Data-Informed Instruction for Multilingual Learners in Elementary Mathematics

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MASTER'S DEGREE FINAL EVALUATION REPORT

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The supervisory committee met with the candidate for a final evaluation in which all aspects of the candidate's program were reviewed. The committee's assessment and recommendations are:

Recommendations:

- ✓ Degree should be awarded

Recommendations:

- ✓ Exit Requirement has been approved

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Chapter 1: Introduction/ Overview

This project investigated how data-informed instructional practices can strengthen mathematical learning for multilingual learners in a 5th-grade classroom. I am an educator who works in a highly diverse California elementary school. I have observed gaps between the conceptual understanding of multilingual learners and their performance on formal assessments. Many of these students demonstrate their thinking when we work as a class or during independent work time. However, this understanding that they show during these times is not always reflected in assessments. There is a disconnect between the classwork and the different forms of data- formative assessments.

Current research highlights that multilingual learners are often lower in mathematics because of linguistic resources, prior knowledge, or cultural backgrounds. (Moschkovich, 2015; Turner et al., 2022). Data-informed instruction is a pathway that should be taken by educators because it increases equity and allows teachers to identify misconceptions early, adjust instruction responsively, and implement scaffolds.

This introduction discussed equitable math instruction, multilingual learner needs, formative assessment, and examined how data-driven decisions in my own classroom can improve learning experiences and outcomes.

Research Question / Statement

Implementing data-informed instructional practices helped improve the mathematical understanding of multilingual learners by adjusting my instruction based

on students' demonstration of their thinking. Multilingual learners needed to receive targeted supports to help increase their access to rigorous mathematical concepts. Some of these supports could look like a word wall, pre-teaching vocabulary, giving definitions of math vocabulary, using visuals, sentence frames, models, using home language, and scaffolding word problems by breaking them into smaller chunks. These practices increased classroom engagement by creating more collaboration and participation. Multilingual learners felt more confident when they were allowed to explain their reasoning, were involved with the lessons, and could demonstrate their understanding.

Project Purpose and Goals

The purpose of this project was to look at how the data-informed instructional cycles could strengthen my teaching and help improve learning for multilingual learners. My goals are to:

1. Understand how different types of classroom data reveal multilingual learners' mathematical thinking.

2. Identify which instructional adjustments are needed to help multilingual learners' conceptual thinking.

3. Increase student engagement.

This project aligned with the relevant Interstate Teacher Assessment and Support Consortium (InTASC) Standards, particularly:

- Standard 1: Learner Development

    - Providing scaffolds such as visual models and structured discourse will help support the multilingual learners' cognitive growth.
- Standard 2: Learning Differences
    - Using students' cultural assets with their math work, such as their home language, backgrounds, and collaborative work.
- Standard 6: Assessment
    - Some of the ways that the student can be assessed are oral explanations, visuals, or written in their home language.
- Standard 7: Planning for Instruction
    - Planning for language objectives to ensure that multilingual learners can stay engaged with their mathematical tasks in the classroom with linguistic supports.

Being able to study my own teaching through action research will help me refine my practices that are related to formative assessment, differentiation, and culturally responsive instruction. I want to learn more about how my teaching practices are helping my students become successful and what I need to work on in order to help my multilingual students.

Significance of the Project

The purpose of this project was to make mathematics equitable for multilingual learners. For this project, I was able to document how a data-driven approach will provide support for multilingual learners. If the data-driven approach did not show us that it supports multilingual learners, then it will give us time to reflect and go a different

route if needed. The difference from most research for this type of project is to create mathematics learning environments where all students can learn in the same classroom and are able to demonstrate their understanding.

Project Design / Methods

Action research is the most appropriate because it allows teachers to identify their problems in their classroom setting, implement interventions, and refine instruction (Mills, 2020). Being able to study my own practice will help with my professional growth and will help with creating equitable teaching practices. Action research is also grounded in a cyclical process of planning, acting, observing, and reflecting, which empowers teachers by systematically improving instruction within their own context (Kemmis & McTaggart, 1988).

Setting and Participants

I conducted my research in my 5th-grade classroom. Approximately one-third of the students are identified as multilingual learners with varying levels of English proficiency.

Data Sources

I collected multiple artifacts to build a comprehensive understanding of student learning:

- Exit tickets and quick checks
- Pre- and post-assessments for each unit

- Work samples

  Observation notes during group work

Determining Impact

In order to know if I have made an impact, I analyzed assessment trends, student work, and recorded whether data-informed adjustments led to improved understanding or engagement. I also documented instructional decisions and their perceived effects. Growth will be shown by increased participation, improved assessment performance, and evidence of deeper understanding.

Final Products and Dissemination

The findings that will be presented are student work, data charts, and reflective insights. This research will be shared with my colleagues to help influence their teaching as well. In hopes that the audience members walk away with an understanding of how data-informed instruction can help multilingual learners in mathematics. All while teachers are learning how to implement this in their instruction.

