and consisted of 7 likert scale questions. At the end of the project, the same questionnaire was applied to assess students' perception after the STEAM project.

To design the English lessons incorporating the STEAM approach, three primary disciplines were selected: Art, Science, and Mathematics. A total of ten lessons were developed. The classes were conducted over a period of three months, with each session lasting 1 hour and 30 minutes per week. For the didactic sequencing, the additional disciplines to be integrated into the English lessons were introduced sequentially, starting with Art, followed by Science, and concluding with Mathematics. This interdisciplinary approach facilitated the teaching of English grammar and vocabulary, covering topics such as parts of the house, prepositions of place, the usage of "there is/there are," healthy and unhealthy diets, the five food groups, telling time, and numbers. Detailed lesson plans integrating each of these disciplines are provided in Appendices B, C, and D.

Additionally, notes were taken during the project classes and, in the end, the achievements and challenges of the experience with the STEAM approach were presented, from my perspective as the pre service teacher.

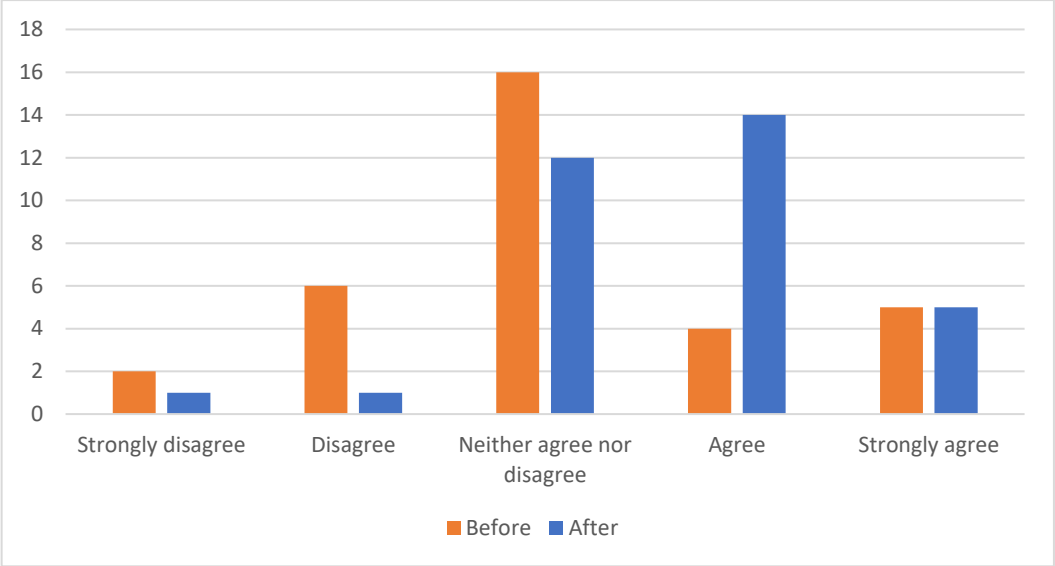
5 FINDINGS

In this section, we present the results of the questionnaire applied to a group of 33 participants. The questionnaire contained 7 questions designed to assess students’ perception of the English discipline both prior to and following the implementation of the STEAM project. The results

are illustrated through graphs that depict students' responses before and after the STEAM intervention, providing a comparative analysis of their perceptions over time.

Question 1: Are you satisfied with your performance in the English subject?

