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FOSTERING LANGUAGE AND LITERACY THROUGH STREAM EDUCATION: INTEGRATING READING INTO INTERDISCIPLINARY LEARNING

Damyana Grancharova
South-West University "Neofit Rilski", Bulgaria

Abstract. Language education with the combination of STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) can be extremely effective due to its interdisciplinary nature which allows students to connect and communicate using different literacy approaches. STREAM-oriented education not only aligns with traditional STEM methodologies but also highlights the role that reading plays in the learners of the 21st-century challenges. This paper focuses on collaborative projects in the STREAM area that help to develop the linguistic and communicative abilities of students. It presents solution models informed by literature-based problem-solving and digital technologies, gaining on insights from recent theoretical perspectives. At the same time, the article argues that STREAM, through foreign language teaching, can be a tool for bringing deeper engagement and acquisition of essential skills across disciplines.

Keywords: STREAM education; literacy integration; interdisciplinary learning; language skills

Introduction

The changing pattern of education made integration of the disciplines of greatest importance. Modern education demands knowledge that enables the students to face challenges from multiple sides. The application of the STREAM system which represents Science, Technology, Reading, Engineering, Arts, and Mathematics, besides extending STEM and STEAM structures, aims to integrate *Reading*, to the forefront of interdisciplinary education (Yoh et al., 2021). It endorses skills development in problem solving, organizing ideas, team working, and, in addition, developing students' communication, reading, and critical thinking (Mohsen et al., 2025).

STREAM education is also a response to the global need to have educational programs that enhance the scientific minds and the linguistic abilities of the students. Such an approach can be used in various ways, for example, as it provides students with the means to express their thoughts and solve problems besides learning how to communicate and spread information in a clear and simple way (Sun and Zhong,

2024). In the multilingual context of foreign language learning, STREAM aims at providing opportunities for academic language assets with real, project-based activities. Moreover, STREAM is an unbiased, all-around, approach to education which benefits diverse learners through the engagement of creativity, collaboration, and communication (Sabeghi and Rahimi, 2024).

This paper is an effort to discuss STREAM educational benefits through language and literacy development. Based on the latest theoretical and empirical studies, we would like to demonstrate the ways in which interdisciplinary STREAM projects can be used as efficient tools for developing foreign language proficiency, literacy skills, and cross-curricular competencies.

Employing STREAM education in language learning is founded on several theoretical perspectives which are constructivism, sociocultural theory, and metacognitive learning. From the perspective of constructivism, that envisions the learners not as passive receptors but as a designer of their own knowledge by engaging in a social process of reflecting and transforming their mental models through active exploration and interaction. In the case of STREAM projects, students may be required to conduct inquiry-based tasks by which they read, synthesize, and articulate information in ways that are directly applicable to real contexts (Toma, Yáñez-Pérez and Meneses-Villagrá, 2024). Learners do not simply consume content but instead interact with texts, make use of the collaborative tasks with their peers, and demonstrate understanding using models, posters, digital presentations, and written reports (Nguyen, Sivapalan and Hiep, 2021).

Sociocultural theory, specifically Vygotsky's concept of the Zone of Proximal Development (ZPD), highlights the importance of social interaction transdisciplinary problems, negotiating meaning, and assist and encourage each other's development. Language serves as a tool to convey; thus, learning is a collaborative process, especially when students take part in scientific discourse, peer feedback, and presentations (Badmus and Omosewo, 2020).

Another significant aspect of STREAM education is the development of metacognition, that is, the awareness and the control of all cognitive processes. STREAM tasks require the students to logically sequence, coherently express, and reflect on their understanding of the material and the language they use (Șuteu et al., 2024). Reflexive journal writing, group examination, and iterative project updates are some of the strategies that are frequently employed to support the learners in taking the lead in their own learning and literacy growth.

The implementation is aligned with the CLIL (Content and Language Integrated Learning) framework that prioritizes dual-focused learning goals, i.e., gaining knowledge in relating subjects while obtaining language skills simultaneously (Pérez-Cañado, 2020). STREAM, as an example is the natural environment of CLIL where students do tasks that require not only understanding of subjects but also effective communication, especially in foreign language settings. The foundation of STREAM

on constructivist, sociocultural, and metacognitive theories provides a powerful base for improving language and literacy development in today's classrooms.