I. Context of the Project

I am currently a fifth-grade teacher at Vista Hills Elementary School in San Jose, California. This is my fourth year of teaching experience, and it is my third year teaching fifth graders. My classroom has approximately 25% of students who are identified as English Learners (ELs) and speak Spanish, Vietnamese, and Tagalog. This demographic presented both opportunities and challenges in delivering equitable mathematics instruction.

Over time, I have noticed a recurring pattern in which students demonstrate their knowledge and understanding in class. However, they struggle with the same concepts on assessments. This demonstrates that traditional assessments do not fully capture the mathematical reasoning of multilingual learners. I am motivated to provide equity and instructional improvement so that students can be successful during classroom instruction and assessments. I am choosing this capstone project to explore how data-informed instructional practices can help multilingual learners in mathematics because I see on a day-to-day basis that students are struggling to bridge that gap.

I am aiming to create an environment where data serves as a tool to provide growth and empowerment. This project is to enhance formative assessment cycles promptly and provide specific feedback.

II. Rationale: The "Why" of the Project

Research indicates that multilingual students often encounter linguistic barriers in mathematics assessments, which can lead to underrepresentation in advanced coursework and STEM fields (Ladson-Billings, 1995). Why this project? This project was important because it addressed the achievement gap that multilingual learners face in mathematics. When instruction and assessments do not support multilingual learners, this project will seek to address this issue for multilingual learners. By implementing data-informed instruction practice, the project seeks to empower students to set goals for themselves, provide equitable access to mathematics, and utilize formative assessments as a tool. The gap that I would be filling is students breaking down barriers in mathematics.

III. Theoretical and Scholarly Connections

Culturally Responsive Pedagogy

Ladson-Billings (1995) emphasizes the importance of culturally relevant pedagogy, which asserts that teaching should be grounded in students' cultural contexts. By providing this framework, I am validating students' cultural backgrounds tied to their instructional practices. This will enhance their engagement and their learning outcomes. When students can connect their life outside of school to life in school, it creates a different learning environment. Culturally Responsive Pedagogy involves linguistic diversity as an asset in students' learning.

Formative Assessment Theory

Black and Wiliam (1998) argue that formative assessment—ongoing assessments conducted during the learning process—is crucial for improving student achievement. Going off of what Black and Wiliam stated, I agree that formative assessments are crucial for student achievement. This is an important tool that can be used to highlight feedback, peer, and self-assessment. Research also shows that when formative assessments are used regularly, teachers can adjust their instruction and target supports that students need to help them understand (Hattie, 2009). Nicol and Macfarlane-Dick (2006) emphasize that having effective formative feedback will help students with their learning and help them progress towards improving their performance in their academics.

Assessment Literacy

Stiggins (2005) defines assessment literacy as the ability to understand and use assessment data effectively to improve student learning. To give an assessment, you must truly understand how to dissect the assessment. This strategy goes with the project's goal of a data-informed teaching approach. Using strong assessment literacy gives targeted feedback to teachers and helps with monitoring student progress over time, which is beneficial for students' improved learning outcomes (W. James Popham, 2009). By teachers developing assessment literacy, this provides alignment for instruction, assessment, and learning goals that guide the student with support to their understanding and achievement (Margaret Heritage, 2010).

Sociocultural Theory

Vygotsky's (1978) sociocultural theory posits that cognitive development is deeply embedded in social interactions and cultural contexts. ELs can achieve their goals with the correct guidance and support. By implementing collaborative learning and scaffolding in mathematics instruction.

IV. Alignment with Professional Standards

This project aligned with the following standards:

- **Western Oregon University M.S.Ed. (Curriculum & Instruction) Learning Outcomes:**
    - Apply research-based practices to improve curriculum and instruction.
        - Formative assessment strategies to monitor student understanding through instruction.

        - Using visuals, models, sentence frames, math discourse, and feedback to help with conceptual understanding.
    - Demonstrate commitment to equity and culturally responsive pedagogy.
        - Supports for multilingual learners that include sentence frames, visual representation, hands-on models, and collaborative learning.
    - Engage in reflective and ethical professional practice.
        - Examine the different forms of assessment that help find the gap between students' conceptual understanding and formal assessment performance.
    - Use data to inform decision-making and continuous improvement.
        - Collect and analyze assessment data such as pre-assessment, formative assessments, exit tickets, and final performance.
        - Adapt instruction based on assessment data and provide targeted support.
- **California Standards for the Teaching Profession (CSTP)**:
    - CSTP 5: Assessing Students for Learning— This project focuses on using assessment data to improve student outcomes.

