DEVELOPING STUDENTS' COMMUNICATIVE COMPETENCE ON THE BASIS OF STEM EDUCATIONAL TECHNOLOGY: HISTORY AND FUTURE

Ahmadjonova Odina Anvarjon qizi
Namangan state university, PhD student
Gmail: ahmadjonovaodina2020@gmail.com

Abstract: *The purpose of this study is to investigate one of the urgent issues in the field of education: the features of developing students' communicative competence through STEM educational technology as well as this article reveals the history and future of teaching English in relation to STEM.*
Keywords: *STEM, ESL, K-12, "The 4Cs", 21st Century skills, TESOL;*

РАЗВИТИЕ КОММУНИКАТИВНОЙ КОМПЕТЕНЦИИ СТУДЕНТОВ НА ОСНОВЕ ОБРАЗОВАТЕЛЬНЫХ ТЕХНОЛОГИЙ STEM: ИСТОРИЯ И БУДУЩЕЕ

Ахмаджонова Одина
Наманганский государственный университет докторант
Gmail: ahmadjonovaodina2020@gmail.com

Аннотация: *Целью данного исследования является исследование одного из актуальных вопросов в сфере образования: особенностей развития коммуникативной компетентности учащихся с помощью образовательных технологий STEM, а также в данной статье раскрывается история и будущее преподавания английского языка применительно к STEM. .*
Ключевые слова: *STEM, ESL, K-12, «4C», навыки 21 века, TESOL;*

STEM TA'LIM TEXNOLOGIYASI ASOSIDA O'QUVCHILARNING INGLIZ TILIDA NUTQIY KOMPETENTSIYASINI RIVOJLANTIRISH XUSUSIYATLARI: TARIX VA ISTIQBOLLARI

Ahmadjonova Odina Anvarjon qizi
Namangan davlat universiteti tayanch doktoranti
Gmail: ahmadjonovaodina2020@gmail.com

Abstract: *Mazkur tadqiqotning maqsadi ta'lim sohasidagi dolzarb masalalardan biri bo'lgan STEM ta'lim texnologiyasi orqali talabalarning kommunikativ kompetentsiyasini rivojlantirish xususiyatlarini o'rganish, shuningdek, ushbu maqola STEM ta'lim texnologiyasi bilan bog'liq holda ingliz tilini o'qitish tarixi va istiqbollari haqida ma'lumot beradi.*

***Kalit so'zlar**: STEM , ESL, K-12, "The 4Cs", 21st Century skills, TESOL,*

Introduction

Due to the rapid change of today's globalization, English has become increasingly essential for communication. English is one of the most core subjects that students must acquire for greater social understanding. The language is also massively used in technology-based scheme. At the same time, education in the current era of modernization requires schools to be able to create students who are not only possessing cognitive skills but also 21st-century skills. Partnership for 21st Century Skills (P21) elaborated the skills as part of individual competencies known as "The 4 Cs" - communication, collaboration, critical thinking, and creativity. These four skills should be possessed by individuals to face the challenges of the 21st century.

STEM (Science, Technology, Engineering & Mathematics) education could be one of the efforts to equip the 21stcentury skills. The term STEM Education was first coined in the year 2001by the scientific administrators of the US National Science Foundation. The word is an acronym for its four component subjects which are Science, Education, Technology, Mathematics. The model was thus conceptualized as an integrated and holistic learning experience for students in these disciplines. STEM offers students to learn to apply the main content and practice each of the STEM disciplines in all situations that students face in their lives[1] . It provides an opportunity to communicate, collaborate, think at higher levels, and increase creativity as the requirements of the 21st century. With STEM, students are expected not only to be able to solve problems in science, technology, engineering, and mathematics, but also to be able to solve various types of complex problems that can also develop their higher-order thinking skills, besides that STEM can also prepare 21st-century human resource needs and develop competencies in the STEM field. For these reasons, teaching English and connecting this with STEM educational technology is becoming one of the crucial requirements of this period.

[1] Bybee, R. W. The Case for STEM Education- Challenges and Opportunities, NSTA Press, 2013

Literature review

Over the last decade, STEM employment grew at a much faster pace than non-STEM jobs; 24% versus 4% [1]. . Moreover, STEM employment is predicted to continue to grow much faster than other occupations for the foreseen future. Individuals in STEM fields enjoy 29% higher wages and 50% higher rate in obtaining a college degree compared to their counterparts in non-STEM fields[2]. Taylor claimed that during the next three decades 90% of the U.S. labor force growth will come from new immigrants and their children and predicted that ELL students will constitute a significant portion of the work force. Hence, STEM education becomes a critical component in preparing ELL students with the skill level needed to make them prosper in a job market that is fueled by advancements in science and technology.[3]

