

STEMSS Strategies Professional Development to
Support Academic Language Acquisition

by

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ABSTRACT

This study explored the effects of a science, technology, engineering, math, and social studies (STEMSS) professional development (PD) on teachers of language learners' (TLLs) knowledge, skills, and self-efficacy in teaching content and language in tandem in their classrooms. With the growing population of English learners (ELs) in today's classrooms, it is essential TLLs have the skills to support language development while teaching content. This study investigated a face-to-face PD that developed skills in supporting ELs' academic vocabulary development using strategies in content lessons.

This research drew upon Shulman's (2013) Knowledge Growth in Teaching Framework by looking at content, pedagogical, and curricular knowledge with the PD building knowledge and skills in addressing these areas of knowledge through the strategies. In addition, this research drew upon Lucas and Villegas' (2013) Linguistically Responsive Teacher Education Model that addressed how teachers gain knowledge, skills, and self-efficacy to change pedagogical practices.

Title I Kindergarten through high school TLLs voluntarily participated in the PD. A mixed methods approach was used. Quantitative data was collected using a pre, post, and maintenance survey and qualitative data was collected through a lesson analysis, fall and spring observations, snapshot surveys, and focus groups.

Results suggested that the STEMSS PD increased knowledge, skills, and self-efficacy in teaching ELs content and language using strategies that support academic vocabulary. The qualitative data supported the survey results in the increase of knowledge and skills immediately following the PD and increased self-efficacy a year

following the PD. The results also suggested that the strategies supported through PD, lesson development, and time to implement may better address the needs of TLLs in the classroom.

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CHAPTER 1

Introduction

High quality public education is crucial for all students in America. With the increase in linguistically diverse student populations, teachers must have the skills, knowledge, and self-efficacy to be able to meet the needs of this diverse population while also providing twenty-first century knowledge and skills needed for higher education and the workforce. To ensure quality learning takes place in their classrooms, teachers are continually participating in professional development (PD) to build knowledge, increase skills, and stay relevant in current best teaching practices. This research will provide and evaluate a much-needed PD for teachers to support linguistically diverse students that are found in classrooms across the country.

Problem of Practice

Despite the availability and supported research of effective program models to bridge the gap for English learners (ELs), prior to 2020, schools in Arizona mandated EL services in pull-out English-only classrooms. Because of this, to meet the needs of ELs as effectively as legally possible, teachers had to identify academic language strategies that could be embedded in integrated curriculum and assess these strategies for effectiveness so that they could be implemented in the classroom to support ELs. To address this problem of practice, a STEMSS PD was developed that specifically focused on the integration of STEMSS content instruction and language acquisition best practices through a series of 10

strategies. The impact of the PD on teachers' knowledge, skills, and self-efficacy in supporting EL's academic language development in the classroom was evaluated.

National Context

Language acquisition best practices are constantly being researched and shared as our country becomes more diverse and teachers serve more language learners in their classrooms. The National Center for Education Statistics (2015) stated that more than 4.5 million students (9.3%) of K-12 students were classified English Learners (ELs) during the 2013 - 2014 school year, up from 8.8% a decade earlier. Many EL programs focus on grammar-based instruction rather than a more natural way to learn a language, and often times ELs miss content instruction when they are pulled out for these services.

One of the most effective program models, Dual-language programs have been growing in numbers in recent years because they not only service the EL students through an additive approach, but also provide a bilingual experience for native English speakers who attend the program. Collier and Thomas (2014) researched dual language and bilingual programs for more than two decades. Through the dual language research, they found that students learning language must learn through high-quality content instruction in an additive approach (students will learn a second language with no cost to their primary language or to content instruction) to be successful and to catch their counterparts in the K-12 system (Thomas & Collier, 2014). Thomas and Collier (2003) have administered many studies across the country to review, observe, collect data, recommend, provide

professional development and report findings of the most effective ways children learn a language. Ovando's (2006) work built on Collier and Thomas' (2003) earlier studies through focused research and detailed explanations of various program models that were used to meet the needs of English language learners across the country: ESL Pullout, ESL Class Period, Sheltered Content-Based Programs, Newcomer Program, Transitional Bilingual Education, Developmental Bilingual Education, One-Way Dual Language and Two-Way Dual Language with Ovando (2006) citing ESL Pullout as being the most expensive and least effective program. By reviewing available research-based program models and program models being implemented in the classrooms, research can understand the context in which EL needs are being met.

