



www.ijemst.net

The Effect of Translanguaging in a Middle School Science Classroom

Ma Teresa Aki 
California State University, USA

Kathryn Theiss 
California State University, USA

To cite this article:

Aki, M.T., & Theiss, K. (2025). The effect of translanguaging in a middle school science classroom. *International Journal of Education in Mathematics, Science, and Technology (IJEMST)*, 13(6), 1509-1526. <https://doi.org/10.46328/ijemst.5734>

The International Journal of Education in Mathematics, Science, and Technology (IJEMST) is a peer-reviewed scholarly online journal. This article may be used for research, teaching, and private study purposes. Authors alone are responsible for the contents of their articles. The journal owns the copyright of the articles. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of the research material. All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations regarding the submitted work.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

The Effect of Translanguaging in a Middle School Science Classroom

Ma Teresa Aki, Kathryn Theiss

Article Info

Article History

Received:

15 May 2025

Accepted:

16 September 2025

Keywords

Translanguaging

Multilingual

Science education

Inclusive classroom

Abstract

In today's increasingly multilingual classrooms, leveraging students' diverse linguistic resources is essential for fostering equity, inclusion and deeper learning. This action research explored the impact of translanguaging on student engagement, joy, and identity in a middle school science classroom. Translanguaging, which is leveraging students' full linguistic repertoire, was integrated into NGSS-aligned instruction in 8th grade science classes. Using pre- and post-surveys, data collected were analyzed to assess changes in student learning experience. Analysis of data indicates that translanguaging strategies foster greater engagement, affirm students' cultural and linguistic identities, and create more inclusive and collaborative learning environments. The significant shifts in the reported instances of translanguaging, peer collaboration using LOTE, and positive shifts in attitudes and participation confirm that multilingual practices can transform science learning into a more inclusive, responsive, and meaningful experience. While some students have expressed minor concerns for potential confusion, the overall result was overwhelmingly positive. The result of this research reinforces that importance of culturally and linguistically responsive instruction. This highlights translanguaging as an effective strategy to promote equity, belonging and deeper and meaningful learning in science.

Introduction

This action research studied the effects of translanguaging in a middle school science classroom. Translanguaging occurs when individuals use their entire language repertoire to communicate, think and learn or make sense of the world around them, instead of separating them. For example, students might use a mix of their home language and everyday English to better understand or explain an idea. Data were collected to answer this question: How does translanguaging in a science classroom affect students' learning engagement and sense of joy and identity among students?

Based on related studies, if translanguaging is consistently embedded in science learning activities, students will be more engaged and students will have an increased sense of joy and connectedness to the class. Moreover, students will further take pride in their identities in terms of the unique languages and culture that they or their families use or practice. Instruction in a science classroom has traditionally been a monolingual, English-only

approach in the United States. Flores and Schissel (2014) stated that standards-based educational reforms in Anglophone countries, such as United States, United Kingdom, and Australia, are dominated by monoglossic ideologies. This action research investigated the effects of incorporating translanguaging activities in eighth grade science curriculum. It measured the social-emotional connectedness of students to the curriculum, specifically focusing on the sense of joy and identity of the students in the classroom. The effects being studied impact students' joy, wellness, engagement and collaboration in the classroom. This action research aimed to help middle school science educators increase their awareness about translanguaging and find strategies that integrate social-emotional learning strategies and culturally and linguistically responsive pedagogy to help make classroom learning relevant and inclusive to all students, particularly for a middle school science classroom. The action researcher is the teacher at the study site, teaching at least five eighth grade science classes and is the main contact person for this study.

Literature Review

The need for a pedagogical shift to look at how lessons are presented in the classroom in the lens of social justice, cultural relevance and social emotional learning is more urgent than ever. The number of English learners in United States has seen a huge increase in the past decade, signaling more multilingual classrooms are arising. The percentage of students in public school in United States who were English learners (ELs) was 10.6 percent or 5.3 million students in the fall of 2021, up from 9.4 percent or 4.6 million students in 2011 (National Center for Education Statistics, 2023). A translanguaging classroom is built collaboratively by both the teachers and multilingual students as they intentionally use different language practices to teach and learn in deeply creative and critical ways (García et al., 2017). Rowe (2018) describes translanguaging as one which “involves the fluid use of multiple languages in communication and learning” and added that it is a natural process for multilingual individuals and can enhance cognitive and academic engagement. It helps bridge gaps in understanding and enabling students to access prior knowledge and build connections between their home language and the language of instruction. Licona and Kelly (2019) describes translanguaging as a pedagogical tool to bridge linguistic and conceptual gaps. As a classroom strategy, Rowe (2018) suggested encouraging students to use their home language alongside the language of instruction in discussions and assignments, with added resources such as bilingual texts, glossaries and/or visual aids. It is a practice where bilinguals use their entire linguistic repertoire, not as separate language systems, but as an integrated communication system (García et al., 2017).

Multiple studies have shown that translanguaging is important in multilingual science classrooms. Licona and Kelly (2019) found out that translanguaging fosters a sense of inclusion and supports bilingual students in accessing and contributing to scientific discussions. In their study, students used Spanish to clarify and scaffold their understanding of scientific ideas and used English for formal scientific discourse. Their study concluded that translanguaging enables students to leverage their full linguistic repertoire to make sense of complex scientific ideas. Pierson et al. (2021) explored the integration of scientific modeling and translanguaging to enhance multilingual students' learning and engagement in science and argued that combining these approaches can possibly create an inclusive learning environment that supports diverse linguistic and cultural resources while fostering a deeper understanding of the scientific concepts. Lemmi and Pérez (2023) found that translanguaging

promotes deeper comprehension of scientific ideas by allowing students to think critically and creatively in their preferred language. Translanguaging replaces the deficit term “English learners” with a strength-base view with “emergent bilinguals”, thus recognizing bilingual students to be in the process of developing proficiency in multiple languages (García et al., 2017). Flores and Schissel (2014) explored the concept of translanguaging from both sociolinguistic and pedagogical perspectives. Flores & Schissel (2014) defined monoglossic ideology as an idea that treats English-only as the norm and enforces the idea that there is only a single and standardized language and they argued that traditional monoglossic language ideologies fail to capture the fluid language practices of bilingual communities. Instead, they advocate for a heteroglossic approach that recognizes and values these dynamic practices (Flores & Schissel, 2014).

