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Picking Up STEAM: The Role of Languages and Linguistics

Abstract

Languages and linguistics are powerful skills that enhance STEAM curricula and careers. A variety of approaches and methods to language teaching and learning inform educators how to proceed with the enhancement of STEAM programs. Linguistics, the science of language, can help STEAM students, especially within the science and mathematics components, because of its reliance on hypothesis formulation for scientific inquiry and data collection and analysis. Language, an important aspect of the human experience, elevates or picks up the STEAM experience.

Keywords

STEAM, curriculum, languages, linguistics, interdisciplinary learning

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Picking Up STEAM: The Role of Languages and Linguistics

Keith Mason

Introduction

Languages and linguistics can play an important role in STEAM. They can elevate the study of the disciplines within the STEAM umbrella that stands for Science, Technology, Engineering, Arts and Mathematics. The "A" was added to the original STEM concept because it was believed that the arts added a helpful component (cf. Sousa & Pilecki, 2018). Because language is such an important part of the human experience, we can emphasize its importance in conjunction with STEAM.

School-based language study is elected by a minority of U.S. students. Only 20 percent of U.S. students study a world language due to teacher shortages (Mitchell, 2017). Despite this fact, students interested in STEAM can enhance their learning by pursuing the study of languages and linguistics. Indeed, this article's title implies that language and linguistics can elevate or pick up the overall STEAM experience. This article addresses both language study and linguistics as complementary to STEAM. It presents the logistics of various approaches and methods in language teaching and learning for STEAM learners. The discussion then turns to linguistics and how the science of language is complementary to STEAM.

It is important to clarify that an individual who knows two or more languages is not necessarily a linguist but a polyglot. And individuals who are well versed in linguistics, the science of language, are not always proficient in another language. Nevertheless, both proficiency in other languages and an understanding of linguistics can both enhance the preparation of STEAM students.

Languages to Pick Up STEAM

An understanding of applied linguistics and the various language teaching and learning approaches and methods can inform STEAM educators of options to pursue. As a language teaching methodologist, I have seen a variety of ways to treat languages in the curriculum. Within foreign language pedagogy and applied linguistics, there exist numerous approaches and methods to language teaching and learning. Richards & Rodgers (2001) provides an overview of the most popular approaches and methods that include grammar-translation, audiolingual, suggestopedia, community language learning, total physical response, the natural approach, communicative language teaching, the silent way, the multiple intelligences, cooperative language learning, content-based instruction and task-based language teaching.

While communicative language teaching has been popular for the past few decades, and is often supported by methodologists, others have adhered to additional tenets including proficiency-oriented instruction (cf. Omaggio Hadley, 2001), standards-based instruction and technology-driven instruction.

Because STEAM is an umbrella term that represents five main disciplines, we may discount other disciplines that are complementary in nature, often known as cognate courses or distribution requirements. Languages and linguistics can be considered part of this group. These encourage interdisciplinary learning, providing a bridge between STEAM content courses and language.

When we are studying a specific discipline, we often benefit from learning other disciplines. It is precisely the goal of this article to show how language study and linguistics can

complement the STEAM curriculum. Indeed, Barack (2018) has observed that STEAM can be utilized in various subjects such as Spanish or business.

Types of language that benefit students or career opportunities include being able to read STEAM-related articles and books in their original language and the ability to communicate fluently and proficiently in the language in all four skill areas of listening, speaking, reading and writing. Culture is also considered an important component of language learning, and also has a role in STEAM.

Within applied linguistics, an entire subfield known as languages for specific purposes exists. This focuses on designing courses to meet the needs of a particular population. For example, Spanish for medical or legal professionals (Author 1991; Author 1992), French for the legal professions, German for business, etc. It is possible to design specific sections of basic language courses to enhance STEAM student learning and can be continued to intermediate and advanced levels. Ultimately, we can encourage language learning in students who show verbal-linguistic intelligence as outlined by Howard Gardner in his Multiple Intelligences theory (Gardner, 1993) or what was referred to previously as language aptitude

General ideas about language learning are outlined in Author (2019A). The discussion is divided into several categories including language in the curriculum, foreign language curricular issues and considerations, course selection and requirements, second language acquisition, individual needs and curriculum. Habits of Mind are 16 dispositions that assist individuals with life and school challenges. Author (2019B) outlines ways that the habits encourage language learning.

The following outlines options for languages in general and ones tied to STEAM content:

Traditional language courses: Certainly, it is true that students can study traditional offerings of languages that promote all four language skills and culture. This can serve as a base for students to branch out and be able to handle STEAM in the target language. Courses from introductory to Advanced Placement are ideal to encourage proficiency in the language.

Special interest sections of traditional language courses: In order to target a language course to STEAM, language methodologists can design courses with input from STEAM instructors. This would mainly involve vocabulary, thematic units or modules, readings and projects that promote STEAM themes.

Online options: Students can learn a language online, especially in school districts or colleges that may not offer certain languages.