State Context

Currently, Arizona's public schools serve an estimated 85,000 English learners (ELs; Arizona Department of Education, 2014). This high number of ELs has brought about the necessity to ensure the educational experiences of these students, both linguistically and academically, are of high quality and effective. Recent studies (e.g. Garcia, Lawton & Diniz de Figueiredo, 2010; Rumberger & Tran, 2010; Losen, 2010) document that the state policy has had little effect in overcoming the EL achievement gap.

With the increasing numbers of ELs, teachers of ELs need to be well versed in important issues specifically relevant to bilingual development: what to teach, how to teach it effectively, and how it will be assessed and monitored. However, de Jong, Arias, &

Sanchez, (2010) reported that teacher preparation to support ELs in Arizona has been significantly reduced since the establishment of restrictive policies at the K-12 level in the state. The most restrictive policy has been Proposition 203 which mandated ELs learn in English-only settings within a four-hour structured English immersion (SEI) block that focuses on grammar without the inclusion of content instruction (Jimenez-Silva, Gomez, & Cisneros, 2014). De Jong and colleagues (2010) explain that the effects of new teacher preparation practices established after Proposition 203 include the reduction of curricular requirements from 24-27 credits in ESL and BLE programs (between 360 and 405 hours) to only three credits in the current SEI endorsement required by teachers in Arizona who will work with these students. This new number accounts for less than 10% of the preparation needed to effectively serve ELs (de Jong, Arias, & Sanchez, 2010). Because of these reduced requirements, professional development offered by local colleges, districts, and organizations are often provided to support teachers of language learners (TLLs) as they navigate planning, instructing, and evaluating this population of students with whom they work.

Personal Context

I was a sixth-grade teacher for ten years, working with ELs as they learned content and language in the classroom. Not having an ESL endorsement, I had to learn on my own how to meet the needs of my students linguistically when I was only trained how to support content knowledge development and mastery. I didn't speak the primary language of the

majority of my EL students and often had four or more different languages spoken in my classroom. Navigating the process of supporting such a diverse group of students was a skill I grew in each year, but never fully mastered. Even after earning my ESL endorsement, I still had to apply the strategies that were theoretically effective but not part of my teaching practices.

I then became a teacher consultant through the Arizona Geographic Alliance (AZGA) and learned how to effectively integrate content instruction with language development. I also learned how to share new information with my colleagues through a hands-on professional development (PD) train-the-trainer skill session. Through this experience I began to conduct PDs at my school district and across the state and country at numerous conferences. It was during this time that I went back to school and got a Masters in Elementary Education and continued my own development of effective teaching practices.

I now am a clinical faculty in the Mary Lou Fulton Teacher's College at Arizona State University (ASU), preparing preservice teachers to work with diverse learners, as well as continue to conduct PD for teachers across the country in the areas of cross-curricular instruction and technology integration. I do this to continue to support TLLs with current instructional best practices in hopes of supporting ELs by developing high quality teachers who have strategies to support language acquisition through content instruction.

The Current Situation

The focus of this study was on providing and evaluating professional development

training for TLLs. Research by Ryoo (2009), Vaughn, Martinez, Linan-Thompson, Reutebuch, Carlson, and Francis (2009), and Hinde, Osborn Popp, Jimenez-Silva, and Dorn (2011) all demonstrated the impact in English language development through content instruction in science, social studies, math, and geography. The intent of this project was to further the research in EL support through STEMSS (science, technology, engineering, math, and social studies) instruction utilizing a series of 10 strategies that target academic language development through scaffolded content instruction.

Several cycles of research were conducted by the researcher as part of the dissertation coursework in preparation for this cycle to support TLLs in meeting the needs of ELs in Arizona. The initial cycle included identifying strategies through research review and collecting data from K-12 teachers on their use of these strategies in supporting ELs using a simple survey. Ten EL strategies that have been shown to be most supportive in teaching academic language intensively and frequently throughout STEMSS instruction were identified, and included: interactive notebooking, graphic organizers, quick chat/quick write, big books, songs and chants, murals and graphic input charts, 10 important sentences, word walls, sentence frames, and color-coding. These strategies were then included in a STEMSS PD institute in the summer of 2016. Participants were surveyed at the end of the 2016-2017 school year with results demonstrating usage of these strategies in content instruction in the participants' classrooms beyond the initial pilot of a STEMSS lesson they developed. The researcher then collected data to build knowledge on what was effective