Karlsson et al. (2020) explored how translanguaging facilitates continuous and meaningful learning in multilingual science classrooms. Their study highlighted the role of translanguaging in maintaining a “continuity of learning”, ensuring that multilingual students can bridge gaps between prior knowledge, new information and scientific processes. Cognitively, translanguaging aids comprehension of scientific concepts by allowing students to process information in their strongest language (Karlsson et al., 2020). Translanguaging enhances comprehension and engagement by allowing students to process complex concepts in their preferred language (Rowe, 2018). Moya (2023) explored how translanguaging acts as a bridge to help students navigate scientific content, fostering inclusivity and understanding. The study focused on emergent bilingual learners, students who are acquiring proficiency in an additional language while continuing to develop their native language(s) and used translanguaging as a resource allowing students to use their full linguistic repertoire (native language and additional language) to engage in science learning. In their close examination of how translanguaging and literacy development intersect, García and Kleifgen (2019) emphasized that translanguaging literacy framework enables multilingual students to deepen text comprehension through discussion, annotation, bilingual texts, and multimodal resources; generate diverse texts that reflect their identities, lived experiences, and full language practices; build confidence (*confianza*) by affirming their linguistic identities in academic spaces; and lastly, develop critical metalinguistic awareness by analyzing and reflecting on their language use. These studies show the positive impact of integrating translanguaging in the science classroom.

Andersen et al. (2022) argue translanguaging approach views students’ home languages as integrated in the learning process rather than separate systems and highlights how teachers can implement it through multilingual discussions, resources, and activities. Key elements, such as language fluidity, sensemaking, multimodal integration, asset-based perspective and its critical role in scientific practices, show that translanguaging supports deeper scientific understanding, inclusivity, and the development of essential scientific practices. Translanguaging can be used as a tool to develop students’ science and engineering skills such as constructing scientific arguments. In a study by Licona and Kelly (2019), students were observed engaging in evidence-based argumentation, switching between English and Spanish to articulate claims, provide evidence and justify reasoning. When teachers used translanguaging strategies to support students’ meaning - making by encouraging bilingual discussions, students engaged in collaborative activities where they alternated between languages to clarify ideas, construct arguments, and present their findings (Lemmi & Pérez, 2023). These findings highlight the potential of translanguaging to enrich science learning in multilingual classrooms, promoting further investigation into its

specific impact in middle school students' engagement and understanding.

Methods

This research was conducted in an urban middle school located in Southern California with a student population of 1,295 for the school year 2023-2024, where 31.6% were 8th grade students, 32.3% were 7th grade students and the remaining 36.1% were 6th grade students. It is a public school that received federal Title 1 funding, which supports schools serving high number of students from low-income families. The school has 59.4% of its student population identified as socioeconomically disadvantaged and 1.7% are English learners, with Spanish and Russian identified as their first language. In addition, its enrollment by ethnicity is composed of African American (14.7%), American Indian or Alaska Native (0.1%), Asian (6.9%), Filipino (5.6%), Hispanic or Latino (57.4%); Pacific Islander (0.3), White (10.6%), and two or more races and/or not reported (4.4%) (California School Dashboard (ca Dept of Education, 2024).

Data Collection

Data was collected during the fall semester of 2023, across five 8th grade science classes taught by the first author. Using a pre and post experimental design, the students took a three-section survey during 5th and 10th week of the semester. The data was collected and analyzed using a mixed methods approach. Data collection was a combination of pre-defined answer choices (Yes, no, or I do not know) and open-ended questions. Data analysis was a combination of quantitative analysis using paired t-test and qualitative analysis using coding and thematic analysis of student responses to the open-ended questions.

The first section focused on the students' language background and usage to understand the students' linguistic background and environment, and their personal language experiences. The questions were constructed to gather information about the students' linguistic backgrounds. It asked about the languages spoken at home, their primary home and peer communication languages, and any languages they are currently learning. The second section centered on collecting data about the students' experiences of use of multiple languages or languages other than English (LOTE) in their science classes from either current or past experience to investigate instances of translanguaging, where students and teachers might use different languages for communication or understanding. This section included close-ended questions that explored whether students have experienced or observed the use of multiple languages in their science classroom.

The third section of the survey zeroed in on collecting student reflections on the use or integration of translanguaging in their science class. This was composed of open-ended questions that invited students who answered "Yes" in section 2 to elaborate on their experiences. It asked students to add detailed reflections on how using multiple languages influences science learning, engagement, confidence, identity, cultural connection, and belonging. It also asked students of any perceived challenges and the overall impact of translanguaging in the classroom. Additionally, students were asked to rate their sense of joy, identity, and belonging in relation to these multilingual practices or integration of translanguaging in the science classroom. Finally, students were asked to

rate the impact of translanguaging on their confidence level and overall learning experience.

Action Research Activities

One activity where translanguaging was integrated was a written assignment for students to complete as part of their standard homework. Students were asked to interview their parents about their opinion about the word “work” while students were learning about the scientific concept. Students were encouraged to use their home language in completing the written assignment. Then, the students were asked to volunteer to present to the whole class a summary result of their “findings” from their interview. Some students used LOTE during their presentation as they read what their parents shared with them, some parents of which spoke LOTE. During a whole class discussion on the lesson about collision of objects, the first author used translanguaging. The first author used words from LOTE that meant “collision” to further the class discussion. At the end of the lesson, students summarized their learning by creating their notes where students were encouraged to use LOTE. During the implementation of the above-mentioned classroom activities, students were not required to use LOTE but were encouraged to do so if they prefer to do so. The basic information about the lesson was delivered in English. The use of LOTE when students responded during or completed summary notes was not required to ensure equity and access to the content and learning process (see Table 1).