V. Implementation Plan: The "How" of the Project

Participants and Setting

- **Grade Level**: 5th grade
- **School**: Vista Hills Elementary, San Jose, CA

- **Participants**: Approximately 28 students, with 25% identified as English Learners
- **Duration**: 5-6 weeks (February- March 2026)
- **Focus Unit**: Adding and subtracting fractions with like and unlike denominators

Procedures

1. **Pre-Assessment**: An assessment that is related to adding/ subtracting fractions.
2. **Instructional Planning**: Identify key standards and linguistic challenges.
3. **Formative Assessment Cycles**:
    - Weekly exit tickets
    - Small-group discussions
    - Peer and self-assessment activities
4. **Data Analysis and Reflection**:
    - Analyze assessment data to identify similarities where students are struggling and adjust instructional practices.
5. **Instructional Adjustments**:
    - Modify lessons to address identified gaps.
6. **Student Data Chats**:
    - Engage students in group discussions about their learning progress.
7. **Post-Assessment and Reflection**:
    - Evaluate student progress and reflect on instructional effectiveness.

Data Collection

- **Quantitative**:

    - Pre- and post-assessment scores
    - Weekly exit ticket data
- **Qualitative**:
    - Observation notes
        - Taking notes while walking around the classroom to see if students are on task, helping others, and understanding all the steps required.
    - Student reflections
        - Students have self-reflection on their computer through out math program and rate their understanding for each section.
    - Teacher reflection logs

VI. Anticipated Outcomes and Significance

Through this capstone project, I anticipate that:

- Multilingual learners have increased confidence and demonstrate engagement in mathematics.
- Instruction is more responsive and differentiated.
- Data conversations are growth-oriented.

VII. Conclusion

This capstone project is a commitment to equitable, data-informed instruction that honors students' cultural diversity. This project aims to have all students succeed in

mathematics, not just a few or some of them. Using formative assessments, scaffolding, data, culturally responsive pedagogy, etc.

Chapter 2: Literature Review

Introduction and Rationale

The purpose of this literature review was to examine research. Grounded in data-informed instructional practice, formative assessments, and equitable mathematics instruction for multilingual learners. This review supported my project about *Data-Informed Instruction for Multilingual Learners in 5th Grade Mathematics*. Formative assessment, when used effectively, has been shown to have one of the highest impacts on student achievement (Black & Wiliam, 1998; Hattie, 2012). However, multilingual learners often face inequitable access to such instructional practices due to linguistic barriers, traditional assessment limitations, and deficit-based interpretations of data (Abedi, 2017; Gutiérrez, 2018). This shows that their mathematical thinking may not be shown properly or even understood correctly.

This provides for implementing equitable, data-informed, asset-based instruction that is tailored to multilingual students. The rationale for this work is driven by growing national concern about opportunity gaps in mathematics (NCTM, 2020). Multilingual learners' mathematical capabilities are often underestimated due to language-heavy assessments, which can cause them to show no progress in their academics even if they understand how to do the math (Chval & Chávez, 2021; Moschkovich, 2015). Furthermore, data-driven school initiatives frequently reinforce inequities rather than reduce them when implemented without adequate attention to culture, language, and student identity (Love, 2019; Klenowski & Wyatt-Smith, 2014). Research also indicates

that teachers often struggle to interpret and use assessment data meaningfully (Datnow & Hubbard, 2016; Heritage, 2018).

With these concerns, it is important to understand the instruction, formative assessments, multilingual learning, and equity that are needed for mathematics. By analyzing these studies, we are able to find the basis of this content, point out any flaws, and find the gaps in the field. This research is being used to design this project so it can make a valuable contribution to multilingual students' academics and equitable mathematics instruction.

Methodology for the Literature Review

Search Strategy

These are the databases that were searched and looked into for this project:

- ERIC (via EBSCOhost)
- Google Scholar
- JSTOR
- ProQuest Education Journals
- SAGE Journals
- Teachers College Record
- National Council of Teachers of Mathematics (NCTM) Research Library

These resources focused on contemporary instructional and assessment practices. Most of these articles were published within the past ten years. However,

there are foundational works and seminal theories that are still a great influence and have been published longer than ten years ago.

Search Terms and Outcomes

A search was conducted with terms that could be explored for this topic, such as mathematics education, multilingual learners, formative assessment, etc. The table below shows the term that was searched and from which database it was looked at.