Literacy, Language, and Reading in STREAM Education

Reading as one of the elements of STREAM, is a way to blend literacy into the science curriculum. This notion is constructed in such a way that literacy is seen as a complete element of the process. STREAM education is a more integrated approach where science and art skills are developed at the same time as literacy skills. Students can develop their language skills through the process of projects while they write research reports and prepare presentations of their findings. At the same time, the use of literacy will be related to the situations of life, which will make reading and writing alive and more tangible for students (Sun and Zhong, 2024).

Being bound by the STREAM framework, reading is not just a straightforward way of getting information, but it involves both analysis and synthesis of the critical data. The things taught in class help the students identify the information, understand the data, and make the right assumptions comprehensively. This reflects the role of critical thinking which is necessary for the new-age learning approach of solving problems and creating innovative thoughts (Șuteu et al., 2024).

Communication is the backbone of all activities carried out in STREAM projects and demonstrates the significance of skills. The learners not only reveal their language skills but also display their ability to develop interpersonal and cultural skills. On the other hand, utilizing arts also supports the idea of being able to involve students in creative and innovative ways of relaying thoughts and ideas to other students (Sabeghi and Rahimi, 2024). Working on interdisciplinary projects allows practicing the foreign language in different domains, so learners' active vocabulary increases. By integrating STEAM principles such as reading and languages, the STREAM model enriches the educational experience by nurturing literacy in addition to providing technical and creative skills. As a result of the process, students can not only handle but also contribute to a set of problems connected to the different parts of the world in a more effective way.

Benefits of Integrating STREAM into Language Education

The STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) framework is dedicated to building language abilities from different angles. The transformation of language learning through digital literacy arises from the fact that digital technology is a must in every STREAM project. It helps students to develop digital literacy skills besides traditional literacy skills. A good example of such practice is that students used popular software and online platforms at schools to improve their navigation and critical assessment skills. This ability is critical to the world where digital literacy is the essence of good communication and reports.

STREAM education's cross-disciplinary nature meets various learning styles and capacities to generate inclusiveness. The immersion of arts and reading allows students to stretch beyond their limits, which makes STEAM subjects easier to understand for every student in the process of making education more accessible. This mechanism gives the nod to various types of intelligence and thus provides an environment of inclusion where everybody can succeed. The inclusion of these subjects is what makes the students more inquisitive and gives a reason for learning beyond their traditional classrooms. Along with this, students gradually acquire the skills of critical thinking and problem-solving developing a growth mindset that helps them cope with their ever-changing society (Sánchez Milara and Cortés Orduña, 2024).

Intelligent uniting of STREAM in the language classroom is only possible with careful forethought and execution. A curriculum that integrates STREAM parts with language aims in such a way that the outcome is a coherent learning experience. For instance, a module on environmental science may involve reading scientific articles, writing the reports, and creating artistic representations of data, thus incorporating all STREAM elements. This technique language learning is meaningful based on environmental phenomena thus learners become more engaged and their retention of what they learn is improved. The introduction of digital learning tools like simulations, coding platforms, and collaborative software could be other means of improving the learning process. For instance, pupils may use programming languages to develop interesting stories or games combining coding and narrative skills (Chen, Lasecki and Dong, 2020).

Project-Based Learning (PBL) is a learning strategy that involves students то work on a long-term project, creating final products or presentations. Combining STREAM themes with PBL gives students the opportunity to take a closer look at scientific concepts while working on other language skills reinforcing the different language components. For example, students may come up with a design for a green community, which may require to engage in the skills of researching (reading), writing a proposal (writing), group discussions (speaking), and delivering presentations (listening and speaking). This hybrid model of teaching integrates language learning within valuable content (Chen, Lasecki and Dong, 2020). Group discussions served as fuel for the development of oral language, while in turn, presentations to the peers and parents boosted the public speaking skills. This form of guidance converted abstract concepts into reality and use of language to practical end (Sánchez Milara and Cortés Orduña, 2024).