Table 1. Sequence and Summary of Learning Activities

Activity	Modes/Models	Description
Introduction of the new lesson on work and energy	Presentation	Students were introduced to the lesson using a slides presentation. The presentation used languages other than English (LOTE) next to the key vocabulary the students were expected to understand for mastery of the lesson.
Problem solving	Timed-Pair-Share	Students shared their solutions with their partners after the individual problem-solving activity.
Hands-on activity	Lab activity by teams of 4-5 students	Students were provided a hands-on activity guide and materials to perform the activity.
Homework	Writing assignment	Students were given instructions to interview their parents about “work”; students are encouraged to write LOTE that their parents might use to describe what the word “work” means to them.
Unit summary	Sketch notes/ Summary notes	Students were given a guide to create a summary of the lesson through a sketch notes.

Data Analysis

The three sections of the survey were analyzed separately. Descriptive statistics were used to evaluate students’ responses to the questions about their linguistic background. The data from the pre-survey and post-survey were compared to examine any trend on the changes in students’ language use or language learning interests following

the implementation of translanguaging strategies in the science classroom. Paired t-test was used to analyze the data collected from the second section of the survey. Thematic analysis was used to analyze student responses to the open-ended questions in the third section of the survey. Each response was thoroughly read and coded to identify key patterns, recurring themes, and insights regarding students' observations and perceptions of multilingual practices in the classroom. This qualitative component allowed for a deeper understanding of how translanguaging was experienced by students in a science classroom context. To further analyze the data collected through thematic analysis, the range of responses through thematic analysis were analyzed to measure, if any, the significance of changes by calculating the percentage increase or decrease for each response category. All analyses were run in SPSS 29.0.2.0(20).

Results

The pre- and post-survey was given to all students in the science classes of the first author where translanguaging was integrated. Each student in all those classes were asked to complete the assent and consent forms. After collecting the completed consent and assent forms, the second author sorted out the responses based on student participants who have thoroughly completed the assent and consent forms. The total number of responses to be analyzed was further filtered to those students who completed both the pre- and post-surveys. The total number of valid samples analyzed was 50.

Student Language Identities

In the first section of the survey, the students were asked what languages are spoken at home, what their preferred language or languages are when they communicate with their families and their peers, and what language they were trying to learn, if any. The survey results showed that 49% of the students have languages other than English spoken at home while the remaining 51% said they only have English-speaking homes (N = 50). [See Table 1.] For those students who said they have other languages spoken at home, 19% was Spanish, 7% was Tagalog, 16% was Korean, 4% was Japanese, 4% was Bengali, 3% was Yoruba, 1% was Arabic, 1% was Gujarati, 1% was Igbo, 1% was Ilocano, and 1% was Vietnamese (N = 50). A total of 76% of students say they speak English at home to communicate with their families who may be speaking LOTE. The survey results indicated that 98% of the students spoke and communicated with their peers using English only.

Experience with Translanguaging or Use of Multiple Languages in Class Instruction

When asked if they had previously experienced translanguaging or using multiple languages in their science classroom to support learning or to communicate ideas, 88% of students responded "No" and the other 12% indicated that they did not know about translanguaging (N = 50). After the research implementation, 82% of the students reported that they had experienced translanguaging, which was a significant increase (p-value = <0.001). Only 14% of students indicated that they had still not experienced translanguaging and 4% indicated that they still did not know about translanguaging (see Figure 1).

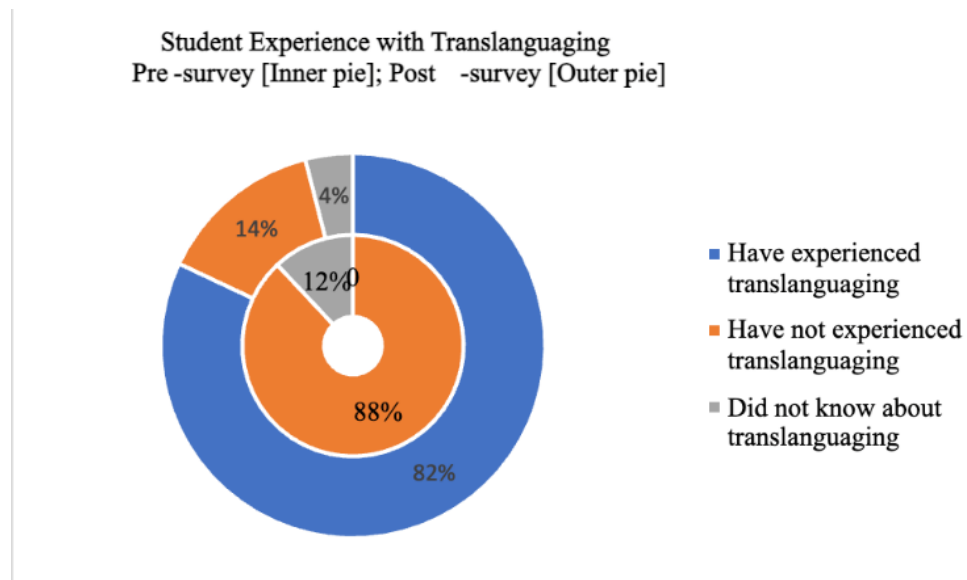


Figure 1. Comparison of Students' Experience with Translanguaging

Students were also asked if there were any occasions when students and teachers used translanguaging or LOTE together during activities or discussions in their science class (see Figure 2). Prior to the implementation of translanguaging strategies, 72% students reported that there were no occasions when they or their teacher used LOTE during science class activities or discussions, 10% indicated that multilingual interactions occurred, and 18% reported they did not know (N = 50). Following the research, 76% of students affirmed experiencing moments where LOTE were used collaboratively in their science class, 16% reported no occasions where translanguaging was used and 8% reported they do not know about translanguaging. The difference between pre- and post-survey responses was statistically significant ($p < .001$).