Graph 1: Responses to question number 1

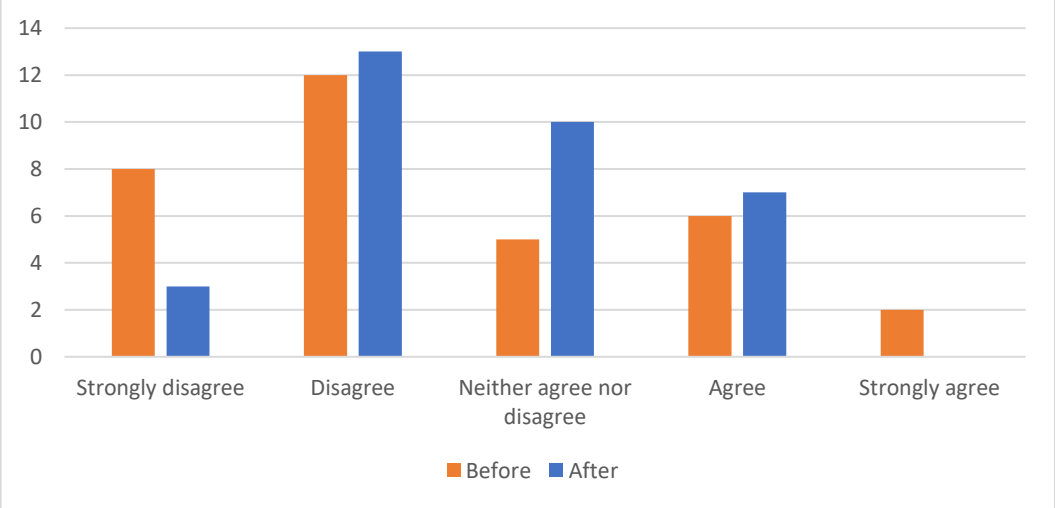


Source: Field Research (2023)

Evidently, there was an increase in the number of students satisfied with their performance in English after the project's implementation, as indicated by 19 students who agreed or strongly agreed with this statement.

Question 2: Do you think studying English is more difficult than studying other subjects?

Graph 2: Responses to question number 1

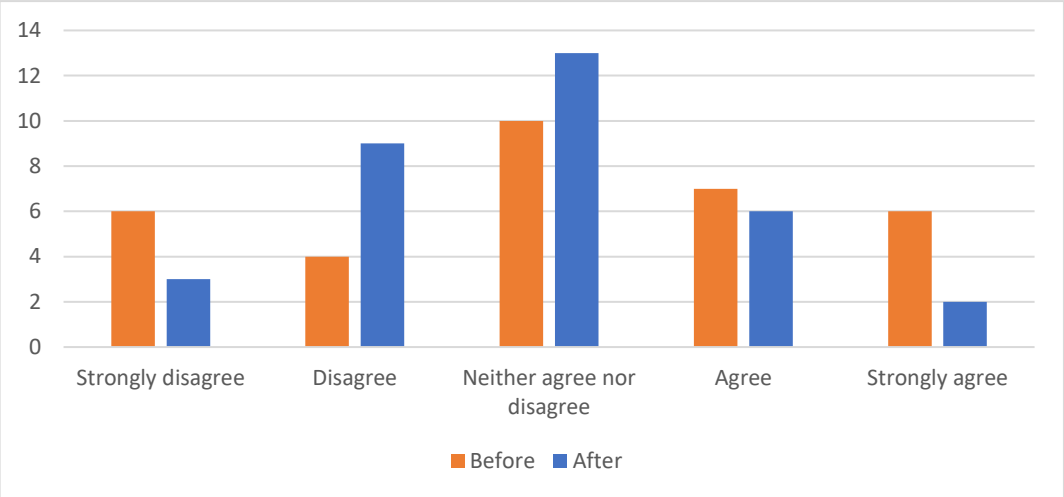


Source: Field Research (2023)

It can be stated that, after the project, a significant number of students still agreed or remained neutral regarding their satisfaction (15). However, it is important to highlight that no student strongly agreed with the statement after the completion of the project.

Question 3: Do you find English classes difficult to understand?

