

IMPACTS OF ESOL PD ON STEM TEACHERS' CLASSROOM INSTRUCTION

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ESOL PROFESSIONAL DEVELOPMENT FOR STEM CONTENT TEACHERS: PACIFIC UNIVERSITY'S **ELSTEM (ESOL FOR STEM EDUCATORS)** PROJECT

- ▶ Federal Grant Program: NPD (National Professional Development)
- ▶ Grantor: (OELA) Office of English Language Acquisition, US Department of Education (Title III Grant)
- ▶ **ELSTEM**: A federally funded professional development project designed and implemented to serve secondary pre-service and in-service STEM teachers (*tuition scholarship and stipends award*)
- ▶ Objectives: Design and implement a new ESOL teacher preparation curriculum that integrates teacher training in STEM (science, technology, engineering and math) and an endorsement in ESOL (English to Speakers of Other Languages)

ELSTEM COURSEWORK OVERVIEW

- ▶ Preservice program: STEM teacher preparation program fully incorporating ESOL endorsement coursework (based on the Pacific University's Woodburn campus)
- ▶ Inservice program: Online ESOL certification program for STEM teachers in 8 partner school districts in Oregon.
- ▶ Alignment with Oregon TSPC standards for ESOL endorsement
- ▶ Curriculum tailored to the needs of secondary STEM teachers (specialized curriculum)

TSPC STANDARDS #1: LANGUAGE

- ▶ Linguistic competency required for ESOL-certified teachers
- ▶ How is it addressed to ELSTEM participants?
 - Rigorous linguistic training and analysis practice (phonetics, phonology, morphology, syntax, semantics, pragmatics, discourse analysis, language acquisition, language variations) through a series of *learning* modules
 - Strong focus on application of linguistic knowledge on STEM content instruction through *application* modules
 - Online small group discussion on application to instructional setting (small groups are formed for specific content and grade levels: MS Math, MS Science, HS Science, HS Technology)

TSPC STANDARDS #2: CULTURE

- ▶ Cultural competency required for ESOL-certified teachers
- ▶ How is it addressed to ELSTEM participants?
 - Cultural awareness online workshops and postings
 - Service learning components incorporated (getting to know who their ELs are at their schools and how they engage in STEM content instruction)
 - Consulting an ESL case manager at their schools to discuss their schools EL accommodations, ways to enhance el case management, particularly for STEM subjects.
 - Development of awareness and understanding for ELs with special needs

TSPC STANDARDS #3: PLANNING, IMPLEMENTING, AND MANAGING INSTRUCTION

- ▶ Lesson planning and curriculum adaptations to facilitate ELs' STEM content learning
- ▶ How is it addressed to ELSTEM participants?
 - Building strong foundations in ESOL methods, particularly for sheltered content instruction and K-12 sheltered instructional models (SIOP, GLAD, SDAIE, Constructing Meaning)
 - Small group discussion on lesson and curriculum adaptations for secondary science and math content (for specific content and grade levels such as MS Math, MS Science, HS Science, HS Technology)
 - Strong focus on how to teach STEM vocabulary and integrate STEM literacy into secondary science and math lessons
 - The courses taught by STEM professionals with ESOL certifications and extensive experience of teaching ELs in secondary schools

TSPC STANDARDS #4: ASSESSMENT

- ▶ Knowledge and proficiency in language assessment required for ESOL-certified teachers
- ▶ How is it addressed to ELSTEM participants?
 - Building foundational knowledge of language assessment
 - Building knowledge and proficiency in English language proficiency standards and how the language proficiency standards (i.e., ELPA 21 standards) are aligned with CCSS for Math and NGSS standards for Science)
 - Explicit incorporation of language assessment tools and criteria in STEM lesson and unit planning

TSPC STANDARDS #5: PROFESSIONALISM

- ▶ Knowledge and competency in the history of EL and bilingual education policies of the U.S., the current legislation relevant to EL education, various language policy and political issues relevant to EL education
- ▶ How is it addressed to ELSTEM participants?
 - Building knowledge and background in history of EL and Bilingual Education in the U.S.
 - Law and court rulings relevant to ESOL education
 - District and state el education policy reviews
 - District and school el policy implementation analysis

TSPC STANDARDS #6: TECHNOLOGY

- ▶ Use of effective instructional technology in EL instruction
- ▶ How is it addressed to ELSTEM participants?
 - Incorporation of instructional technology in sheltered STEM lesson and unit planning
 - Knowledge and awareness in STEM teaching and learning-related web resources that would be effective in teaching ELs