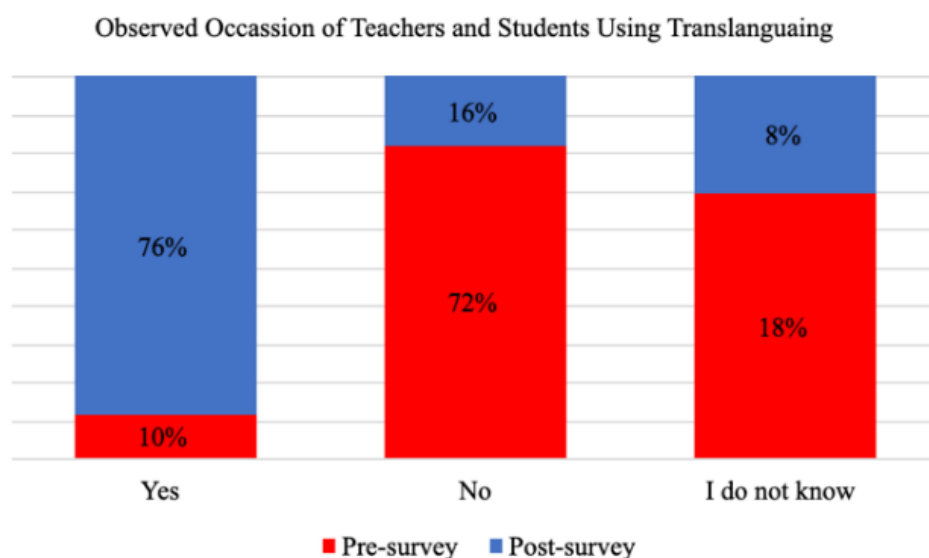


Figure 2. Comparison of Observed Occasions When Students and Teachers Used Translanguaging

When asked if they had observed any instances where students used their own home languages or other preferred languages to explain scientific concepts to peers or teachers, 66% of students in the pre-survey responded "No",

24% indicated they did not know and 10% reported observing such instances (N = 50). In the post-survey, 28% indicated not observing any instances, 12% said they did not know and 60% reported observing such instances. This difference was statistically significant ($p < .001$; see Figure 3).

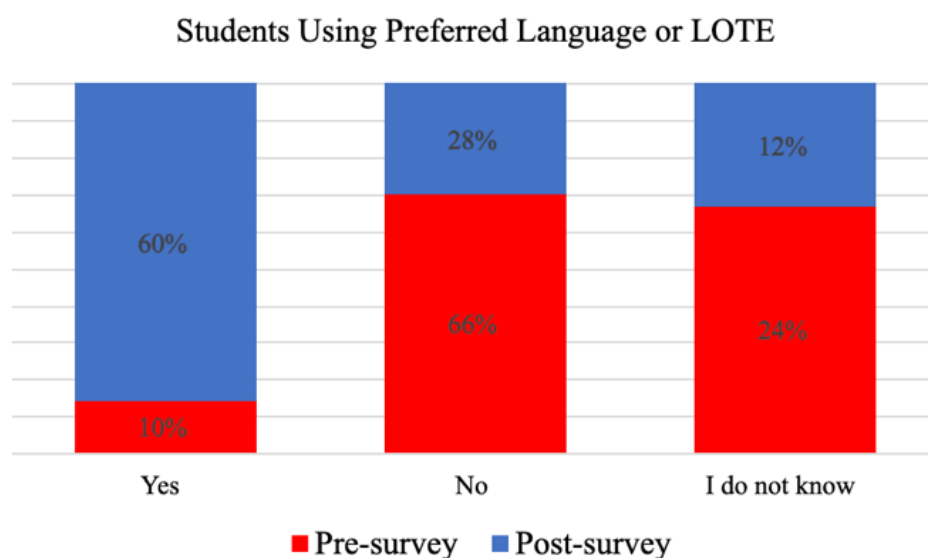


Figure 3. Comparison of Observed Instances When Students Used Translanguageing

Effects of Translanguageing on Student Engagement, Feeling of Joy and Sense of Identity

When the students were asked to rate how translanguageing or the intentional use of multiple LOTE in sensemaking in their science class impacted their engagement, feeling of joy, and sense of identity as a student, 58% of students in the pre-survey selected not applicable, 12% reported it to have low impact, 26% chose moderate impact and 4% did not respond (N = 50). The answers differed significantly ($p < 0.001$) after the activities: 6% selected not applicable to them, 8% reported it to have low impact, 66% indicated it had moderate impact, 10% reported it had high impact and 10% did not respond.

Effects of Translanguageing on Student Sense of Belongingness and Connectedness in the Classroom

Students were also asked to rate their level of belongingness and connectedness in the classroom. The pre-survey results showed that 12% of the students said not applicable to them, 6% reported low level, 48% reported moderate level, 28% indicated high level and 6% did not indicate any answer (N = 50). The post-survey showed that 2% of the students chose low level, 56% indicated moderate level, 34% chose high level and 8% did not respond ($p < 0.001$). None of the students indicated “not applicable” in the post-survey.

Open-Ended Questions about Student Experience of Translanguageing

Students were asked to describe an occasion or instance in which the teacher or the students used their home LOTE to explain scientific concepts to their peer or to the teacher. The themes in the responses ranged from

teacher-led instances, student-led instances, no experience or occasions observed, unsure how to respond and no response. In the pre-survey, one student described a teacher-led instance, five described student-led instances, 13 reported no experience, six were unsure how to answer the question, and 25 did not provide any answer. In the post-survey, 25 students described teacher-led instances where translanguaging was used, eight describe student-led instances, three reported no experience of any, two were unsure how to respond and 12 did not answer the question.

Students were asked how they think the use of multiple languages in the science classroom would affect students' engagement and interest in learning science. Student responses varied and fit into seven themes: no experience, unsure how to answer, positive effect due to feeling included or acknowledged, positive effect due to increased engagement, positive effect due to comfortable use of multiple languages, negative effect due to disengagement and not effect at all. In the pre-survey, no students reported no experience, three were unsure how to answer, three cited positive effect due to feeling of being included or acknowledged, 12 cited increased engagement, six stated comfortable use of multiple languages, four indicated a negative effect, one reported no effect and 23 did not have any response. In the post-survey, one student reported no experience, two were unsure how to answer, 13 cited a positive effect due to feeling included or acknowledged, 15 cited increased engagement, nine cited comfortable use of multiple languages, two indicated a negative effect, two reported no effect and 12 did not respond. One student in the post-survey said that "Different languages in the science classroom affect how comfortable students are – they may not be confident with speaking English so having the opportunity to speak their own language with confidence is important. By being confident with a language, the students could feel more accepted into the science experience."