Results

Having read related literature it has been found that college- and career-ready standards present both opportunities and challenges for ELs, necessitating that educators at multiple levels of the education system develop new areas of expertise. Historically, within the classroom, STEM content learning has been considered the province of STEM content educators, while language learning has been considered the province of language educators. Current understanding of the co-development of language and content necessitates that educators of STEM content are familiar with the nature of language, language learning, and exemplary STEM instruction that includes attention to language. To achieve this objective, educators of STEM content must learn to interrogate their preconceived notions and tacit assumptions about language, starting with the most fundamental, though rarely discussed, question, "What is language?" In the same way, language educators will need to become familiar with the nature of STEM content areas. To use science as an example, language educators should ask the question, "What is science?" They will need to understand how STEM subjects are conceptualized in modern standards, such as how science is conceptualized in the Next Generation Science Standards, as these standards reflect the field's most current conceptualization. In the case of mathematics, language educators and math educators who work with ELs will need to know how research has answered the questions, "What is mathematics proficiency? How do students learn mathematics through using language?" Appreciation of the

---

[1] Howard, N. R., & Ifenthaler, D. (2018). Integrating STEM opportunities for young learners, Tech Know Learn, 23, 195-197.

[2] Langdon, D., McKittrick, G., Beede, D., Beethika, K., & Doms, M. (2011). STEM: Good jobs now and for the future. U.S. Department of Commerce; Economics and Statistics Administration. Retrieved from http://www.esa.doc.gov/sites/default/files/reports/documents/stemfinaljuly14.pdf

[3] Taylor, P. (2014). The next America: boomers, millennials, and the looming generational showdown (1st ed.). New York: Public Affairs.

role of language in content learning has developed over time with historical roots dating back to the last quarter of the previous century. To understand current research and practice in STEM teaching and in the education of ELs requires working knowledge of some of the more salient elements of that history.. This overview is not exhaustive, but provides an essential, albeit brief, historical context for the current charge and report. Research on Language Among English Learners as ELs increased in numbers and became a focus of attention in K–12 classrooms, the first response was to prepare ESL teachers who would teach English to ELs in separate classrooms and then send them to "content" classrooms once they had developed sufficient proficiency. An early response of the field of TESOL (Teachers of English to Speakers of Other Languages) to the challenge of ELs keeping up with grade-level learning in K–12 contexts was the emergence of "content-based language teaching". This approach recognized that children best learn language if it is taught in meaningful contexts of use, and that for children in school, the meaningful contexts are the subject areas. This idea was further supported by the work of Cummins [1]; in particular, he made a distinction between informal conversational language and more formal academic language in his research on children developing bilingual competence at school. This distinction generated controversy from the beginning, but has nonetheless proved valuable in drawing attention to the many ways that individuals use and understand language in education, as well as more generally. Nevertheless, as "content-based language teaching" developed, it was unclear how the relationship between "content learning" and "language learning" was to be articulated. During the same time period, research was increasingly pointing to the need for explicit attention to language itself as part of the second-language learning process in school contexts, as exposure to the language alone did not lead to development of proficiency. Whereas initially this research primarily studied the ways teachers helped ELs use English with greater accuracy by providing feedback on errors, subsequently the main focus of research on English development has changed in recognition that learners inevitably make errors as they expand their meaning-making repertoires .[2]

Discussion

One issue in research on ELs is the use of the construct *academic language*.Introduced by Cummins through his notion of CALP (cognitive academic

[1] Cummins, J. (1981). The role of primary language development in promoting education success for language minority students. In California State Department of Education (Ed.), Schooling and Language Minority Students: A Theoretical Rationale (pp. 3–29). Los Angeles: California State University

[2] Valdés, G. (2005). Bilingualism, heritage language learners, and SLA research: Opportunities lost or seized? The Modern Language Journal, 89(3), 410–426

language proficiency), this term has been widely employed since the 1980s to describe the language children are exposed to and that they may need to develop to succeed in schools. The term has been critiqued as presenting a "symbolic language border" that can be detrimental if ELs are seen to bring only limited language resources to STEM education, but we use it in this report to describe the range of registers used in STEM learning. *Register* refers to the variation in language choices that people make in engaging in a range of activities throughout the day. Understanding academic language as part of a set of *registers* positions it as more than just disciplinary vocabulary that can tend to be the focus. Research on mathematics learning with ELs over the past 30 to 40 years shows movement toward new ways of conceptualizing the meaning of "mathematics language," the definitions of mathematics activity, and a focus on resources rather than obstacles. Early studies of bilingual mathematics learners failed to include bilingualism as a resource, framing the "problem" as one entirely owing to linguistic challenges: solving word problems, understanding individual vocabulary terms, or translating from English to mathematics symbols . Later studies developed a broader view of mathematics activity, examining not only responses to arithmetic computation, reasoning, and problem solving, but also the strategies children used to solve arithmetic word problems[1], and student conceptions of two-digit quantities . Since these early studies focused on carrying out arithmetic computation and solving word problems, conclusions were limited to these two mathematics topics. It was not possible to generalize from studies on arithmetic computation and algebra word problems to other topics in mathematics, such as geometry, measurement, probability, or proportional reasoning. Following the failure of an emphasis on only procedural skills, research has focused on approaches that include the other strands of mathematics proficiency, especially conceptual understanding and reasoning, as well as mathematics discourse .Additional research has begun to explore how students use and connect their linguistic and cultural resources to the learning of mathematics. Science Learning with English Learners The general direction of early research on science learning with ELs did not attend to the practical need for all students to meet the full range of science standards or abilities while also developing English proficiency. In the 1990s, studies of disciplinary practices in science education emerged from the scholarship of science studies—the empirical study of science communities. Sociology and anthropology of science identified the important ways that science is constructed through discourse and social practices . Much of the early