Table 1

Search Terms and Database:

Search Term:	Database:
“ Formative assessment mathematics elementary”	ERIC, Google Scholar
“Multilingual learners' math instruction”	Google Scholar, ProQuest
“Data-informed instruction”	ERIC, SAGE
“Data-driven instruction critique”	JSTOR
“Equitable mathematics instruction”	NCTM, Google Scholar

“Math assessment of English learners”	ERIC
“Mathematical discourse multilingual”	Google Scholar
“Culturally responsive mathematics”	Google Scholar
“Teacher data literacy”	ProQuest

Inclusion and Exclusion Criteria

Inclusion Criteria

Studies were included if they:

- Reviewed journal articles
- Published between 2015 and 2025 (unless innovative)
- Focused on K–12 math education
- Looked into multilingual learners, formative assessment, data use, and equitable math practices.
- Contributed theoretical or conceptual insights relevant to instructional decision-making

Exclusion Criteria

Studies were excluded if they:

- Related more to high school or higher education
- Focused on standardized testing
- If they were not factual
- Unrelated to mathematics instruction

Studies were excluded if they primarily focused on high school or higher education, as they needed to focus on elementary school content. What was also excluded was testing focused on standardized testing, and if it was not related to mathematics instruction. Action research is used to address problems, while also making sure that the literature aligns with the grade level. Action research prioritizes context-specific, practitioner-driven inquiry, requiring sources that meaningfully inform instructional decision-making and equitable practice (Herr & Anderson, 2015).

Coding and Synthesis Procedures

The most frequent concepts found include: equity, assessment access, linguistic scaffolding, math disclosure, instructional responsiveness, and feedback. Looking through these frequent concepts, there are four concepts that have been decided to use.

The four major themes:

1. Formative assessment improves learning but is inconsistently implemented and can be inequitable.

2. Learning Math for multilingual learners requires linguistic access, not simplification.

3. Data-informed instruction is most effective when grounded in teacher expertise and equity.

4. Culturally responsive mathematics instruction supports identity, engagement, and achievement.

Major Themes in the Literature

Theme 1: Formative Assessment Improves Learning but Is Inconsistently and Inequitably Implemented

Using formative assessments can be one of the most powerful instructional practices that can improve student learning (Black & Wiliam, 1998; Hattie, 2012; Heritage, 2018). Summative assessments give feedback at a later time; however, formative assessments are supposed to give immediate feedback, and adjustments are made to the teacher's instruction. The con about formative assessments is that the literature demonstrates the data not being meaningfully adapted to the instruction. (Furtak et al., 2016; Brookhart, 2017). The importance of this theme is to stay consistent with the students in the classroom. Providing consistency with formative assessments helps with data collection and giving the correct supports to multilingual learners.

Inconsistent Implementation

Furtak et al. (2016) have noticed that teachers are misinterpreting formative assessments and the data they provide. Many teachers give exit tickets or quizzes, but do not make the adjustment to their instruction. Brookhart (2017) reported that teachers offer feedback that states “This is correct/incorrect”. Instead, teachers should be giving actionable feedback such as “ Here is your next step.” This shows that formative assessments do not support students' learning when used improperly.

Equity Concerns

Gotwals and Birmingham (2021) let us know that multilingual learners often receive fewer opportunities than other students when it comes to feedback. Giving student assessments that have unnecessary linguistic demands can lead to a misrepresentation of the student's understanding. This can result in inequitable instruction for the students. Linguistic complexity in assessments has been shown to negatively impact performance and lead to underestimation of students’ knowledge (Abedi, 2006). These equity concerns are important to keep in mind because multilingual learners can be receiving less rigorous instruction. Multilingual learners receiving less rigorous instruction can lead to an achievement gap, and that gap can grow bigger over time.

Controversies and Critiques

Formative assessments have been used by teachers to go through the motions of being educators and having to use them for students' learning. They tend to feel

superficial rather than being useful for their success in their academics (Schildkamp, 2019). There have been other critics who have argued that teachers are starting to use formative assessment as something quick and easy. Teachers are not using them to gain a deeper understanding of their math skills; they are using them to show that they collected data (Klenowski & Wyatt-Smith, 2014).

Relevance to the Capstone Study

This capstone project responds to the inconsistencies of the formative assessment cycle. All while students are being trained to understand, reflect on, and use their personal learning data.

Theme 2: Mathematics Learning for Multilingual Learners Requires Linguistic Access, Not Simplified Content

Multilingual learners are capable of mathematical thinking but tend to struggle due to the linguistic barriers within the instruction and assessments. This can become defeating when dealing with word problems and not knowing what needs to be solved. However, if the numbers were given to them with the correct operation, in most cases, the problem would be solved (Moschkovich, 2015; Abedi, 2017). Mathematics assessments and lessons heavily rely on English vocabulary, and that obstructs the students' learning.

Linguistic Demands Affect Access

Abedi (2017) claims that mathematical assessments and lessons let us know about a student's reading ability more than their understanding of math. This comes from word problems, using unfamiliar vocabulary, or complex grammar. With that being said, it does not show us if multilingual learners understand the mathematics. It can tell us that they do not understand how to show their work, because they do not have supports for the language barrier. Martini and Suárez (2020) discovered that multilingual learners tend to solve a math problem correctly when language is minimized or when there are visual supports that are added.

