Work in Progress: How Multilingual Homes Shape STEM Identity Development

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Translation at Home: Exploring How Multilingual Family Interactions Shape STEM Identity (Work in Progress)

Abstract

Despite ongoing efforts, students from historically underrepresented groups remain underrepresented in U.S. STEM fields. STEM identity, or the extent to which a student views themselves as a science person, is a key factor that influences student persistence in STEM. Previous literature has shown that home environments have a significant impact on a child's STEM identity development from as young as 5 years old. For students from historically underrepresented backgrounds, many grow up in multilingual households where they are navigating multiple languages. As they grow, a child's ability to talk about or translate their STEM knowledge or interests can vary depending on the fluency of their home language. This interaction may influence how they express their understanding of STEM concepts, participate in STEM-related conversations, and receive recognition from family members. These dynamics are central to STEM identity development yet remain underexplored in multilingual family contexts.

This work-in-progress study aims to investigate how translation practices in multilingual households shape high school students' STEM identity development through the lens of performance, competence, and recognition. Semi-structured interview protocols were developed for students participating in a summer science program and their parents or guardians to explore how, if any, STEM topics were discussed at home, the role of translation in these interactions, and the perceived supports and barriers to home STEM engagement.

Introduction

U.S. STEM industries face a growing demand for a larger workforce and improving retention of students from underserved communities is a key strategy for meeting this need [1]. Increasing the representation of minority workers in STEM requires fostering early positive STEM experiences in students' development [2]. STEM identity, or how much a student views themselves as a science person, has been widely shown as a key factor in students' academic success and persistence in STEM pathways. Prior research has shown that students who identify as "science people" are significantly more likely to pursue a STEM career [2,3]. Understanding how STEM identity forms across home and school contexts is therefore critical for improving retention and broadening participation in STEM fields [4].

This study draws on Carlone and Johnson's STEM identity framework, which conceptualizes identity as the interaction of performance, competence, and recognition

[5]. Performance is the ability of a student to do STEM related tasks which can be seen through applying learned concepts to real life. For example, using physics to predict where a ball will land. Competence is the actual understanding of STEM topics. For example, understanding that a chemical reaction is what causes a cake to rise. Recognition can be both internal and external recognition of STEM accomplishments in performance and competency. While competence is often developed and assessed within school settings, performance and recognition can be strongly shaped by family interactions and home discourse. STEM identity development begins in K-4 and a child's home environment, including family values, conversations, and forms of recognition related to STEM play a key role [3,6,7]. These forms of recognition can be from teachers, parents, or peers through direct complements on their STEM ability as well as though rewards in school and home. High STEM identity gives the child confidence to continue to pursue science topics regardless of difficulty [3].

Many students from historically marginalized communities grew up in multilingual homes. A report from National Center for Education Statistics in 2019 indicated that 9.6% of students in the U.S. were registered as English language learners. However, this may not be representative of all multilingual learners as it does not include those students who may be fluent at English but speak another language at homes [8]. In the context of STEM identity development, the influence of the home environments on multilingual students' STEM identity development is currently under explored. Further understanding of the dynamics of these specific communities may lead to the development of better interventions [3,4]. Within multilingual households, children often possess varying levels of fluency across languages spoken at home, which may shape their ability to discuss STEM interests, explain academic experiences, or translate technical ideas for family members [9]. Many students regularly translate for parents or guardians, particularly in immigrant and refugee-origin families. This translation work introduces additional layers of responsibility, agency, and cognitive demand, and may influence how students see themselves, and how their parents and guardians see them, as STEM learners. Research on translanguaging has shown positive effects on student engagement and meaning-making in classroom settings [10]; however, less is known about how translation and translanguaging function within home environments and how these practices shape students' STEM identities beyond school. In multilingual households, challenges or opportunities in translation may affect whether students feel recognized as "STEM people" by their families and whether they are able to develop their STEM identities through discussion, explanation, and shared meaning-making at home.

Understanding how STEM identity develops within multilingual households is critical for designing equitable STEM programs that extend beyond the classroom and into

students' lived experiences. Accordingly, this study addresses the following research questions: 1) How are STEM topics translated and discussed in multilingual households? 2) How does STEM topic translation influence students' STEM identity development? 3) How do parents in multilingual households contribute to the recognition of their child's STEM identity? 4) What supports could strengthen students' capacity for STEM talk at home?

Study Design

This work-in-progress study employs a qualitative interview-based research design to explore how multilingual home language practices and translation shape high school students' STEM identity development. A semi-structured interview protocol was developed for high school student participants and their parents or guardians in order to capture the lived experiences of both perspectives within a family dynamic The interview aims to understand the translation practices and perceived supports and barriers within the multi-lingual home environment.

Data will be collected either in person or via videoconferencing software. Interviews will be conducted in English or with the support of translators, as needed, to ensure participants could communicate comfortably in their preferred language. Separate interview protocols were developed for students and parents or guardians to capture role-specific perspectives while allowing for consistent thematic comparison across interviews. Interviews were held separately between children and parents to ensure that one interview does not influence the other and that both may speak comfortably.

Student interviews begins by exploring students' self-perceptions as STEM learners, how STEM is discussed at home, how others may perceive them, and the cultural and lingual contexts in their households. Students were also asked about their roles as translators within their families, the frequency and context of translation related to STEM topics, and how these experiences influenced their confidence, sense of belonging, and identity development. These questions were designed to capture the three dimensions of Carlone and Johnson's STEM identity framework: students' self-perceptions provide insight into competence and performance, while questions about the home environment provide context on sources of recognition [4].

Parent or guardian interviews followed a similar framework. Interviews begin by exploring parents and guardian's self-perceptions as a STEM learners, followed by questions about how STEM is discussed at home. Participants are asked to compare their experiences to those of their peers and conclude with questions about their cultural context. Parents were also asked about perceived barriers to discussing STEM topics and what resources or supports would be helpful. While student interviews address all three

dimensions of the STEM identity framework, parent interviews focus specifically on recognition. These questions also explore potential barriers to STEM-related communication, particularly for parents who are not native English speakers, which may inform future intervention design.

All interviews will be transcribed and deidentified. Thematic analysis will be utilized to identify patterns related to language use, translation practices, family engagement, and STEM identity development. Initial coding will be guided by Carlone and Johnson's STEM identity framework. Additional inductive codes will be developed to capture emergent themes related to translation, translanguaging, and perceived supports or barriers. Ongoing analysis will compare student and parent perspectives to identify points of alignment and divergence.

All recruitment materials and study protocols were reviewed and approved by the UMass Lowell Institutional Review Board (IRB).

Conclusion

This work-in-progress study seeks to understand how multilingual home environments and translation practices shape high school students' STEM identity development. While prior research has established the importance of home experiences in fostering STEM identity, less is known about how students from multilingual households navigate STEM-related communication with their families. By centering both student and parent perspectives, this study highlights the home as a critical, yet often overlooked, site of STEM identity formation.

Although data collection and analysis is currently ongoing, this study is positioned to generate insights that inform future STEM education programming and intervention design. Findings from this work will contribute to the development of supports that may strengthen home-based STEM conversations, empower parents as partners in STEM learning regardless of language background, and promote more inclusive pathways into STEM fields. Ultimately, recognizing and valuing multilingual households as sites of STEM engagement may play an important role in improving STEM identity development and long-term retention for students from historically underrepresented communities.

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