[1] Secada, W.G. (1991). Degree of bilingualism and arithmetic problem solving in Hispanic first graders. The Elementary School Journal, 92(2), 213–231.

literature on effective science instruction with ELs focused on engaging ELs in hands-on activities to make science concrete and experiential while reducing language load. In addition, discrete science process skills (e.g., hypothesizing, observing, inferring, predicting) were perceived as compatible with language functions (e.g., describing, summarizing, reporting). Focusing on the social and discourse practices of science education began to situate instances of talk and action around meaning-making in ongoing social and cultural practices of the specified classroom, laboratory group, museum, or other educational setting. Lemke's Talking Science was a seminal work in science education. This study of primarily teacher-led discourse practices identified the important ways that the thematic content of scientific knowledge was instantiated in secondary science classrooms. Through detailed linguistic analysis of discourse processes, Lemke identified the many ways that science can be obscure, difficult, and alienating to students. This study opened up the field to take a closer look at the various discourse processes and practices of science. Studies of discourse in science education have identified ways that student interests, narratives, and personal and cultural worlds contribute to how they are positioned and how they come to see themselves as science learners. Given the variation in students' home culture and language practices, educators have sought to understand how students' cultural knowledge, affiliations, and identities are constructed within the context of science learning .

Conclusion

This study concludes that english learners (ELs) bring a wealth of resources to science, technology, engineering, and mathematics (STEM) learning, including knowledge and interest in STEM-related content that is born out of their experiences in their homes and communities, home languages, variation in discourse practices, and, in some cases, experiences with schooling in other countries. ELs are those students ages 3 through 21, enrolled in an elementary or secondary school, not born in the United States or whose native language is a language other than English, and whose proficiency in speaking, reading, writing, or understanding the English language may be sufficient to deny the individual the ability to successfully achieve in classrooms where the language of instruction is English. The diversity of ELs includes heterogeneity in cultures, languages, and experiences that may have an impact on these students' education (including the contexts that expose them to risk factors that may have negative impacts). Federal, state, and local policies can either facilitate ELs' opportunities in STEM or constrain teaching and learning in ways that are detrimental. This report addresses the factors that affect ELs' access and opportunity to rigorous, grade-appropriate STEM learning .ELs develop STEM knowledge and language proficiency when they are engaged in meaningful interaction in the. classroom that includes participation in the kinds of activities in which STEM experts and professionals regularly engage. Whereas there is no language without content, there is some content that is less dependent on language. STEM subjects afford opportunities for alternate routes to knowledge acquisition (i.e., experimentation, demonstration of phenomena, and demonstration of practices) through which students can gain a sense of STEM content without resorting predominantly to language to access meaning—it is through this experience that language is also learned.

REFERENCES

1. Bybee, R. W. The Case for STEM Education- Challenges and Opportunities, NSTA Press, 2013
2. Howard, N. R., & Ifenthaler, D. (2018). Integrating STEM opportunities for young learners, Tech Know Learn, 23, 195-197.
3. Langdon, D., McKittrick, G., Beede, D., Beethika, K., & Doms, M. (2011). STEM: Good jobs now and for the future. U.S. Department of Commerce;
4. Taylor, P. (2014). The next America: boomers, millennials, and the looming generational showdown (1st ed.). New York: Public Affairs.
5. Cummins, J. (1981). The role of primary language development in promoting education success for language minority students. In California State Department of Education (Ed.), Schooling and Language Minority Students: A Theoretical Rationale (pp. 3–29). Los Angeles: California State University
6. Valdés, G. (2005). Bilingualism, heritage language learners, and SLA research: Opportunities lost or seized? The Modern Language Journal, 89(3), 410–426
7. Secada, W.G. (1991). Degree of bilingualism and arithmetic problem solving in Hispanic first graders. The Elementary School Journal, 92(2), 213–231.