Graph 3: Responses to question number 3

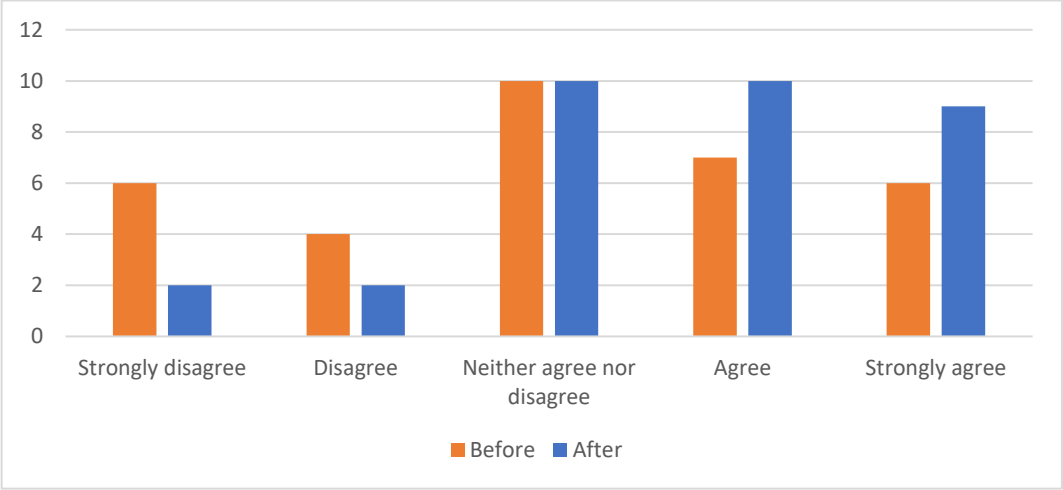


Source: Field Research (2023)

An increase in the number of students who disagreed with the statement was observed, while the number of students who agreed or strongly agreed decreased.

Question 4: Do English classes allow you to actively participate?

Graph 4: Responses to question number 4

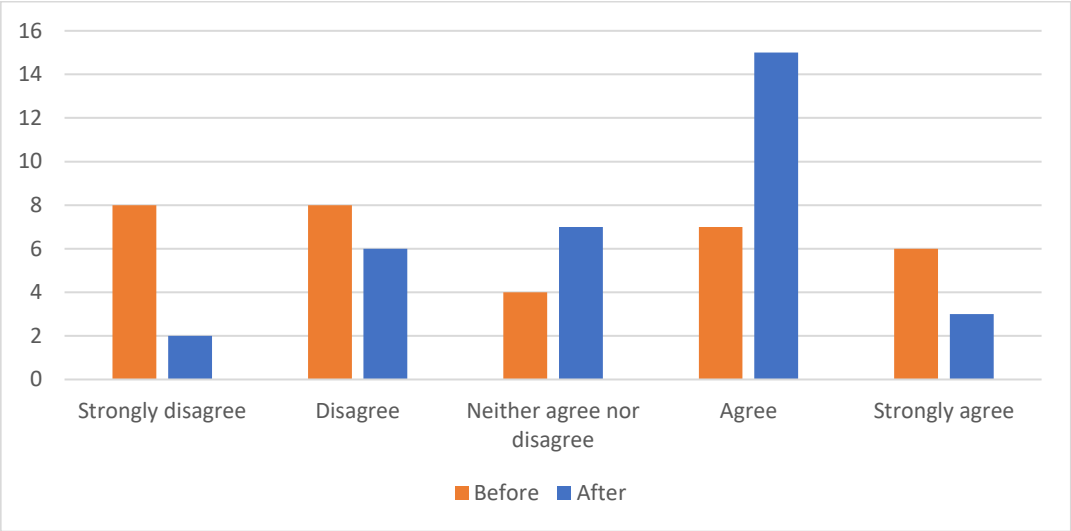


Source: Field Research (2023)

After the project's implementation, a significant number of students (19) agreed or strongly agreed that the classes allowed their active participation.

Question 5: Do you think English classes relate to your reality?