ESOL PD FOCUS IN ELSTEM PROGRAM: BUILDING FOUNDATION IN SHELTERED STEM CONTENT INSTRUCTION MODELS (SI)

- ▶ Instructional models developed to teach K-12 English learners in their content subject area.
- ▶ SIOP (Sheltered Instruction and Observation Protocols),
- ▶ GLAD (Guided Language Acquisition Design),
- ▶ SDAIE (Specially Designed Academic Instruction in English),
- ▶ Constructing Meaning (CM)
- ▶ CM (Constructing Meaning)

ELSTEM PD PROGRAM ASSESSMENT CRITERIA: COMMON ELEMENTS IDENTIFIED IN SI MODELS (I)

- ▶ *Identification and Review of Content Lesson Objectives*
- ▶ *Identification and Review of Language Objectives*
- ▶ *Activation of Background Knowledge*
- ▶ *Modeling*
- ▶ *Scaffolding of Key Academic Concepts*
- ▶ *Multi-faceted Vocabulary Instruction*

ELSTEM PD PROGRAM ASSESSMENT CRITERIA: COMMON ELEMENTS IDENTIFIED IN SI MODELS (I)

- ▶ *Explicit Instruction of Academic Language*
- ▶ *Visual Aids (Diagrams, Charts, Graphic Organizers), Realia, Manipulatives*
- ▶ *Partner and Small Group Work, Cooperative Learning*
- ▶ *Positive Learning Environment, Motivation*

RESEARCH QUESTIONS

- ▶ In what ways are ELSTEM participants similar or different in classroom instruction when compared to non-ESOL-trained STEM teachers in ESOL?
- ▶ What language scaffolding and ESOL strategies are commonly observed among ELSTEM participants' classroom teaching?
- ▶ What types of ESOL strategies appear to be most prevalent in their STEM content instruction?

RESEARCH PARTICIPANTS

- ▶ 5 ELSTEM project participants (in-service STEM teachers): Surveyed and observed at the beginning and at the end of the project participation: Average teaching experience (6 years, ranging from 2 to 11 years)
- ▶ 4 Non-ESOL-trained participants (in-service STEM teachers recruited from the same districts where the ELSTEM participants were teaching): Surveyed and observed toward the end of a school year using the same criteria/rubrics used to evaluate the ESOL-trained STEM teachers
Average teaching experience (12 years, ranging from 8 to 20 years)
- ▶ Classroom teaching observation reports using an established template to identify sheltered instruction strategies
- ▶ Self-reported surveys (pre- and post-participation surveys)
- ▶ ESOL portfolios submitted by participants