and needed to be changed through participant interviews and observations of three of these teachers to further gather qualitative data to support the development of the strategies and PD for future cycles. The observation tool used was the OPAL (observing protocol for academic literacies) to observe usage of strategies and support of language in content instruction. This tool was piloted to determine its effectiveness in collecting data on teacher practices in the classroom to support ELs with results determining that the specific categories and set of questions provided strategic feedback to support informed teacher practices in supporting LLs in the classroom. The teachers were then interviewed to clarify strategies that they used that were effective in supporting language learners and thoughts on technology integration and needs to better support ELs in STEMSS content instruction. These results informed the next cycle of this research, in which a 10-day **professional development** was conducted on an integration of STEMSS content and these 10 strategies. A pre and post survey was administered before and after the 5-day **intensive** institute to assess the knowledge, skills, and self-efficacy in teaching ELs using these strategies. The survey demonstrated the strategies' usefulness, integration in teaching, and teacher's self-efficacy in utilizing the strategies after experiencing how to effectively use them in the PD.

Purpose of Study

The purpose of this study was to document and analyze the impact of the STEMSS PD on TLL's knowledge, skills, and self-efficacy in supporting EL's academic language development in the classroom. A 10-day STEMSS professional development was

conducted by recruiting 15 TLLs from Arizona public schools to voluntarily participate in the PD to improve their effectiveness in teaching language learners STEMSS content. Data was collected through pre and post surveys, classroom observations, snapshot surveys, lesson plan analysis, and focus groups.

Research Questions:

1. To what extent did teachers apply and describe the impact of the PD on their knowledge, skills, and self-reported efficacy in teaching academic vocabulary through STEMSS content?
2. In what ways did teachers apply the 10 strategies that were taught in the PD throughout the school year?

CHAPTER 2

Literature Review Introduction

To build a background in understanding the problem of practice and research methods of this study, this literature review focused on the gap in the literature on teacher skills in addressing EL students in STEMSS instruction, EL and STEMSS needs in bridging the achievement gap, TLL needs in supporting ELs, and professional development that can support TLL needs. In addition, the theories that informed the intervention, measurements, and analysis of this study were explored.

Research Needed to Further Support TLLs

ELs have been falling behind their counterparts in America's public schools and have increasingly been since No Child Left Behind began tracking test scores on this population (Polat, Zarecky-Hodge, & Schreiber, 2016). With the diverse student population growing, Shin and Ortman (2011) predicted that ELs will make up 40% of the K-12 population by 2030. These trends, according to Polat and colleagues (2016) had policy makers, administrators, and the community looking for answers in how to reach this underserved population to ensure they have equal opportunity in the classroom. Though there is some research on best practices, such as Echevarria, Vogt, and Short's (2013) sheltered instruction observation protocol (SIOP) and Lee, Maerten-Rivera, Penfield, Leroy, & Secada (2008) research that demonstrated ELs can learn science if teachers are trained, the successes are few and far between. The trend does not address the increase in the achievement gap as a result.

The initial need for ELs to learn content in the classroom is developing their English proficiency, including their academic language. Uccelli, Galloway, Barr, Meneses, and Dobbs (2015) have shown that academic language proficiency is directly connected to reading comprehension. This, in turn, has a direct correlation to content achievement. Uccelli and colleagues (2015) demonstrated the need for ELs to increase academic vocabulary in order to increase achievement in content knowledge and skills; however, the limitations showed that the small sample size did not demonstrate specific skills to accomplish this task.

Olson, Matuchniak, Chung, Stumpf, and Farkas (2016) assessed an effort to address the achievement gap in writing skills with a 46-hour PD program that provided an intensive training on a very specific strategy to support high school analytical writing skills of ELs. This research provided a writer's toolkit with a training on effective strategies that supported teacher's knowledge and skills. This study demonstrated the effectiveness of training teachers on specific strategies to address ELs needs in the classroom but only looked at a single set of skills for a very specific population of ELs and did not reach statistical significance due to the small sample size. In addition, the assessment of teacher's knowledge and skills in how to address the needs aside from analytical writing was not evident.