While the high school students were immersing themselves in environmental research projects, they inquired into local ecological troubles. They did field research, analyzed data and put together reports. The increased need to understand scientific texts, synthesize information, and express the findings both in oral and written forms besides raised their academic language proficiency substantially. This authentic application of the learned skills to the actual world further underlined to the students

the significance of their learning. The mission to implement STREAM projects confronts some inherent difficulties: Successful realization of STREAM projects requires good background equipment, the latest gadgets and devices. Schools are expected to maintain equal resource supplies to each student, so that there are no learning disparities between them. Addressing these problems needs careful setting of the objectives and cooperation of the community (Chen, Lasecki and Dong, 2020).

In some cases, teachers may need specific professional development courses to teach both STREAM and language to students. First of all, the training should mainly concentrate on the teaching of subjects within the framework of multidisciplinary and use of technical devices. The bottom line, need for teachers with the skills and the confidence to innovate, which is a precondition for an effective implementation (Sánchez Milara and Cortés Orduña, 2024).

Traditional evaluation methods might not demonstrate the full extent of students' achievements in a cross-curricular project. Furthermore, composing rubrics that consider students' understanding of the content and analyzing language competence is pivotal. The recommendations in terms of accurate and fair evaluations that provide the real characters of the projects are given (Chen, Lasecki and Dong, 2020).

STREAM Education, the Development of 21st-Century Competencies and Multilingualism

STREAM education is beneficial as it sets the stage for the development of vital 21st-century competencies such as critical thinking, creativity, collaboration, communication, digital literacy, and adaptability. These are not only indispensable skills for academic success but also the striking features of modern workplaces reformed by the boom of technology and the change in culture (Pérez-Cañado 2020; Toma, Yáñez-Pérez and Meneses-Villagrá, 2024).

The open-ended, hands-on approach of STREAM education pushes students to think from different perspectives when posed with complex and real-world challenges. For example, the solution of a problem like city pollution may require certain activities such as the collection of scientific data (Science), the preparation of infographics (Arts), the coding of interactive maps (Technology/Engineering), and the writing of explanatory reports (Reading/Writing). This is when students can develop their skills and become multifaceted by creating a strong base of competencies in more than one area at once (Sun and Zhong, 2024).

In addition to this, STREAM is designed to teach the student to think about the problems in real life, considering all the interconnected factors. The system's approach is a powerful support for deeper learning that makes students be more active as world citizens in a world shaped by creativity and technology (Yoh et al., 2021). Alongside the collaboration on various STREAM projects, students practice managing roles, resolving conflicts, and presenting effective information - abilities that are closely connected to communication and team-based problem-solving.

STREAM is not just a teaching model, but a new learning principle that is shaped by the skills needed in the dynamic 21st century. What is truly amazing about the approach to STREAM in the context of language education is its natural affinity with multilingual environments. Activities of STREAM can become a real-life, content-laden environment in which the students can learn and use a foreign language for a clear and relevant purpose. However, instead of learning the language in isolation, the learners are getting acquainted with vocabulary, syntax, and discourse structures within scientific inquiry, artistic exploration, and collaborative dialogue (Sabeghi and Rahimi 2024; Badmus and Omosewo, 2020).

STREAM is particularly valuable in CLIL (Content and Language Integrated Learning) cases, when STREAM gives the raw material and examples to teach learners how to handle the academic language in a certain context. For instance, a student has to compose a lab report not in his/her mother tongue but in the foreign language and consequently, the student has to be accurate not only with grammatical but also scientific terminology, embed passive constructions properly, and establish logical sequences – language functions that of course are part of STREAM assignments (Pérez-Cañado, 2020).

Additionally, STREAM enhances translanguaging practices and helps students to use their entire linguistic knowledge base instead of using only one language even in completing complex cognitive tasks. In this case, students have the choice of performing tasks in foreign languages during the lesson. It is the variety of language use which makes this a true reflection of the real world, and which also simultaneously promotes the notion of being multilingual in the global context. Thus, the fact that STREAM places an emphasis on the arts and reading contributes to cultural immersion and narrative expression and, as a result, provides students with the opportunity to form meaningful connections between themselves and the academic content. This, therefore, would make the program an accelerator of not only foreign language proficiency but also intercultural competence, and multilingualism in the classrooms (Șuteu et al., 2024).