The third open-ended question asked the students if they noticed any changes in students' attitudes towards science as a result of using multiple LOTE in their science class. Thematic analysis of the student responses categorized the student answers into six themes: no experience with the use of translanguaging, no noticeable change, positive change in persistence/collaboration/inquisitiveness/creativity, positive change in their level of comfort and sense of belonging, positive change in excitement/curiosity/open-mindedness/reflectiveness, and no response. In the pre-survey, 18 students reported no experience with the use of translanguaging, 4 indicated no noticeable change in attitude, none described changes related to persistence, collaboration, inquisitiveness or creativity, one mentioned increased comfort level and sense of belonging, four cited increased excitement, curiosity, open-mindedness or reflectiveness, and 23 did not respond. In the post-survey, two students reported no experience, 16 indicated no noticeable change, three described changes related to persistence, collaboration, inquisitiveness and creativity, six mentioned increased comfort and sense of belonging, eight cited increased excitement, curiosity, open-mindedness and reflectiveness, and 11 did not respond. A student response stated that "Students seem to have more fun while learning and are more engaged in the topic".

The student responses as to whether they have noticed any changes in students' levels of confidence when they were encouraged to use multiple LOTE in the science classroom were categorized into eight themes: no response, unsure, no experience of multiple language use, no noticeable change in confidence, negative impact due to embarrassment or shame, increased confidence in presenting problem-solving skills or projects, increased

participation in discussions, and increased willingness to try new things or use tools. In the pre-survey, 23 students did not respond, four were unsure, 12 reported no experience with the use of multiple languages, five stated no noticeable change in students' confidence, one described a negative impact, one cited increased confidence in presenting, one noted increased participation in discussions, and one indicated increased willingness to try new things or tools. In the post-survey, 12 students did not respond, one was unsure, one reported to experience of translanguageing, 20 stated no noticeable change, one described a negative impact, two cited increased confidence in presenting, five noted increased participation in discussions, and none indicated increased willingness to try new things or tools.

When the students were asked to share specific ways in which using multiple LOTE in the science classroom contributes to students' sense of belonging or connection to their cultural backgrounds, their responses were categorized into ten themes, which was the most varied response of any open-ended questions. These categories included no response, "I do not know", unsure how to answer, no experience with translanguageing, does not contribute to sense of belonging, feeling validated or recognized, opportunity to learn about self, others and/or their cultures, feeling included and connected through the use of multiple LOTE, connection through expressing themselves with others who speak different languages, and a fun experience. In the pre-survey, 24 students did not share any answer, one answered "I do not know", nine reported no experience with translanguageing, one indicated it does not contribute to sense of belonging, three described feeling validated or recognized, three cited that it gave opportunities to learn about themselves or others, two noted feeling included and connected and none described connection through expression with others who speak different language or referred to it as a fun experience. In the post-survey, 16 students did not respond, none answered "I did not know", one was unsure, none reported not having any translanguageing experience, two indicated it does not contribute to a sense of belonging, six described feeling validated and connected, eight described connections made through expression with others who speak different languages and three referred to the experience as fun.

The students were asked what they thought would be the impact on students' overall learning experience if multiple LOTE were used in the science classroom. The generated responses were categorized into eight themes: no response, "I do not know", no impact on learning, increased engagement or interest, improved ability to express or explain ideas, increased comfort or sense of belonging, enhanced understanding or retention of content, and simultaneous learning of content and culture. In the pre-survey, 21 students did not respond, two answered "I do not know", one stated there was no impact, four reported increased engagement or interest, three mentioned improved ability to express or explain ideas, nine indicated increased comfort or sense of belonging, nine noted enhanced understanding or retention, and none describe any impact on simultaneous learning of content and culture. In the post-survey, 11 students did not answer this question, two answered "I do not know", two stated there was no impact, five reported increased engagement or interest, two mentioned improved ability to express or explain ideas, six indicated increased comfort or sense of belonging, four noted enhanced understanding or retention, and 15 described using multiple LOTE made learning both of the content and culture at the same time possible.

The final open-ended question asked the students if they encountered any challenges or concerns when

translanguaging was used in their science classroom. The responses were categorized into seven themes: no response, “I do not know”, no challenges or concerns, no experience with use of multiple LOTE, potential source of confusion, difficulty repeating words using unfamiliar languages, and concerns about students feeling left out. In the pre-survey, 26 students did not respond, one answered “I do not know”, 18 reported no challenges or concerns, two indicated they had no experience using translanguaging in their science class, three noted that other students may become confused. In the post-survey, 14 students did not respond, two answered “I do not know”, 27 reported no challenges or concerns regarding the use of translanguaging in class, three noted potential confusion for some students, one reported difficulty in repeating unfamiliar words from another language and two expressed concern that some students may feel left out when translanguaging is used.

Discussion

This action research investigated how translanguaging affects the engagement, joy and sense of identity of students in a middle school science classroom. Translanguaging was intentionally integrated in the science classroom during the research period and data showed changes in students’ awareness of translanguaging, and the students’ perceived impact of translanguaging on their level of engagement and interest, attitude, level of confidence, sense of belonging and connection in their science classroom.