Graph 5: Responses to question number 5

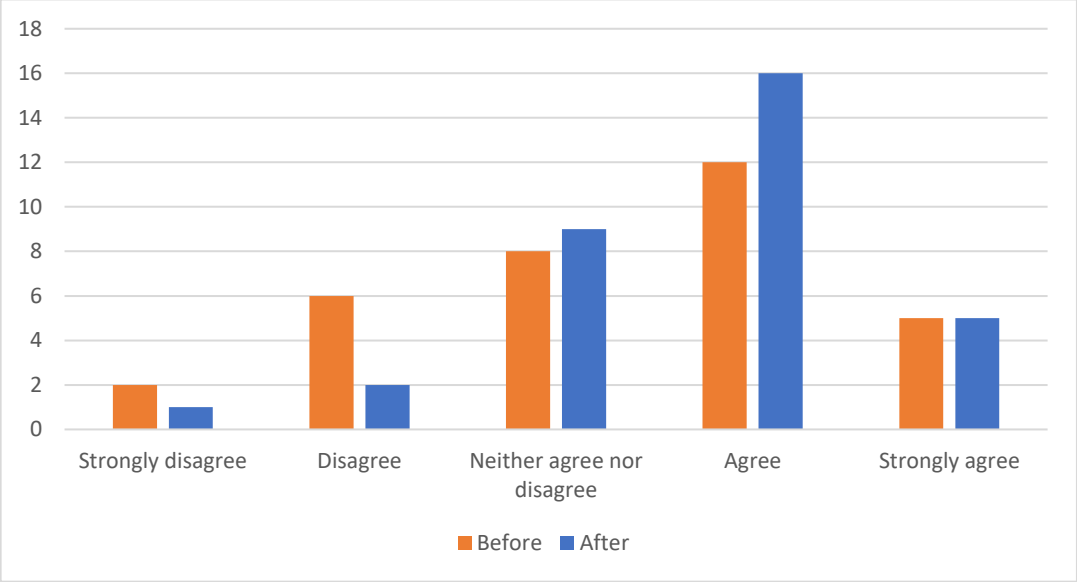


Source: Field Research (2023)

The number of students who agreed or strongly agreed that the classes relate to their reality (18) increased significantly after the project.

Question 6: Do you think English classes encourage your creativity?

Graph 6: Responses to question number 6

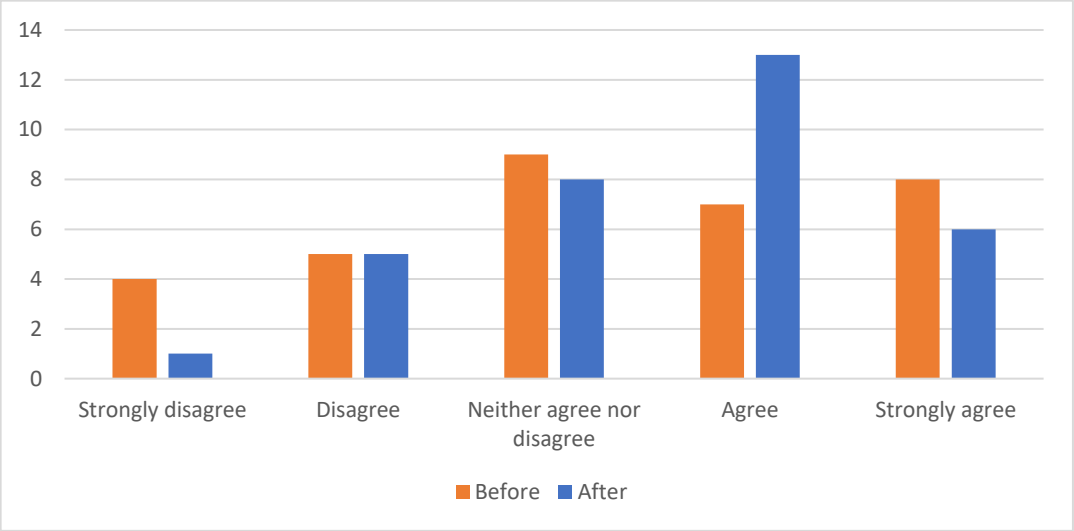


Source: Field Research (2023)

The number of students who agreed that the classes encourage their creativity (16) increased after the project.

Question 7: Do you think English classes encourage your critical thinking?

Graph 7: Responses to question number 7



Source: Field Research (2023)

After the project, there was an increase in the number of students who agreed that the classes encourage critical thinking. Moreover, fewer students strongly disagreed with this statement.

6 DISCUSSION

It can be inferred that, following the implementation of the project, students generally demonstrated greater satisfaction with their performance in the subject, indicating that the classes facilitated active participation. This observation was evident not only in the questionnaire results but also throughout the development of the project. The STEAM approach enabled students to express themselves actively, encouraging interaction during lessons and the practice of English language skills. The use of technology and group activities, characteristic of this approach, also resulted in more effective participation during English classes.