Experiment and Research: Analyzing Literacy Development through Selected Physics Lessons

In order to deepen the discussion on the integration of reading and literacy development within STREAM education, it is essential to explore how authentic instructional materials foster interdisciplinary competencies. For this purpose, a focused analysis was conducted on all of the exercises included in the student's textbook "Physics and Astronomy for 9th Grade" (Publishing House: Anubis). We found six exercises in six different lessons from the type "Read the text and answer the questions" – out of a total of 44 lessons. This section provides an evaluative attitude on the adequacy and reach of these exercises to encourage literacy skills in a STREAM context.

Each of the six exercises contains a scientific text that requires students to read it and then answer the few questions based on the content. The tasks are aiming to bring the reading literacy into the physics curriculum which directly corresponds with the main theme of STREAM – the "Reading" part. Students get to read either scientific descriptions or explanations of the concepts (with a given specific subject from Newton's Laws, heat phenomena, light, or celestial observations) and then respond to the questions.

The exercises make a substantial impact in terms of literacy development by fostering numerous key skills:

– *Reading Comprehension in Scientific Contexts*: Students are expected to read the exercises, use the scientific information from the texts, and comprehend the natural science phenomena linked to real-world situations.

– *Critical Thinking and Application*: A few of the problems require students not just to remember facts but to involve themselves in the direct situation, and to give examples, provide descriptions in their own words to develop critical thinking.

– *Vocabulary Acquisition*: The familiarization with words likes "inertia," "gravitational force," "reflection," and "celestial bodies," which are part of the specialized language, will enable students to have clear communication and comprehension of ideas in the fields of science and technology.

Looking at STREM literacy skills, these tasks are a good starting point for students. Nevertheless, prospects exist for further and much more intertwined development of the areas. The readings are mostly brief and focused on giving the main ideas of a subject. The texts are open-ended on scientific issues, historical studies, complex phenomena that can give deeper analytical thinking and motivate multi-disciplinary engagement. This will support the STREAM focus on critical inquiry and problem-solving. The questions, which are already effective in terms of comprehension and application, could be further strengthened by including tasks that challenge students to construct arguments, compare scientific models, or critically evaluate experimental methods. Moreover, the addition of collaborative communication skills - an integral part of STREAM – could be realized through the organization of more group activities, peer discussions, and oral presentations connected to the reading assignments. These strategies will develop the students' ability to work in groups, negotiate meaning, and communicate scientific information effectively.

Incorporating reading tasks into physics courses is compelling proof of the growing importance of reading literacy in science education. Moreover, they offer a foundation for deepen, broaden, student-centered STREAM activities. For example, a lesson on optics could be extended including project-based approach where students design optical tools (engineering), develop representations of light phenomena (arts), and create informational brochures for students' audiences (reading and communication), hence holistically enhance literacy across STREAM dimensions.

In order to fully take the literacy development for the STREAM, numerous improvements can be proposed.

– *More Challenging Reading Assignments*: Including interesting texts, such as scientific case studies, different stories, or contemporary situations to adopt in-depth understanding and the ability to critically discuss the issues.

– *Relationships between subjects*: Creating stronger connections between the content of natural science subjects and the latest technology, environmental topics, engineering applications, and different art forms.

– *Team Projects*: Making tasks that involve group work, writing a common paper, or team presentations, and thus, will help students to improve their language and interpersonal skills.

– *Real-Life Situations*: Placing reading activities with open-ended problems that need research, formulating hypotheses and conducting experiments, indicating the realities of scientific inquiry.

Conclusion

In summary, the selected exercises from *Physics and Astronomy for 9th Grade* can be characterized as an effective model for the initial introduction of reading in science. These activities represent a rich reading and language entrance to the world of science since they activate the development of various competencies like understanding the scientific texts, remembering vocabulary, critical analysis, and communication - all of these are essential for the successful implementation of STREAM. Through blending the basics with other subjects of common interest and involving students in inquiry and collaborative work, educators can achieve a better fit of the goals of STREAM education and classroom practices. STREAM is beyond educational strategies; it is a model based on sustainability and an inclusive community that helps students use language as a tool for inquiry, innovation, and global communication. By adopting creativity, critical thinking, and important cross-disciplinary learning, STREAM fosters a new generation of learners trained to succeed in an interconnected world.

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✉ **Dr. Damyana Grancharova, Chief Assist. Prof.**
ORCID iD: 0000-0002-4465-4511
South-West University "Neofit Rilski"
Blagoevgrad, Bulgaria
E-mail: damyanat@yahoo.com