DATA

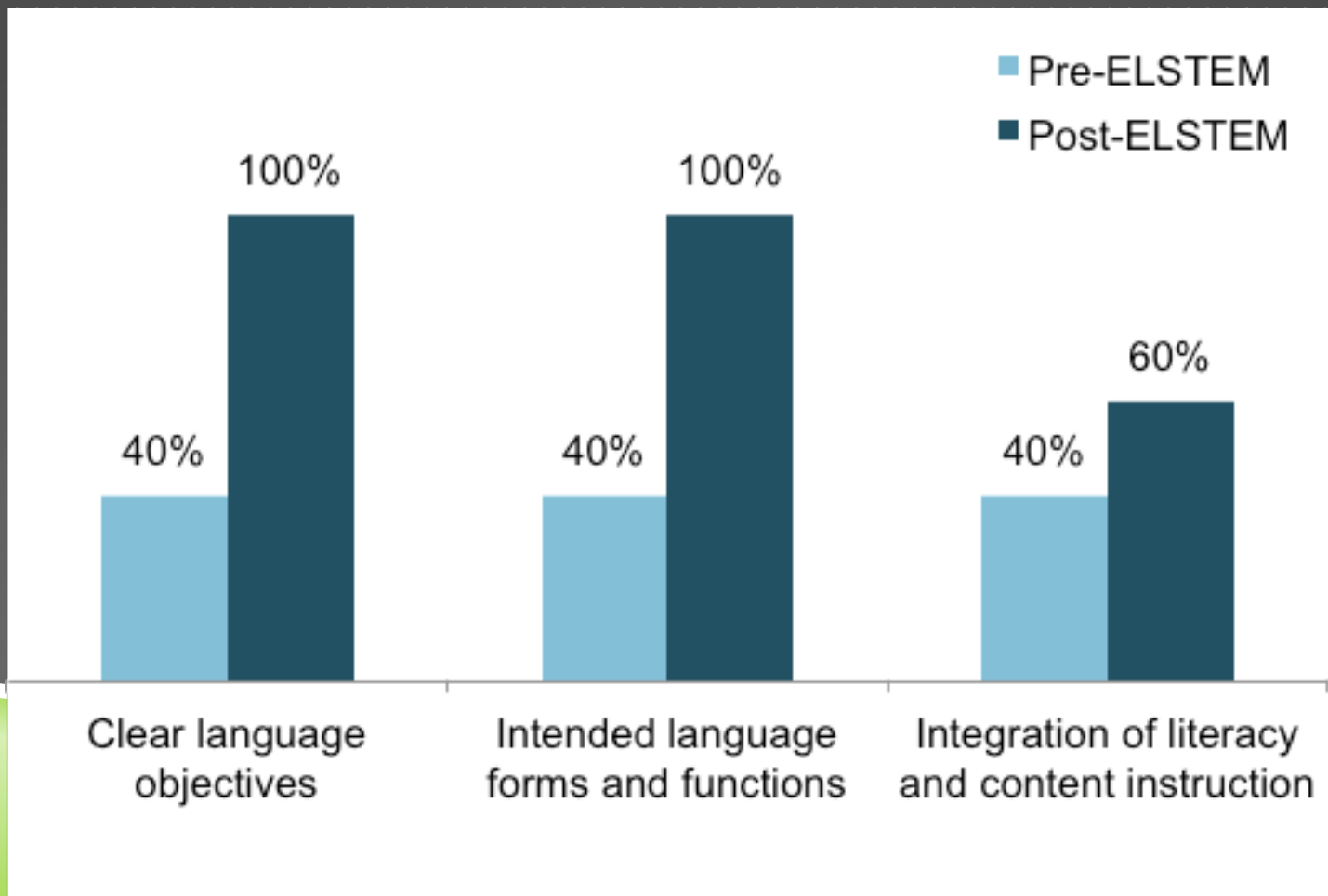
- ▶ Classroom teaching observation reports, videotaped instructional segments for further analysis
- ▶ Self-reported surveys
- ▶ ESOL portfolios

OVERALL EL TEACHING EFFECTIVENESS COMPARISONS

- ▶ Overall rating of the ELSTEM program participants' teaching effectiveness for ELs improved: on a 4-point scale, it increased from 2.8 before participation to 3.5 toward the end of their participation.
- ▶ Overall rating of the non-ESOL-trained STEM teachers: on a 4-point scale, overall rating of lessons for the non-ESOL-trained STEM teachers was 2.75
- ▶ **Similarities** between the non-ESOL-trained STEM teachers and the ELSTEM participants:
 - Clear lesson and language objectives in their instruction.
 - Most of the teachers did not heavily rely on textbooks, but used various instructional materials such as tools and props, models, and teacher-made materials.
- ▶ **Differences** between the non-ESOL-trained STEM teachers and the ELSTEM participants:
 - Incorporation of explicit linguistic features
 - Integration of STEM literacy and content instruction
 - Activation of ELs' background knowledge