Mathematical Discourse Supports Learning

Moschkovich (2015) focuses on the positivity that allowing students to draw, use sentence frames, or use their home languages supports their deeper thinking with math. If all teachers provide support to the multilingual learners, then it will help them become more successful with their mathematical learning.

Controversies and Debates

Some scholars believe there should be a debate between the two topics: Teacher-provided or student-constructed scaffolding. Some might even say that if you overscaffold, it can reduce cognitive demand. On the other hand, if you remove the scaffolds too early, then you can take away the students' work workflow. (de Araújo, 2019). Making sure there is correct pacing for each student is crucial. Truly knowing

your students and their backgrounds will be beneficial for their academics and what is needed to help with their performance in the classroom.

Relevance to the Capstone Study

This project includes linguistic scaffolds in order to help multilingual learners show their understanding of math without unnecessary language barriers. To break those barriers, the teacher provides supports to help multilingual learners. In hopes that the supports being provided will make the achievement gap smaller and not bigger. The teacher wanting multilingual learners to be able to show their math skills without having to battle with a language that they do not understand.

Theme 3: Data-Informed Instruction Is Most Effective When Grounded in Teacher Expertise, Not Compliance

Data-driven instruction often relies on students' test scores and their quantitative metrics. Whereas data-informed instruction relies on a teacher's professional judgement alongside multiple data resources. (Datnow & Hubbard, 2016; Popham, 2017).

Limitations of Data-Driven Initiatives

Koretz (2017) argues that the accountability movement has impacted minority students and led to the narrowing of the curriculum. Love (2019) critiques traditional data cycles as they have already failed multilingual students before the assessments hit their desks. The traditional data cycles are marginalized for students.

Teacher Data Literacy

Research proves that teachers often lack the training to understand assessment data, which causes the success rate for students (Datnow & Hubbard, 2016). Schildkamp (2019) found that professional development around data tends to lead teachers to focus on reporting rather than instructional response. Other scholars agree that educators have less preparation in assessment literacy. This can cause a lack of understanding by educators because it is hard to interpret data that has been collected from students (Popham, 2017). More support for teachers in understanding how to analyze data will be more effective for students and their needs in the classroom.

Relevance to the Capstone Study

This study looks into how using data makes teachers reflect, students have conversations, and provides equitable feedback. The project is built to look at data literacy and asset-based student achievement.

Theme 4: Culturally Responsive Mathematics Instruction Enhances Identity, Engagement, and Achievement

Culturally responsive mathematics education (CRME) is a framework of culturally responsive teaching that connects with students' mathematical learning by incorporating cultural identities, languages, and community experiences. (Aguirre et al., 2013; Ladson-Billings, 1995). When the correct combination of assessments and CRME is used, it can reduce the inequities in student access and engagement.

Identity and Engagement

Felton and Koestler (2021) discovered that culturally responsive math tasks create more student participation and are more self-driven by allowing those experiences into their school work. CRME allows students to bring their cultural backgrounds into the classroom and connect with their mathematical reasoning.

Critiques and Limitations

Some researchers have noted that CRME is implemented in the classrooms, but in a superficial way. Meaning that teachers might talk about it, but do not have it deeply embedded (Sleeter, 2012). Others try to bring in students' cultural backgrounds. However, they are generalizing them based on their race instead of learning their own individual traditions or values (de Araujo, 2019).

Relevance to the Capstone Study

The project incorporates culturally responsive elements by connecting math tasks to students' lived experiences and identities and by incorporating linguistic supports that honor students' home languages.

Conclusion: How the Literature Informs the Study

The research demonstrates that:

- Formative assessments can hold a lot of weight, but teachers implement them improperly due to a lack of training.
- Multilingual learners require linguistically accessible and culturally responsive math instruction.

- Data-informed instruction is most effective.
- Culturally responsive approaches enhance engagement, identity, and achievement.

The capstone project takes these findings to help create a structured formative assessment cycle that is equitable for multilingual learners in mathematics. Having teachers integrate linguistic scaffolds, actionable feedback, and culturally responsive tasks allows the project to strengthen instruction and raise multilingual learners' confidence, engagement, and achievement in mathematics.

Chapter 3: Project Design

District and School Context

I worked in the Alum Rock School District in San Jose, California. This district has about 22 different schools in its district and about 7,400 students spread across those schools. My school, Vista Hills Elementary, serves over 500 students, and the majority of the students attending this school are Hispanic. I am currently a 5th-grade teacher serving 28 students. In my class, I have nine ELL students (English Language Learner), sixteen EO students (English Only), seven LTEL students (Long Term English Learner), and two who are EL students and have an IEP (Individualized Education Program).

This school serves as a traditional Kindergarten to fifth-grade elementary school. My school and our district have a high population of multilingual learners who speak Spanish as their primary language at home. My school is a title 1 school and has free school lunch provided to all students attending the school. Some of my students only have one parent in their lives, some parents that work nights, some parents that are stay-at-home parents, and some that have both parents in their lives. What I want for my students is to become successful with their education in all subjects, no matter what the circumstances are in their lives. I want my students to stay engaged with their learning and acknowledge that their learning is important.