Key Findings on Students’ Experiencing on Translanguaging

The data show a significant increase in students’ experience (or awareness) with translanguaging after the action research implementation. Before the research, 88% of students said they had never experienced translanguaging, and 12% were unfamiliar or not sure what it was. After the action research at the post-survey, 82% reported experienced translanguaging ($p < .001$), showing the strategies were effectively and clearly recognized by the students. The sharp decline in the number of students who reported no experience or awareness of translanguaging demonstrates that it became a visible and meaningful part of their science learning. Students who reported to have experienced translanguaging in the post-survey most likely participated in using LOTE in their science class. Translanguaging is not code-switching or simply alternating between two languages but provides students opportunities of fluid use of all their linguistic resources to support understanding (García et al., 2017). This fluid use of their linguistic resources might have occurred in the facilitated class discussions which the teacher has intentionally designed to draw on student languages. In addition, there was a significant shift in students’ experiences with the use of languages other than English (LOTE) during science instruction. Before the action research, 72% of the students reported that neither they nor their teacher used other languages in class, and only 10% observed any multilingual interactions. After the action research implementation, 76% of the students reported experiencing collaborative use of LOTE during science class activities ($p < .001$). This increase indicates that translanguaging became a consistent and recognizable practice in the classroom, reinforcing that students were not only aware of the strategies but actively engaging with them during class instruction. García et al. (2017) added that classroom implementation may include multilingual writing, bilingual reading, and dual language journals. The implementation in this research included multilingual writing and group discussion. There is still more work to do to successfully integrate and implement translanguaging in the science classroom. Lemmi and

Pérez (2023) added that teachers must be equipped with training and resources to implement translanguaging effectively and balancing the use of multiple languages to meet educational standards while supporting students' linguistic diversity requires thoughtful planning.

Student observations of their peers using their home or preferred languages to explain scientific concepts increased significantly following the implementation of translanguaging strategies, from 10% in the pre-survey to 60% in the post-survey ($p < .001$). This suggests that translanguaging practices extended beyond teacher-led strategies and became a student-driven norm in the science classroom, most likely promoting collaboration and deeper engagement through the use of the students' full linguistic repertoires. Andersen et al. (2022) emphasized that translanguaging enhances student ability to make sense of scientific phenomena and supports the development of scientific practices and deeper content understanding.

Impact of Translanguaging

Student responses to the open-ended question about specific instances of translanguaging revealed a clear increase in both the teacher-led and student-led use of home languages in science instruction and learning. In the pre-survey, only one student described a teacher-led instance and five noted student-led instances. After the action research implementation, 25 students described teacher-led examples and eight described student-led ones. This substantial increase shows that translanguaging became not only more visible but also more frequent in both the teacher's content delivery and student-to-student interactions. The decline in the number of students reporting no experience (from 13 to three) further supports that translanguaging practices were actively taking place in the classroom. The first author's intentional structure of the lessons during the research provided students with the opportunity to experience translanguaging. Students may be given the opportunity to experience translanguaging by intentionally implementing classroom activities that use students' home language in discussions, reading and writing and allowing partner and work in students' preferred languages (Menken & Sánchez, 2019).

Impact of Translanguaging on Student Engagement and Interest

Student reflections on the effect of using multiple LOTE on their engagement and interest in science revealed a clear shift towards recognizing the benefits of translanguaging. In the post-survey, 13 students reported positive impacts, including feeling included or acknowledged, which is up from three in the pre-survey; 15 students reported increased engagement, up from 12; and nine reported greater comfort using multiple languages, up from six in the pre-survey. Translanguaging helps bridge gaps in understanding and fosters sense of belonging by affirming students' cultural and linguistic identities (Rowe, 2018). Fewer students expressed uncertainty or no response in the post-survey, indicating growing awareness of translanguaging's role in classroom learning. A student comment about "the opportunity to speak their own language with confidence is important" reflects how translanguaging supports emotional safety and inclusion, which are key to encouraging active participation, inquiry and collaboration in science. Lemmi and Pérez (2023) added that translanguaging promotes deeper comprehension of scientific ideas by allowing students to think critically and creatively in their preferred language. Although there were still two students who expressed concerns about disengagement or no effect, the

overall trend supports that multilingual strategies positively influence student engagement and interest in science learning.

Impact of Translanguaging on Student Attitude Towards Science

Student responses showed an increase in observed positive shifts in attitudes towards science following the encouraged use of multiple LOTE in class. In the post-survey, three students mentioned changes in the persistence, collaboration, inquisitiveness or creativity during the implementation, while none mentioned this in the pre-survey. The number of students who mentioned about increased comfort and sense of belonging grew from one to six, and reports of excitement, curiosity, open-mindedness or reflectiveness doubled from four to eight in the post-survey. These emerging patterns suggest that translanguaging supported social-emotional growth and a more engaged student mindset towards learning science. Translanguaging helps students navigate complex scientific ideas, express themselves creatively and participate more actively in discussions (Pierson et al., 2021). When a student shared about how students seem to have more fun while learning highlights how the use of LOTE not only supported identity but also made the classroom climate more enjoyable and stimulating. There were 16 students in the post-survey who still reported no noticeable change in attitudes, which can be attributed to other factors. The rest of the increase in positive impact on the attitude of students reflects the potential of translanguaging to foster more collaborative, curious, and emotionally connected learners.

Impact of Translanguaging on Students' Level of Confidence

Student responses regarding the impact of translanguaging on their levels of confidence showed slight but notable shifts. While majority of students still reported no noticeable change in their level of confidence, 20 students in the post-survey, there were increases in specific categories identified. For example, the number of students who indicated that they observed an increase in the number of students who participated in discussions increased from one in the pre-survey to five students in the post-survey. In addition, two students indicated increased confidence in presenting problem-solving skills or projects in the post-survey, up one from the pre-survey. These small gains suggest that translanguaging may contribute to a more inclusive classroom environment where some students may feel empowered to speak or present in front of everyone. Translanguaging validates students' cultural and linguistic identities, fostering sense of inclusion and confidence (Lemmi & Pérez, 2023). However, the limited gain also indicates that building academic confidence through culturally and linguistically responsive strategies may require more time and sustained implementation. Implementing translanguaging requires a shift from traditional monolingual teaching approaches and teachers may need additional training to effectively manage multilingual interactions and develop translanguaging strategies (Karlsson et al., 2020). It can be noted that the number of students who expressed uncertainty (chose "I do not know") or did not provide any answer decreased from 27 to 13, suggesting increased student awareness and reflection on the impact of translanguaging on students' level of confidence. Translanguaging literacy framework enables multilingual students to build confidence (*confianza*) by affirming their linguistic identities in academic spaces (García & Kleifgen, 2019). Overall, the data show some possibility for translanguaging to positively influence students' self-confidence in a middle school science classroom.