Notably, fewer students found the classes difficult to understand. Relating English language teaching to topics with which students were already familiar allowed for a more intuitive learning experience. Furthermore, the application of the Scaffolding method provided

the necessary support for students to engage in discussions, obtaining the input needed to begin using and understanding the English language.

Another relevant point is that students agreed that the classes were more connected to their realities, which was one of the main expectations of this project. It is believed that by considering students' experiences and prior knowledge, the English language teaching and learning process became more engaging for them, inviting them to share their different perspectives and also discuss topics common to all. The STEAM approach aims primarily to provide a context in which language serves as a medium for learning or discussion, rather than merely being the object of study. In this sense, the integration of disciplines and the teaching of the English language through the approach proposed in this research allowed for a range of engaging discussions and activities for students.

Another pillar of the STEAM approach is the stimulation of students' creativity and critical thinking during the teaching-learning process. It can be inferred that this objective was achieved during the project's implementation, as a significant number of students agreed that during the intervention project, creativity and critical thinking were stimulated.

Students, in general, still consider English more difficult to study compared to other subjects, which is understandable when analyzing the context in which they are situated. Firstly, English is a foreign language in Brazil, and any foreign language tends to seem difficult until one begins to study and engage with it. Secondly, in Brazil, English language teaching in public schools is introduced only from the 6th grade, meaning that this was the first time students had English classes in school, unlike other subjects with which they were already familiar. Thirdly, some students simply have more affinity or interest in other subjects, highlighting the motivational factor in learning.

In summary, this project highlighted several benefits in terms of increased student participation and interest in English classes, as well as the stimulation of creativity and critical thinking. Although the evaluation of English language acquisition was not the focus of this research, it is noteworthy that through the STEAM approach and the proposed activities, students utilized all four English language skills, with an emphasis on listening and speaking, unlike traditional classes where reading and writing are the focus.

Among the challenges of this project, classroom management stands out, as in a large class, student participation must be conducted in an organized and democratic manner, requiring the teacher to master techniques to capture students' attention and include them in activities.

Finally, an important consideration for future research and projects aiming to implement the STEAM approach in English language teaching is the development of educational materials that combine the integration of disciplines and propose activities using resources attainable in the context of a public school. Teacher training through courses and workshops is also of utmost importance to understand this approach, its objectives, and how to apply it effectively.

7 FINAL CONSIDERATIONS

The pursuit of an education that aligns with the realities and challenges of its time is an ongoing concern, and in this regard, we will always have something to learn from the contributions of scholars in the vast field of teaching and learning. Over the years, various pedagogical approaches have been proposed with the aim of enhancing the quality of education and making learning more meaningful for students.

As highlighted in this work, the teaching of foreign languages, in particular, can be significantly enriched through its integration with other areas of knowledge. The STEAM approach seeks to achieve this integration effectively, providing the necessary support for conducting more engaging classes that stimulate students' creativity and critical thinking—crucial elements in the process of acquiring a second language. This approach not only facilitates the understanding and practical use of the foreign language but also makes learning more contextualized and relevant to students.

Moreover, the development of future research on the application of the STEAM approach in foreign language teaching, as well as its classroom practice and the proper training of teachers in this methodology, is essential. Further exploration in this field can contribute to the creation of innovative pedagogical strategies that meet the demands of contemporary education, better preparing students for the challenges of an increasingly globalized and interconnected world.

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APPENDICES

APPENDIX A: Survey Questionnaire

Para cada pergunta abaixo, circule a resposta que melhor descreve como você se sente, no qual:

1 – Discordo totalmente 2 – Discordo 3 – Nem discordo nem concordo 4 – Concordo 5 – Concordo totalmente

		Discordo totalmente	Discordo	Nem discordo nem concordo	Concordo	Concordo totalmente
1.	Você está satisfeito com seu desempenho na disciplina?	1	2	3	4	5
2.	Você acha que estudar inglês é mais difícil que estudar para outras matérias?	1	2	3	4	5
3.	Você acha difícil de entender as aulas de inglês?	1	2	3	4	5
4.	As aulas de inglês possibilitam que você participe ativamente?	1	2	3	4	5
5.	Você acha que as aulas de inglês se relacionam com a sua realidade?	1	2	3	4	5

6. Você acha que as aulas de inglês estimulam sua criatividade?	1	2	3	4	5
7. Você acha que as aulas de inglês estimulam seu pensamento crítico?	1	2	3	4	5

APPENDIX B – Lesson plan integrating Art

Lesson title: Parts of the house

Grade Level: 6th grade

Subject: English and Art

Objectives: Students will be able to name different parts of the house. Students will develop a drawing project of their dream houses.