Students received integrated ELD support while learning about mathematics rather than having separate instruction. The classroom environment emphasized collaborative learning, independent work time, visual supports, conceptual understanding, and time to check in with the teacher to check for understanding. My

role will include designing instruction, implementing formative assessments, collecting data, analyzing results, and reflecting on how I taught the instruction to the students. I can observe all of the students' learning and make decisions in the moment that will best help students individually.

Research Design

This project is an action research design, which is helpful to identify the problems in the classroom setting, implement interventions, and refine instruction (Mills, 2020). This research allows the teacher to generate equitable instructional decision-making. In order to gather information for this research project, I used formative assessment cycles, data-informed instruction, and equitable mathematics for multilingual learners (Black & Wiliam, 1998; Heritage, 2018; Moschkovich, 2015).

Project Timeline and Process

The project is implemented over a 4-5 week instructional period during a mathematics unit focused on fractions, adding, subtracting, and multiplication. The instructional design follows a recurring formative assessment cycle consisting of five phases: planning, gathering evidence, analyzing data, responding instructionally, and reflecting.

Phase 1: Planning (Weeks 1–2)

During the planning phase, I was able to identify the mathematical learning goals aligned with the fifth-grade level standard. I looked through the unit to identify vocabulary, misconceptions, and language barriers that might occur. This phase aligns with planning that provided effective formative assessments (Heritage, 2018).

Phase 2: Evidence of Learning (Weeks 2–4)

I used a variety of formative assessment strategies to gather evidence of student understanding, which include:

- Exit tickets
- Quick checks
- Math journals
- Whiteboard responses
- Small-group observations
- Oral explanations during math discussions

These methods were selected because students are able to demonstrate their knowledge. These methods used were highly important for multilingual learners and being able to see their understanding (Moschkovich, 2015).

Phase 3: Analyzing Data (Ongoing, Weekly)

Each week, data was collected to review weekly in order to identify misconceptions, patterns, and strengths. Students' work samples, such as exit tickets, whiteboard responses, and quick checks, were used as evidence of conceptual understanding and student engagement.

Phase 4: Instructional Response (Weeks 4–5)

Based on the data analysis, instructional adjustments were implemented, including:

- Targeted small-group instruction
- Language scaffolds such as sentence frames and visuals

- Re-teaching concepts using alternative representations
- Adjusting pacing or task complexity

I made this decision based on researchers recommending responsive instruction be used within formative data rather than using standardized measures (Furtak & Ruiz-Primo, 2020).

Phase 5: Reflection and Refinement (Ongoing)

Throughout the project, I maintained a journal that documented students' scores, observed student responses, and scaffolded students' work based on their understanding daily. Reflection is a critical component of action research and supports continuous improvement (Mills, 2020).

Data Collection and Evaluation Procedures

Data Sources

To evaluate the data-informed instructional practices, multiple qualitative and quantitative data sources were collected, which were:

- Pre- and post-unit assessments
- Weekly formative assessments (exit tickets, quizzes)
- Observation notes during collaborative work
- Student reflection responses
- Teacher reflective journal

Evaluation of Project Effectiveness

The effectiveness of the project:

- Student's mathematical understanding, as evidenced by assessment data and work samples
- Student engagement, including participation in discussions and collaborative tasks
- Quality of mathematical explanations, both written and oral
- Use of academic and mathematical language by multilingual learners

Determining Success

The project would be considered successful if the formative data demonstrated:

1. Improved conceptual understanding over time.
2. Increased engagement among multilingual learners.
3. Instructional decisions were made based on evidence.

Chapter 4: Artifacts and Evidence of Practice

2-week learning plan for adding and subtracting fractions with like and unlike denominators.

- 5th-grade students
- **Standard:** CCSS.MATH.CONTENT.5.NF.A.1 – Add and subtract fractions with unlike denominators by replacing given fractions with equivalent fractions.
- **Unit Goal:** Students develop an understanding of adding and subtracting fractions with unlike denominators using visual models, word problems, and equations. Students will use proper vocabulary when their reasoning is explained.

Day 1: Pre-Assessment and Introduction:

- Give students an assessment on adding and subtracting fractions.
- Students take notes in their math notebook of vocabulary words that will be used in this unit. The teacher projects this as the teacher explains to the students the meaning of the words. The words for the unit are numerator, denominator, fractions, LCM (least common multiple), and equivalent.

Day 2: Equivalent fractions:

- Students review their notes from day 1 of the unit.
- The teacher asks the students what equivalent fractions are.