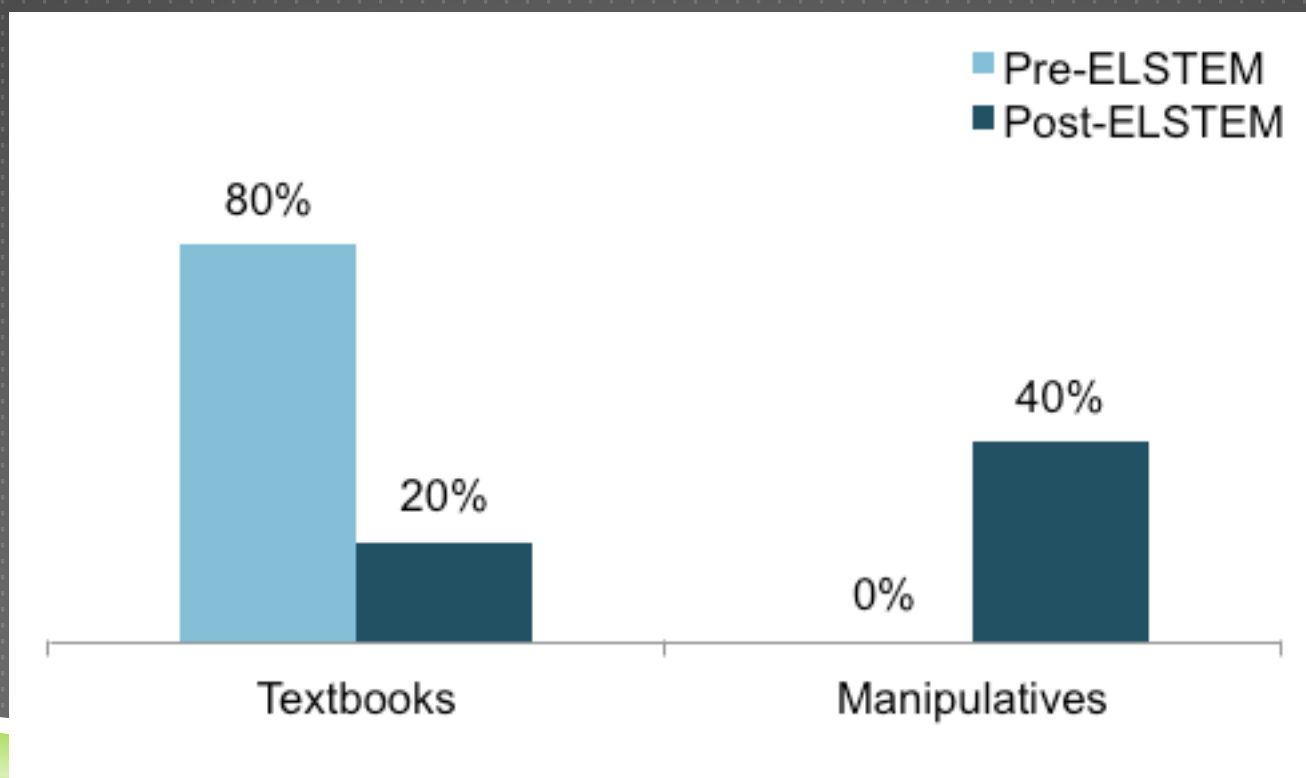
ELSTEM PARTICIPANTS' LANGUAGE SCAFFOLDING AND ESOL STRATEGIES(I)

► Figure 1: Language Integration in STEM Content Lessons



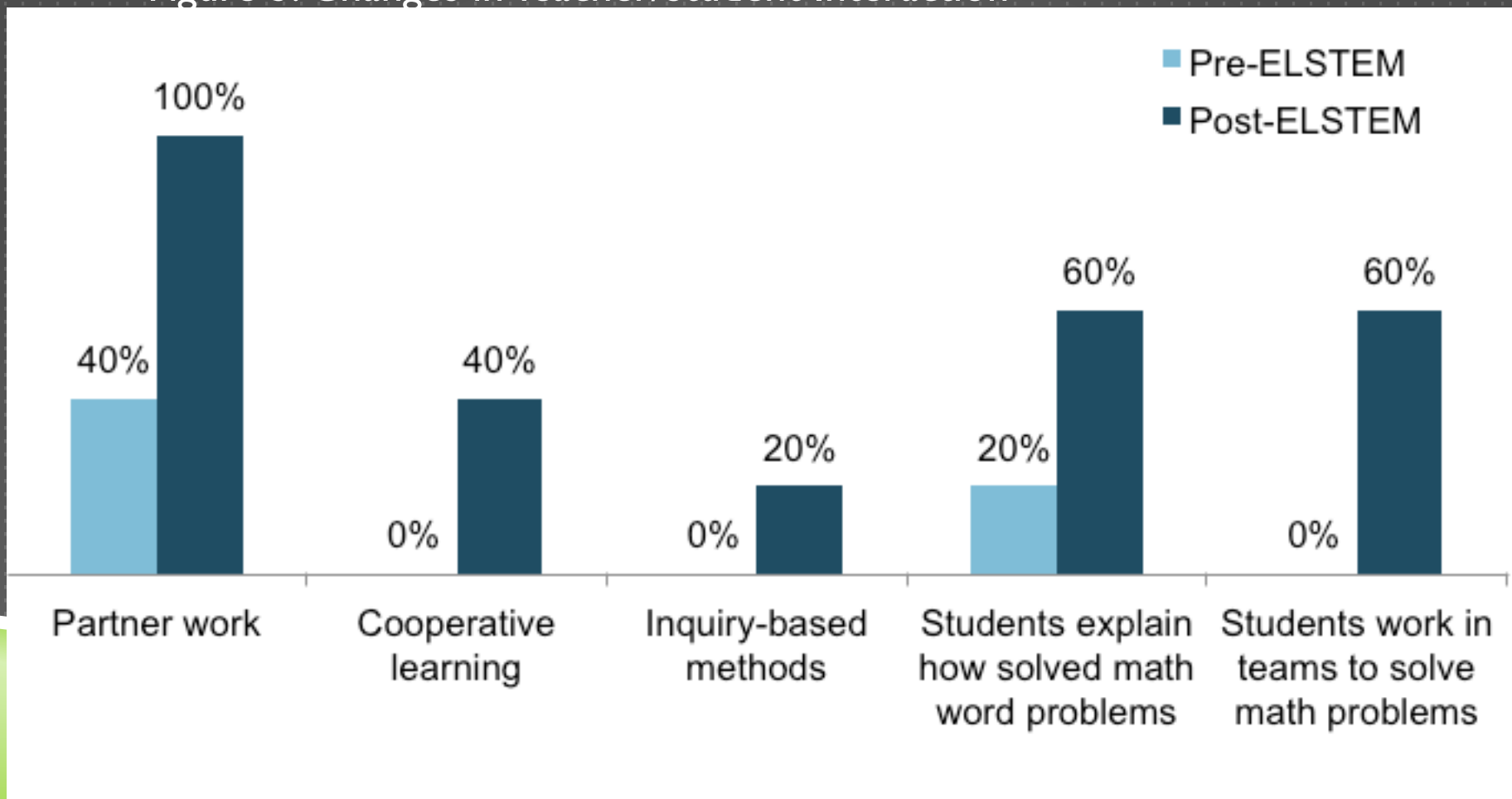
ELSTEM PARTICIPANTS' LANGUAGE SCAFFOLDING AND ESOL STRATEGIES(2)