Impact of Translanguaging on Students' Sense of Belonging

Student responses revealed that translanguaging contributed meaningfully to their sense of belonging and cultural connection in the science classroom. In the pre-survey, only a few students reported feeling validated or included and none mentioned connecting with peers through shared language expression. After the action research implementation, the post-survey indicated more students expressed connection through the use of LOTE. Six students stated the feeling of being recognized or validated, up from three in the pre-survey. As translanguaging recognizes and uses the students' linguistic resources, it validates the students' cultural and linguistic identities (Moya, 2023)

In addition, post-survey showed eight students indicated they observed more students expressing themselves with others who share their language and three found the experience enjoyable. These changes suggest that translanguaging helped create a more culturally affirming environment where students felt both seen and heard. The decrease in the number of students reporting no experience in translanguaging (from nine to zero) and the broader variety of positive themes in the post-survey indicate increased awareness and appreciation of the role that translanguaging or the intentional use of multiple LOTE plays in validating student identity and affirming classroom belongingness. Translanguaging reframes multilingualism as a strength rather than a challenge and by valuing all languages as tools for learning, it creates a more inclusive and equitable educational environment (Andersen et al., 2022). While the post-survey showed two students who still felt that translanguaging did not affect their sense of belonging, the overall trend supports that translanguaging practices can strengthen students' cultural connection in the science classroom. Translanguaging allows students to discuss, analyze, and express scientific concepts in ways that align with their cultural and linguistic backgrounds (Lemmi & Pérez, 2023).

Impact of Translanguaging on Students' Overall Learning Experience

Student responses regarding the impact of translanguaging on students' overall learning experience showed a noticeable shift in depth and reflection after the integration of translanguaging during the action research. While themes like increased engagement, comfort and increased understanding or retention were recurring in the students' answers in both the pre- and post-survey, the most striking change was the emergence of a new theme: simultaneous learning of content and culture. This theme was not mentioned at all in any of the answers of the students in the pre-survey but appeared in 15 student responses in the post-survey. It should be noted that 49% of the students who were part of this action research have families who speak LOTE at home.

Translanguaging gives bilinguals the space to express fluid, hybrid identities rather than conform to monolingual norms and it offers pedagogical strategies that allow students to use all their language resources for deeper learning (García & Li, 2014). Although two students still felt that translanguaging did not have any impact on their learning experience in the post-survey, the overall data reflect a broader appreciation for how translanguaging can support not only content comprehension and expression but also a deeper, more holistic learning experience that values both academic and cultural growth. Pierson et al. (2021) explored the combination of scientific modeling and translanguaging and found that the strategy fostered engagement by allowing students to connect scientific

practices with their linguistic and cultural identities.

Perceived Challenges or Concerns by the Students about Translanguaging

While most students reported no challenges or concerns related to the time when translanguaging was integrated in their science classes, a few important considerations surfaced. In the post-survey, 27 students explicitly stated they had no concerns, which was an increase from 18 in the pre-survey. This suggests overall comfort with multilingual practices in the science classroom. However, some valid concerns were expressed in the post-survey. Three students noted that translanguaging might cause some students to feel left out. These concerns highlight the importance of intentional scaffolding when implementing translanguaging to ensure that all students feel included and supported regardless of their language background. Students who may have expressed their concerns of being left out may be students who only speak English or native English speakers. It is important to note that during the implementation, the main language of instruction was still English and students were not penalized if they were not able to use LOTE. In order to avoid having students feeling left out, intentional grouping during group discussions or activities must be planned ahead of time to cater to the needs and comfort level of all students. For example, students who may benefit from translanguaging strategies because they will be encouraged to speak out further may be grouped together while those students who may be comfortable using English-only discussions may also be grouped together. Rowe (2018) mentioned classroom strategies that include providing resources such as bilingual texts, glossaries or visuals aids; designing collaborative activities that allow students to share their knowledge and insights in multiple languages and valuing all languages in classroom discourse and integrating them into instruction intentionally – all of these alongside using the main language of instruction in discussions and assignments. Classroom teachers know their students and their preferences best and it should be used to make decisions for the best of every student in the classroom. As teachers start to shift their pedagogical approach, it is important to affirm student identities. Translanguaging pedagogy consists of a stance (belief in the value of students' full language practices), design (structuring learning environments that invite students' full repertoires), and shifts (teachers adjusting in real-time to students' spontaneous language use) (García & Kleifgen, 2019).

Implications and Challenges in Teaching Middle School Science Classroom

The findings underscore the transformative potential of translanguaging as an educational practice or strategy in multilingual classrooms. By intentionally incorporating students' home languages alongside English during science instruction, translanguaging fosters a more inclusive learning environment that validates and leverages students' linguistic identities. The results show that strategy enhances students' engagement, joy, and confidence in their learning processes. As students are empowered to express their ideas using familiar linguistic resources, their sense of identity and belonging within the classroom community strengthens, contributing to a more connected and supportive educational experience. The notable increase in the use of home languages in science class and the heightened awareness of multilingual practices among students highlight translanguaging's role in bridging cultural and linguistic divides. It challenges the monolingual approach to teaching science, promoting equity by recognizing the value of students' diverse language repertoires.

As transformative and insightful the results of this research might be, there are some challenges that face educators

daily in the classroom in its implementation. One of the challenges that Moya (2023) identified is the fact that many educational systems still prioritize monolingual instruction, which limits translanguaging and teachers may lack the training or confidence to effectively implement translanguaging strategies. Teachers play a critical role in facilitating translanguaging practices by creating an environment that values and integrates students' linguistic resources (Pierson et al., 2021). Pierson et al. (2021) suggested advocating for adoption of translanguaging and multimodal approaches in science education to better serve multilingual students and to call for teacher training programs that equip educators with the skills and strategies to implement these methods effectively. This suggestion aligns with the summary of Lemmi and Pérez (2023) that teachers must be equipped with appropriate training and resources to implement translanguaging effectively as it is a tool to make science education more accessible and equitable. They emphasized that it required thoughtful planning to balance the use of both (or multiple) languages to meet educational standards while supporting students' linguistic diversity. As with other studies, Karlsson et al. (2020) advocates for translanguaging as a way to promote equity and inclusion in science education and that schools should adopt policies that encourage the use of students' full linguistic repertoires.