- The teacher passed out fraction strips to each group to work with their partner next to them. This allows for all students, including multilingual learners, to follow along with the unit. The teacher showed an example of how the fraction strips work. By placing two 1/4 together and placing 1/2 underneath to show they are equivalent.
- The students worked with their partners to make their own equivalent fractions. When they completed an equivalent fraction, one from each partner wrote their equivalent fraction on the whiteboard in front of the class.
- Once all partners wrote their equivalent fractions on the board, we reviewed them as a class. This allowed all students to see different ways to make equivalent fractions.

Day 3: Finding common denominators:

- The teacher showed an example problem on how to find a common denominator.
    - Ex) 1/3 and 1/4
- The teacher wrote down the multiples of 3 and 4. This allowed students to visually see what the common multiples were. Once we found the least common multiple, I circled that number so we would not forget. We carried on with the process of multiplying the fractions in order for both fractions to have a common denominator.
- Every student has multiplication charts.
- Students worked with their groups on a whiteboard to solve problems that we did in class. Whoever is writing on the whiteboard has to listen to the instructions of the other students in their group on how to solve.

- Exit ticket: Find the common denominator for 2/3 and 3/5

Day 4: Adding fractions with like denominators:

- Discussed that when you are adding fractions, only add the two numbers in the numerator, and keep the common denominator the same.
- Fraction bars, drawings, equations, and vocabulary were used for visuals.
    - Ex) 1/4 + 2/4 = 3/4
- Sentence frames were written on the board for students to use when they were explaining their reasoning to a partner.
    - I added….
    - My denominator is…
    - My answer is….

Day 5: Subtracting fractions with like denominators:

- Discussed that when you subtract fractions, you only subtract the two numbers in the numerator, and keep the common denominator the same.
- Fraction bars, drawings, equations, and vocabulary were used for visuals.
    - Ex) 5/6 - 4/6 = 1/6
- Sentence frames were written on the board for students to use when they were explaining their reasoning to a partner.
    - I subtracted….
    - My denominator is…
    - My answer is….

Day 6: Adding fractions with unlike denominators:

- Reviewed how to find the LCM.
- Discussed that when you are adding fractions, only add the two numbers in the numerator, and keep the common denominator the same.
- Fraction bars, drawings, equations, and vocabulary were used for visuals.
    - Ex) 1/3 + 1/4 = 4/12 + 3/12 = 7/12
- Sentence frames were written on the board for students to use when they were explaining their reasoning to a partner.
    - My LCM is …..
    - I multiplied….
    - I changed my fractions to….
    - 1/3 is equivalent to….
    - 1/4 is equivalent to…..
    - Then I added….

Day 7: Subtracting fractions with unlike denominators:

- Reviewed how to find the LCM.
- Discussed that when you are subtracting fractions, you only subtract the two numbers in the numerator, and keep the common denominator the same.
- Fraction bars, drawings, equations, and vocabulary were used for visuals.
    - Ex) 5/6 - 1/4 = 10/12 - 3/12 = 7/12
- Sentence frames were written on the board for students to use when they were explaining their reasoning to a partner.

- My LCM is …..
- I multiplied….
- I changed my fractions to….
- 5/6 is equivalent to….
- 1/4 is equivalent to…..
- Then I subtracted….

Day 8: Word problems with fractions:

- Ex) Aidan drank 1/4 of his water bottle in the morning and 1/3 at night. How much water did he drink in one day?
  - This was given in English and in Spanish.
- Students highlighted the important information in the problem. When solving the problem, students had the option to use fraction strips, use drawings/ models, or solve the equation.
- The exit ticket was one word problem similar to the example.

Day 9: Review adding and subtracting fractions with unlike denominators:

- Students worked on different problems to keep practicing their skills. The teacher walked around to help students solve the problems they were given. A variety of problems with adding, subtracting, and word problems were given. A max of 10 problems.

Day 10: Post Assessment:

- 2 word problems in English or Spanish based on their first language.

- 5 computation problems

The teacher took notes throughout the process to make sure students were on task and what they needed help with. Also, taking notes on which students understood the questions from the exit tickets that were given.

Chapter 5: Reflection, Implications, and Professional Growth

Revisiting the Original Goals

In chapter 1, the primary goal of this project was to examine how implementing data-informed instructional practices would influence the mathematical understanding and classroom engagement of multilingual learners in my 5th-grade classroom. I decided to use formative data more intentionally to help guide my instructional decisions, help strengthen the multilingual learners' conceptual understanding of mathematics, and increase engagement in the classroom.

Progress Toward Instructional Goals

Overall, the project demonstrated progress toward these goals. Formative assessment cycles became more intentional and structured. Rather than collecting exit tickets and only skimming through them, I analyzed them more in order to identify patterns. This helped me use my assessment cycles as an instructional tool. It also helped with building the gap between the pre-assessment and post-assessment. Although the achievement gap is not where I would like it to be, it allowed multilingual learners to gain more confidence in their academic discussions and their work.