► Figure 2: Participant's Use of Instructional Materials



ELSTEM PARTICIPANTS' LANGUAGE SCAFFOLDING AND ESOL STRATEGIES(3)

► Figure 3: Changes in Teacher/Student Interaction



TYPES OF ESOL STRATEGIES MOST PREVALENT (I)

- ▶ ELSTEM participants' teaching effectiveness is significantly improved in the following ESOL strategies:
 1. All observed lessons included clear lesson and language objectives (compared to 40 percent before participation)
 2. All lessons covered intended language forms and functions (compared to 40 percent before participation)
 3. Literacy and content instruction were integrated in 60 percent of lessons (compared to 40 percent before participation) They relied less heavily on textbooks, seen in just 20 percent of classrooms (compared to 80 percent before participation)
 4. They began to use manipulatives—physical objects (i.e., blocks, tiles, beans, or models) that can be operated by hand to aid in learning—which were seen in 40 percent of lessons

TYPES OF ESOL STRATEGIES MOST PREVALENT (2)

5. Substantial growth in the activation of ELs' background knowledge that applies to a given lesson topic: before the participation in the program (this was seen in no observations, but toward the end of the program participation, it was seen in all (100%).
6. Also, the participants were more likely to incorporate ELs' funds of knowledge into STEM instruction after the *ELSTEM* program participation (40%) than before (20%).

TYPES OF ESOL STRATEGIES MOST PREVALENT (3)

7. Teacher-talk time was reduced (53 to 37 percent of lesson time) while **student to student interaction** increased (30 to 39 percent of lesson time)
8. Teachers used **cooperative learning approaches** in 40 percent of lessons (compared to none before participation)
9. Students worked with **partners** in 100 percent of lessons (compared to 40 percent before participation)
10. Students **worked in teams** to solve math problems (60 percent of lessons) and were asked to explain how they solved word problems (60 percent of lessons), minimally seen before participation
11. A few observed lessons (20 percent) used inquiry-based methods (asking questions; planning and conducting investigations; using appropriate tools and techniques to gather data; thinking critically about relationships between evidence and explanation; and constructing and analyzing alternative explanations)

CONCLUSION

- ▶ ELSTEM (ESOL PD program for STEM educators) indeed enhanced classroom teachers' teaching effectiveness for ELs; STEM teachers demonstrated substantial growth in using many of the ESOL strategies, particularly in activating and building on students' background knowledge, explicit language and content integration, and ample opportunities for student talk and engagement in content instruction.
- ▶ It is notable that the length of teachers' classroom teaching experience was not necessarily correlated with their teaching effectiveness for EL teaching. This implies that EL teaching effectiveness and incorporation of explicit language instruction are not achieved just because content teachers gain more experience in teaching.