Materials needed: Projector, A4 paper (per student), pencil and colored pencils (per student).

Timing: 1h30min

Greetings and attendance (10 minutes)

Warm-up (5 minutes): Ask students if they know the difference between house and home. Explain that house is the physical place you live, it can be a small or a big house. Home is also where you live, but it has an emotional connection, where you feel that you belong, that you feel safe.

Introduction (15 minutes): Tell them that we are going to make a tour in the Simpsons' house today. Play the video. After the video, ask them if they already knew all the rooms in the Simpsons' house. Elicit the name of the parts of the house in English and interact with them by asking: How many bedrooms there are in the Simpsons' house? How many bathrooms?

Quizz (15 minutes): Check students' understanding through a quizz. Divide them in three groups and start an online quizz. Students should guess the right name of the part of the house.

Activity (25 minutes): Students should draw the plant of their dream house in a sheet of paper, adding details, colors and writing the name of the part of the house in English. Let them work individually and provide help if necessary.

Closure (20 minutes): Check the activity. Conduct a show and tell. Students must show their work to the class and describe the house saying the parts of the house in English.

APPENDIX C – Lesson plan integrating Science

Lesson title: Healthy and Unhealthy diet

Grade Level: 6th grade

Subject: English and Science

Objectives: Students will be able to name some healthy and unhealthy food. Students will develop a drawing project in groups.

Materials needed: Projector, poster board (per group), pencil and colored pencils (per student).

Timing: 1h30min

Greetings and attendance (10 minutes)

Warm-up (5 minutes): Ask students if they remember what healthy and unhealthy means. Brainstorm some healthy and unhealthy food. Ask them to give you some examples and write on the board as they do it.

Introduction (20 minutes): Review the 5 food groups through an online quizz. Divide students in 4 groups and review the 5 food groups: Proteins, grains, fruits, vegetables and diaries.

Activity (35 minutes): In the same groups, students should make a table or a pyramid categorizing the 5 food groups. They should draw examples of foods from each group and write their names in English. Give them some time and provide help if necessary

Closure (20 minutes): Check the activity. Divide the tables into stations and tell students that we are going to visit each work one by one. Invite students to follow you through each station and ask each group to describe what they drew.

APPENDIX D – Lesson plan integrating Mathematics

Lesson title: How to tell time

Grade Level: 6th grade

Subject: English and Mathematics

Objectives: Students will be able to tell time in English. Students will use an online analog clock to talk about their daily routine.

Materials needed: Projector

Timing: 1h30min

Greetings and attendance (10 minutes)

Warm-up (10 minutes): Ask students if they know the difference between an analogical and digital clock. Explain the difference by drawing an example of each one the board. Check if they know how to tell time in an analog clock. Draw an example on the board and teach them what a small and big hand is and what they indicate.

Introduction (20 minutes): Project an interactive analog clock on the board. Tell students that when it is a precise hour we use the expression "o'clock". Use the analog clock to exemplify. Draw a pizza next to the clock and show students how they both have the same shape. Use the pizza analogy to teach them what "a quarter" and "a half" means. Then, explain the difference between" a quarter past" and "a quarter to". Also teach when to use "and a half". Check students understanding by using the analog clock and asking them "What time is it?".

Activity (30 minutes): Tell students we are going to use the analog clock to share our daily routine. Ask them to think about what time they get up, have breakfast, go to school, have lunch, etc. Invite students, one by one, to use the analog clock to share what time they do these things.

Closure (20 minutes): Students will use this time to answer the questionnaire about their perception after the STEAM project.