Thematic learning: Supported within language education as well as in Understanding by Design (UbD) (Wiggins & McTighe, 2005), courses can be designed to promote STEAM themes within comprehensive thematic units.

Independent studies: Students can work under the direction of a faculty member to bridge language and STEAM. Content would be chosen that teaches the language while also supporting the five STEAM areas.

Heritage language learners: Some of our students learn a language from their families within their homes. It would be helpful for these heritage learners to maintain their family's language and bridge it to STEAM content.

Language for academic purposes: Courses within applied linguistics are designed to promote academics by tailoring courses. Language can be used as a social means of communicating but

this can be limited. By elevating language to academic levels, it enables students to handle studies at a more challenging level.

Content-based instruction: Students can learn content in the target language. Courses are designed to combine content and language proficiency. Canadian programs featuring French/English immersion can help inform content-based instruction.

Project-based learning: Students who are assigned projects can utilize languages as they research so that their projects are of high quality and at higher levels.

Reading knowledge courses: The ability to read in another language enables students to conduct research and learn from sources not written in their native language. Courses designed for reading knowledge are found in some colleges and universities for students who must attain a reading proficiency for a degree requirement.

Upon reviewing the options above, you may discover that more than one option is feasible within your school. For example, students can choose to study a language that your school does not offer by opting for an online course. Students can take an independent study if their schedule does not allow a spot for language study while some students may double up by taking two languages at the same time. Language options invite collaboration with world language faculty members. Moving beyond language study, the next section explores linguistics for the STEAM student.

Linguistics: The Science of Language

Linguistics is the scientific study of language. General linguistics is usually comprised of four main branches: phonology (sounds), morphology (word formation), syntax (word order and grammar) and semantics (meaning). Other subdisciplines of linguistics have developed over the

years including applied linguistics, psycholinguistics, sociolinguistics, anthropological linguistics, computational linguistics, historical linguistics and others. While linguistics has usually been offered at the undergraduate and graduate levels in colleges, more recently, high schools have begun to introduce linguistics. Linguistics can be offered as a separate course or incorporated into already existing courses. It is worth considering linguistics courses as part of a STEAM program because of the scientific nature of linguistics.

Loosen (2014) describes a linguistics course elective that substitutes for a regular language arts requirement in a Milwaukee high school. She describes the motivation behind the idea and the logistics of implementation. Author (in review) argues for ways to implement high school linguistics not only as a separate offering but also into other already offered subjects. This plays up linguistics in the curriculum so that students can handle an AP course and can continue linguistics at the college level if so desired. Topics addressed include general and specialized linguistics, ideas for implementing linguistics, logistics of linguistics in the curriculum, linguistics integrated into several school subjects and curricular considerations. Subjects in which linguistics may be integrated include family and consumer sciences, language arts, mathematics, music, performing arts, physical and health education, psychology, science, social studies, STEM/STEAM, visual arts and world languages.

A more recent proposal sponsored by the Linguistic Society of America is to offer Advanced Placement: Linguistics. For example, Larson, Denham & Lobeck (2019) describes the initiative and how they recommend its implementation. Their main points include why linguistics should be a school subject, linguistics as a uniquely effective medium for STEM education, linguistics to support new career choices, school-university collaboration and linguistics for high school advanced placement. The authors maintain that UbD is the framework

that the College Board uses for all its AP courses. In a similar vein, Plackowski (in press) describes how to develop a high school linguistics course using UbD. She includes key UbD components such as essential questions, enduring understandings, transfer goals, evidence of student understanding and learning experiences. Assessment is important because it must be determined early on in planning as part of a backwards design. Many educators traditionally would decide on assessments as an afterthought, which Wiggins & McTighe (2005) do not recommend.

The Linguistic Society of America has formed a committee, chaired by Richard Larson of Stony Brook University, whose goal is to have the College Board sponsor an Advanced Placement Linguistics course and test. Larson, Denham & Lobeck (2019) outlines the goals of this initiative and the logistics of its implementation. When creating an AP course in any subject area, we must ensure that introductory and intermediate course work is developed to prepare students for the highly demanding advanced AP course material.

The professional literature argues for linguistics for scientific inquiry, literacy and K-12 integration. Consider Honda (1994), Honda & O'Neill (1993, 2008), Honda, O'Neill & Pippin (2010), Keyser (1970), Larson (1996, 2010) in linguistics/STEAM curricular bridge. Correa (2014) recommends teaching theoretical linguistics in language classes.

Summary

Language study and linguistics can enhance students' opportunities in STEAM curricula and careers. We can rationalize language and linguistics as an important cognate to the STEAM curriculum. A number of options exist for exposing STEAM students to language and linguistics. A concerted effort in coordinating languages and mastery in linguistics will improve mastery of

STEAM concepts and themes while concomitantly encouraging language proficiency and linguistics. Languages and linguistics help students by picking up STEAM.

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