

A Program that Promotes Responsive Mathematics Teaching for English Language Learners in Gr. 6-12 Classrooms (Workshop)

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Abstract

This paper focuses on a state-level program developed and implemented to meet the learning needs of students who are US immigrants, mostly of Mexican descent, and whose first language is not English. It describes a collaborative, multi-year project to improve mathematics teaching for English language learners (ELLs) in grades 6-12 classrooms. Researching extensively on best teaching practices for ELLs, designing curriculum materials, and training teachers were systematic efforts conducted to meet the goal of improving the performance of cultural minority students in the Texas state mathematics assessment, particularly on the exit-level examination taken by high school students. Data from teacher participants included (a) lesson plans that they developed and implemented using teaching strategies with strong language support, hands-on activities, and multiple representations, (b) written feedback from students who were mostly ELLs, and (c) teachers' reflections on using "sheltered instruction" and professional growth.

Statement of the Problem

A global society such as ours has to be prepared to meet the challenges of teaching mathematics to a diverse population. As the student population in the US becomes more diverse culturally, issues in teaching mathematics not only involve mastering content but also linguistic challenges faced by both students and teachers (Bay-Williams, 2007; Schleppegrell, 2007). A focused professional development of mathematics teachers is critical.

Texas is one of the states in the US that historically has shown students with limited English proficiency (LEP) have not performed as well as the English speaking students on the state mathematics assessments. Results from the Texas Assessment of Knowledge and Skills (TAKS) for the past four years (2003-2006) showed that passing rates for students in grades 7-11, were between 11% and 42% (Texas Education Agency, 2006). In order to meet the state's goal of improving the performance of English Language Learners (ELLs), the Texas Education Agency (TEA), in collaboration with the Texas State University System (TSUS), provided funding and guidance for the creation of Mathematics for English Language Learners (MELL) initiative. The researchers involved in this project focused on improving Hispanic students' achievement on Texas assessments through a systematic and innovative program involving classroom strategies that engage and meet the needs of English language learners.

Description of the intervention

English language learners often face challenges in developing both the academic and social language as documented in the research involving English as a Second Language (ESL) and bilingual education. The project first focused on identifying the underlying cultural and linguistic factors that impact the mathematics performance of Texas' ELL students and developing practical teaching resources that help classroom teachers address those issues. As a part of the MELL initiative, Critical Campus Partnerships were formed between university educators and school districts with high ELL populations of students. In the summer of 2006, five full days of professional development were conducted with 25 teachers from three school districts (10

campuses) in the Rio Grande Valley in Texas. This training included topics such as characteristics of ELLs and their challenges, instructional strategies that promote ELL success, mathematics content development tied to lesson modeling, mathematics problems with reduced language requirements, and literacy strategies and language development for mathematics success. This was followed by teachers' attendance at a two-day TSUS MELL Conference in July 2006. A follow-up meeting with the teachers was conducted in August 2006 in which classroom implementation of MELL strategies was discussed, and effective lesson plans for ELL students based on the sheltered instruction model were modeled. Teachers developed and taught mathematics lessons that included "sheltered instruction" techniques (Echevarria, Vogt, & Short, 2004) with emphasis on language development during the fall semester. Results of the classroom implementation were shared during the follow up meeting.

Findings and evidence of success

An external evaluator was hired to monitor the process and outcomes of the summer training. Responses from 25 participating mathematics teachers in the summer program revealed,

- Increased knowledge of mathematical concepts;
- Increased ability to teach for vocabulary learning and communication;
- Gained confidence in using technology to help the visual learners;
- Felt comfortable using strategies that meet the needs of ELLs (e.g., Hispanic students);
- Opportunity to join a support group and share strategies and activities to increase student motivation and understanding,

Additional data from teacher participants' classrooms were collected in November 2006 including their best lesson plan and students' feedback on the lesson taught. Complete data were received from 20 (80% return) teacher participants in November 2006. These mathematics teachers taught grades 7th through 12 in public schools located near the Mexican border. They also turned in the completed questionnaire from 370 students combined. Of this total, 62% speak Spanish only and 34% speak both English and Spanish. The fluency level of each student in each language was not determined.

Teachers' feedback

Analysis of teachers' reflections indicated that their students had opportunities to share, speak, use multiple representations, and write their ideas during the lesson. They also revealed how teachers have changed their teaching method. For instance, one middle school teacher participants wrote: "It is like being a new teacher all over again! I have developed new strategies and ideas to present the lesson." The following are typical written comments from the MELL teacher participants after teaching a lesson using the sheltered instruction.