Conclusion

This action research examined the effects of translanguaging on student engagement, sense of joy, and identity in a middle school science classroom. The findings indicate that when students are encouraged to use their home language, alongside English, they become more engaged, feel more included, and they develop stronger connections to both the science content being taught and their cultural identities. The significant shifts in the reported instances of translanguaging, peer collaboration using LOTE, and positive shifts in attitudes and participation confirm that multilingual practices can transform science learning into a more inclusive, responsive, and meaningful experience. While some students have expressed minor concerns for potential confusion, the overall result was overwhelmingly positive. The result of this research reinforces that importance of culturally and linguistically responsive instruction. This highlights translanguaging as an effective strategy to promote equity, belonging and deeper and meaningful learning in science.

Recommendations

Based on the data collected in this action research, it is highly recommended that educators intentionally integrate translanguaging strategies into their instructions to support student engagement, build confidence on their identity and provide inclusive classroom environment. Teachers should create structured opportunities for students to use their home language during collaborative work, team discussions, and sensemaking activities in science. To address a possible source of confusion (or anxiety) for some students when implementing translanguaging as reflected in the action research data, Rowe (2018) recommended schools to adopt policies that support linguistic diversity and equip teachers with resources to integrate translanguaging. It should be noted that students were highly encouraged to use any of their preferred language but never penalized for not using LOTE during this implementation. Professional development in culturally and linguistically responsive pedagogy should be provided to educators to help them implement translanguaging effectively and equitably. For future research work, the long-term impacts and strategies for implementing translanguaging practices across grade levels and subject

areas should be done. Most importantly, to encourage student agency of their learning, there should be ongoing reflection and open dialogue with students to help address concerns to ensure that all learners feel supported and acknowledged.

Acknowledgements

The authors would like to gratefully acknowledge funding for this project from the National Science Foundation Noyce Master Teacher Fellows Program (1949973; second author co-PI). The project received IRB approval from California State University, Dominguez Hills (IRB-FY2023-99).

References

- Andersen, S., Méndez Pérez, K., & González-Howard, M. (2022). *Reimagining science lessons through translanguaging*. *NSTA*. www.nsta.org. <https://www.nsta.org/science-scope/science-scope-novemberdecember-2022/reimagining-science-lessons-through>
- California School Dashboard (CA Dept of Education)*. (2024, August). [Caschooldashboard.org](https://www.caschooldashboard.org); California Department of Education. <https://www.caschooldashboard.org/reports/19647336061436/2023>
- Flores, N., & Schissel, J. L. (2014). Dynamic bilingualism as the norm: Envisioning a heteroglossic approach to standards-based reform. *TESOL Quarterly*, 48(3), 454–479. <https://doi.org/10.1002/tesq.182>
- García, O., Johnson, S. I., & Seltzer, K. (2017). *The translanguaging classroom: Leveraging student bilingualism for learning* (1st ed.). Caslon Publishing.
- García, O., & Kleifgen, J. A. (2020). Translanguaging and literacies. *Reading Research Quarterly*, 55(4), 553–571. <https://doi.org/10.1002/rrq.286>
- García, O., & Li, W. (2014). *Translanguaging: Language, Bilingualism and Education*. Palgrave Macmillan UK. <https://doi.org/10.1057/9781137385765>
- Karlsson, A., Nygård Larsson, P., & Jakobsson, A. (2020). The continuity of learning in a translanguaging science classroom. *Cultural Studies of Science Education*, 15(1), 1–25. <https://doi.org/10.1007/s11422-019-09933-y>
- Lemmi, C., & Pérez, G. (2023). Translanguaging in elementary science. *International Journal of Science Education*, 46(1), 1–27. <https://doi.org/10.1080/09500693.2023.2185115>
- Licona, P. R., & Kelly, G. J. (2019). Translanguaging in a middle school science classroom: constructing scientific arguments in English and Spanish. *Cultural Studies of Science Education*, 15(2), 485–510. <https://doi.org/10.1007/s11422-019-09946-7>
- Menken, K., & Sánchez, M. T. (2019). Translanguaging in English-only schools: From pedagogy to stance in the disruption of monolingual policies and practices. *TESOL Quarterly*, 53(3), 741–767. <https://doi.org/10.1002/tesq.513>
- Moya, M. F. (2023). *Translanguaging in science emergent bilingual classrooms* [Thesis]. https://csudh.primo.exlibrisgroup.com/permalink/01CALS_UDH/1vc4mkk/cdi_proquest_journals_2861009980
- National Center for Education Statistics. (2023). *COE - English Learners in Public Schools*. Ed.gov.

<https://nces.ed.gov/programs/coe/indicator/cgf/english-learners-in-public-schools>


- Palmer, D. K., Martínez, R. A., Mateus, S. G., & Henderson, K. (2014). Reframing the debate on language separation: Toward a vision for translanguaging pedagogies in the dual language classroom. *The Modern Language Journal*, 98(3), 757–772. <https://doi.org/10.1111/modl.12121>
- Pierson, A. E., Clark, D. B., & Brady, C. E. (2021). Scientific modeling and translanguaging: A multilingual and multimodal approach to support science learning and engagement. *Science Education*, 105(4), 776–813. <https://doi.org/10.1002/sce.21622>
- Rowe, L. W. (2018). Say it in your language: Supporting translanguaging in multilingual classes. *The Reading Teacher*, 72(1), 31–38. <https://doi.org/10.1002/trtr.1673>

Author Information

Ma Teresa Aki

 <https://orcid.org/0009-0002-8026-0066>
California State University, Dominguez Hills
1000 E Victoria Street, Carson, CA 90747
USA
Contact e-mail: ms.aki.science@gmail.com

Kathryn Theiss

 <https://orcid.org/0000-0002-8830-3537>
California State University, Dominguez Hills
1000 E Victoria Street, Carson, CA 90747
USA