Vasquez, Contreras, Solis, Nunez, and Rittershausen (2017) looked at teachers' self-efficacy in meeting the needs of ELs across curriculum; specifically researching new

teachers to the classroom. Twenty teachers were followed for three years as they experienced professional development and gained experience in the classroom. Several needs were discovered, including the need for strategies to support language in content instruction and the ability to apply the strategies they did know to various areas of teaching. In addition, the research participants felt like they needed to know how to adapt the curriculum using strategies to support student achievement and were not confident in doing so with the limited PD they had on skills to increase knowledge in supporting learning in the classroom. They felt like they needed additional strategies and time to apply and reflect on these strategies to effectively implement them. Uccelli, et al. (2015), Olson, et al. (2016), and Vasquez's, et al. (2017) research included the necessity to address academic language development across the curriculum but were not able to specifically address a method that would bridge the achievement gap in doing so.

Kim's (2016) research furthered these studies by addressing PD needs for TLLs. This research addressed the hidden curriculum in a science classroom that required teachers to know how to teach across levels while applying skills gained from PD to different student needs, including the need to verbally interact with their peers about content knowledge. This analysis demonstrated the need for teachers to not only gain skills but to continually self-evaluate their teaching methods as it relates to their specific population of students; gaining skills and self-efficacy in applying and adapting strategies to different teaching and learning experiences. These various studies looked at addressing the

achievement gap of ELs through increasing academic vocabulary, teaching language through content instruction, and training teachers on strategies to effectively teach both language and content. More specifically, the research guides the urgency at looking at PD that develops knowledge, skills, and efficacy in supporting ELs in the classroom. Though briefly touching on these topics, none of this research looked at a comprehensive PD that will provide knowledge to increase teacher's skills in teaching content and language in tandem effectively. The research demonstrates the need to bridge the achievement gap and the need for teachers to be trained to do this within their own community and specific population.

Skills Teachers Need to Address this Gap in Knowledge and Skills

To address the EL achievement gap, teachers need the training in pedagogical practices to support academic content and language instruction in tandem. Penner-Williams, Diaz, and Gonzales Worthen (2017) explained that teachers lack the expertise to support the growing EL population in the schools with limited pre-service programs providing the basic tools to support this. In-service teacher needs for continual professional development is also critical as these numbers have grown over the years. Lucas and Villegas (2011) suggest that teachers must be linguistically responsive, meaning that they must know ELs' language backgrounds, identified language needs, and have skills to scaffold instruction and build language skills. More specifically, ELs need intentional vocabulary development that is explicitly taught in context through content instruction

(Vogt, 2009). To ensure this occurs in the classroom, Vogt (2009) implores that all teachers must be trained to teach content and language in tandem to support ELs. Echevarria and Vogt (2010) go on to further the mandate that teachers provide relevant lessons that promote active learning in which ELs are engaged throughout the lessons and have access to the content through scaffolded instruction to support their English skills. This structured interaction between the content and their peers builds understanding and supports the language process. The framework in which this is recommended is looking at the process of effective instruction from the planning stages, throughout every aspect of the lesson, to the assessment of knowledge stage. One of the essential components of this model is to provide explicit and contextualized vocabulary instruction to ensure academic vocabulary is taught in context and with multiple opportunities to use the vocabulary through language experiences. To recap, Penner-Williams et al. (2017), Lucas and Villegas (2011), and Echevarria and Vogt (2010) all agree that academic vocabulary instruction must be taught through content, in context, and with scaffolded support by trained teachers who understand the needs of ELs as well as are highly trained in both language and content instruction. This research then guides the need for research-based PD in these areas to support TLL's to gain knowledge, skills, and self-efficacy in meeting the needs of their ELs academic and language skill development through engaging curriculum and scaffolded instruction.

Professional Development Needs to Build Effective ELL Instruction

Effective EL instruction is essential and PD to support TLLs in doing so needs to be further researched. Vogt (2009), explained that to ensure teachers are prepared to teach ELs, they must know how to develop or adapt a curriculum that builds second language through content instruction that is differentiated for ELs' levels of English proficiency. Louws, Meirink, van Veen, and van Driel's (2017) research found that teachers want to develop their craft and look for PD that builds their content knowledge in areas that they are trained or interested in teaching, and that seeking and gaining new knowledge in their content area drives interest in continuing education. Teachers also want to learn ways to engage their students and meet their students' needs. To do this, Greenleaf, Litman, and Marple (2018) encouraged integrating literacy skills within content-focused readings and inquiry-based PD to develop effective literacy instruction through content that reputable teachers looking for in continual learning experiences. This supports the need to provide teachers PD that focuses on increasing content knowledge and pedagogical knowledge in supporting ELs understanding of that content.