What Went Well

The areas of the project that were successful:

1. **Student Engagement-** Once students were able to grasp the idea of finding the LCM, students began to participate more, even the students who did not usually

participate in the class. I have one student in the class who mainly speaks Spanish and was able to participate in this unit.

2. **Integration of Language Supports-** Sentence frames, visuals, Google Translate, and vocabulary all helped with language supports and understanding the meaning of words being used for this unit.
3. **Consistency of Formative Assessment Cycles-** Embedding formative checks allowed no surprises for students, which helped students predict what would happen in the classroom. This helped with less test stress/anxiety.

Challenges and Struggles

The project also went through some challenges and struggles:

1. **Emotional Labor-** Making sure to look at only the data for evidence, not letting my emotions be attached to the students that I have to affect the planning I do.
2. **Time Constraints-** Requires a lot of time to sit down and plan accordingly for all 28 students in the classroom. Making sure I used my prep time to plan for this unit resulted in no time for the other subjects in the class.
3. **Cognitive Load-** Looking at conceptual understanding and breaking down the language barriers required a lot of focus and determination, all while teaching the unit itself.

Relationship to the Literature Review

The data that I received in my classroom aligned closely with these claims. Multilingual learners were allowed to explain their reasoning when structured, and when instruction

was happening there was more engagement and achievement was improved. The literature connection to the project:

1. Embedding consistency with formative assessments improves learning (Heritage, 2018).
2. Showing multilingual learners they are capable mathematical thinkers (Moschkovich, 2015).
3. Engaging classroom helps increase conceptual understanding (Turner et al., 2022).

Personal Growth as a Teacher and a Leader

Growth Reflection

This project showed me that I can always learn as I keep teaching. All my ways are not the right ways, and just because I taught a certain way last year does not mean I need to teach like that this school year or in the future. I became more comfortable with asking myself questions such as: What assumptions am I making? What students are getting left behind? Are my assessments effective? Reflection taught me that it was important to realize we will always be growing. It has also taught me that it is okay to admit when you are wrong or when something has not worked out. I have gained more confidence in my style of teaching and more confidence in teaching multilingual learners. During my teaching, I assumed that hands-on visuals are equivalent to drawings/models. With this assumption, it set back some of my students since hands-on techniques were not equivalent for them. Once I started to bring in hands-on activities, it allowed me to show more progress for my multilingual learners.

Reflection on InTASC Standards

These are the InTASC Standards that I stated in Chapter 1:

- Standard 1: Learner Development
    - I was able to deepen my understanding of how multilingual learners' linguistic development intersects with their cognitive development through mathematics. It also opened my eyes to the fact that students can demonstrate their understanding based on differentiating supports.
- Standard 2: Learning Differences
    - Making sure that all students receive the support that is needed for their learning in order to be successful. This means providing beneficial supports for multilingual learners that are embedded into their core instruction. Always making sure to anticipate variability instead of being reactive.
- Standard 6: Assessment
    - This area showed me the growth that the students made throughout the lesson. It provided continuous feedback and helped me plan the next lesson for the unit. I am not able to approach assessment with greater intentions to best serve my students.
- Standard 7: Planning for Instruction
    - During this process, I have become more fluid and responsive in planning. I learned to adjust more quickly and dive deeper based on the evidence I noticed. During this process, I was able to find what works for me, my students, and both of the groups together.

Limitations of the Project

1. **Short Duration-** Only has a 2- 5 week cycle, limiting long-term conclusions.
2. **External Constraints-** ELPAC testing was happening during this window period, which influenced the pacing of the unit.
3. **Teacher-Reacher Bias-** I could have interpreted data through a different lens because I am the instructor and evaluator.

What I Would Do Differently

If I were to do this project again, there are a couple of things that I would change or do differently. I would have student interviews. This would allow me to truly know what the students are thinking and process their work. It helps me gain a perspective of a student. I would also extend the project across multiple units and extend the length of the unit. This will help with more review time and slow down the process for their thinking. The only issue with slowing down the unit is that it puts us behind in teaching all units on time for their testing that happens in May. These changes could strengthen the project's overall validity. These strategies and techniques can be applied to more than just this unit. For the future, I would refine my data-informed practice and share my evidence at PD sessions. In the future, I would also provide incentives for multilingual learners when they are completing their work. The incentives will help multilingual learners gain more confidence in themselves and their academics.

Conclusion

Being able to engage in this research project helped me see different perspectives for all of my students, including my multilingual learners. Through the process of this project, I needed to be vulnerable, persistent, and have critical self-examination. While I was doing this for all of my students, I was able to see it impact my multilingual learners positively. Effective teaching does not require a perfect lesson delivery; it is about knowing your students and what supports are beneficial to their learning. As I continue in my career, I have a deeper commitment to being a leader in my research and in my classroom.

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