The "BicycleTour" lesson gave the students an opportunity to work in pairs. Each pair of students had to present their graph, interpret and answer questions given by the teacher to assess if they understood the lesson. I asked the students to create a table of data given and to label each ordered pair so they could see the relation. Most realized that all the information was the same but different representation. The students liked the lesson so much that all wanted to do after this lesson was to create and make graphs. (7th grade teacher)

The lesson that I taught for the ELL students was very rewarding especially when I am not a math teacher. The emphasis was on the vocabulary and how well they read and understood the directions. The students worked in groups and were helping each other out. The students enjoy more when the activity is on-hands, especially if the activity is very visual and colorful. The objective was met. (ESL teacher)

Writing is one part of the skills where most of my students (high school) struggle. The use of a glossary made a tremendous impact so I posted vocabulary on the walls using the thinking maps. Students see the math vocabulary everyday and, as they write their journals it is easier because they can just look on the wall and pick from the math glossary. (Secondary math teacher)

Students’ feedback on “sheltered” lesson taught

After each teacher taught a “sheltered” lesson, students’ feedback was collected using a short questionnaire that included the following prompts:

1. I learned new English math terms today: __Yes __No
2. I did some writing and explaining today. __Yes __No
3. I was able to work in small groups and share my ideas. __Yes __No
4. I feel good in my math class. __Yes __No
5. I enjoyed today’s lesson because _____
6. One helpful thing that my teacher did was _____
7. I learned _____

Students’ responses to the prompts provided evidence indicating whether or not the teachers had explicitly provided opportunities for ELLs to engage in activities requiring speaking, writing, reading, and listening. Student responses were tallied and summarized per teacher (see Table 1).

Table 1. Students’ feedback on “sheltered” math lesson taught by participants.

Teacher	Grade	Number of students	I learned new math terms	I did some math writing & explaining	I worked with a group
A	7 th	25	23	23	23
B	7 th	25	25	21	24
C	10 th	25	15	23	24
D	9 th	15	10	15	11
E	8 th	8	7	8	7
F	8 th	13	8	13	11
G	7 th	25	25	23	23
H	9-11 th	17	9	12	17
I	7 th	25	25	25	25
J	8 th	15	13	12	13
K	9 th	10	10	7	9
L	8 th	16	16	16	14
M	10 th	10	10	10	10
N	10 th	20	17	16	20
O	10 th	25	24	24	22
P	10 th -11 th	13	12	11	9
Q	10 th -12 th	19	17	17	10
R	12 th	11	11	11	10
S	7 th	12	11	12	11
T	10 th -12 th	41	23	26	15
	Total	370	311	325	308

As a group, 84% of the students said that they learned new mathematics vocabulary during the lesson. Additionally, 87% indicated they were able to explain and to write their mathematics ideas while 83% wrote that they worked in small groups during the class period. On the open-ended items, students wrote their responses in English, Spanish, or a combination of both. Typical responses to prompts #5, # 6, and #7 are listed below.

I enjoyed today's lesson because _____

I got to stand up in front of the class and show what I know;
It involved writing, not just solving but explaining the process;
Habia muchas cosas que yo entendi pero que yo entendi como hacer;
(English translation: Understood better this time)
It was fun working in groups;
We built things, played with cubes;
Worked in groups to play games.

The most beneficial (helpful) thing that my teacher did was _____

Tell me things in Spanish because some words in English I don't know;
Putting us in groups and making 3-D models;
Explicandonos en Ingles y Espanol;
(English translation: explained in both English and Spanish)
Allow us to share ideas with a friend and explain what we don't know;
Explained in different ways;
Assigned a mentor for me.

I learned _____

New vocabulary and how to read graphs;
How to play probability games;
I learned the word "randomly";
Aprendi palabras nuevas.
(English translation: I learned new vocabulary.)

The responses to the open-ended items on the questionnaire gave some indications of the degree of engagement and participation the students had during instruction. The student responses also revealed their attitude and motivation during the class period. Many of the ELL students preferred to write in Spanish, an indication that they have not gained fluency of the English language. The same students however, felt they learned new mathematics vocabulary and that their teachers made modifications (e.g., find a peer as mentor, explain ideas in many ways, say things in Spanish) during instruction to help them learn.

Possibilities for transfer to different environments

The MELL program tailored for mathematics teachers of ELLs can work as well in other mathematics learning environments. The same strategies can be used during tutorials or one-on-one interventions in any mathematics subject (e.g., Geometry, Algebra). One participant who was certified to teach English as a second language used "sheltered" instruction strategies in her multi-grade level class and found these helpful.

Further research

Effective strategies and techniques for helping ELLs gain knowledge and confidence in mathematics need further research. In particular, research should focus on the classroom implementation phase and the support system teachers need to meet the challenges faced by English language learners. Any intervention program to assist teachers in this area should be evaluated based on student success and learning.

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