In addition to building the knowledge needed to work with ELs and the understanding in how to teach content and language through integrated curriculum, teachers need self-efficacy to implement new strategies and skills into their teaching. Penner-Williams and colleagues' (2017) research focused on the necessary pedagogical practices to ensure teachers take skills from PD that can translate into practice in the classroom. This includes the transfer of learning through extended or follow-up PD that supports the process

in applying new knowledge. This can be done through professional learning communities (PLCs) or developing a support system for the teachers. Shifting pedagogical practices takes time and intentional efforts by the teacher. PD should support this to ensure teachers are confident in the change in teaching practices.

There are several key considerations in the development of PD programs for TLLs in supporting ELs academic achievement. Ramos (2017) discusses teacher's self-efficacy and the process of supporting teachers as an essential element in preparing teachers to work with ELs. Jimenez-Silva and Olson (2012) describe the transformation of supporting ELs through teacher interactions and reflections as critical in developing teachers of language learners. King (2016) explored PD as a method to build new practice and change through a transformative model of PD that supports sustained change. By supporting teacher's confidence in their abilities to implement change in pedagogy, teachers are better able to serve their students. Coldwell (2017) supported this claim through his research in following the implications of PD across teachers' careers. Peters-Burton, Merz, Ramirez, and Saroughi (2015) extended this by looking at science teaching and the importance of self-efficacy and motivation in addition to knowledge in implementation of PD skills into practice. Through self-efficacy analysis, teachers need knowledge in their content areas and in language instruction. They need to know how to transfer knowledge to ELs by having skills to teach language and content in tandem. And, teachers need the confidence in applying new skills in their classroom to develop their pedagogical practices in

supporting ELs. This study developed an intervention that addressed some of these needs in knowledge, skills, and self-efficacy.

Theoretical Perspective

The PD intervention used within this study was informed by Shulman's (2013) Knowledge Growth in Teaching framework. This research looks at three types of knowledge: content, pedagogical, and curricular knowledge. The first, content knowledge, addresses the knowledge teachers need to know to teach content to students. Typically, this content knowledge is gained through undergraduate degrees and ongoing education teachers choose to take due to their interest in the content (Louws et. al., 2017). The second type is pedagogical content knowledge. These are the methods needed to transfer the knowledge of content to the students. Echevarria and Vogt (2010) emphasized the skills teachers need to teach ELs by looking at pedagogical skills integrated in all stages of teaching and learning in the classroom. These skills are first gained in teacher preparation courses and refined over time through experiences and additional PD. The final type of knowledge, according to Shulman (2013), is curricular knowledge. This is the understanding of the curriculum that must be taught, standards that must be covered, and knowledge that must be demonstrated through mastery. Teachers must be current on state mandates and expectations within grade levels and subject matter to adapt their instruction to expected curricular outcomes. The PD intervention in this project is designed to build on all three of these types of knowledge. Initially, the PD is focused on innovative and

relevant content that today's teachers are interested in learning to ensure their classroom instruction is focused on "real" learning and knowledge that is needed in the modern world. The PD concurrently focuses on pedagogical strategies to support teaching this content to the diverse student populations found in classrooms. Finally, the PD modeled and had participants apply the content and pedagogical knowledge to state standards through lesson development to support the application of the PD concepts into the classroom.

The PD intervention was also informed by Lucas and Villegas' (2013) Linguistically Responsive Teacher Education model. This research emphasized the need to move from conversational English skill development to academic language skill development through purposeful lessons that teach content and language in tandem. Content must be taught using comprehensible input to ensure ELs understand the content, social interaction is encouraged to support oral language development and content understanding, a safe learning environment must be created for ELs to feel comfortable in trying out the English language as they develop it, and intentional scaffolding includes strategies to teach language through content instruction. This work informed the need to specifically teach strategies to develop academic vocabulary, model strategies that are effective in supporting language acquisition during the content experiences, and to have teachers transfer this knowledge by developing lessons using these strategies to bring them to their classroom.

Lucas and Villegas' (2013) work also informed the measurement and analysis of the

innovation's effectiveness. To ensure teachers were gaining knowledge in meeting the needs of ELs, understanding of how to do this effectively through classroom instruction, and self-efficacy in doing so as teachers change their pedagogical methods, three types of assessments took place. Beginning and end-of-year observations allowed data to be collected on how teachers use strategies immediately following the PD and then again at the end of the year after they had a chance to apply the PD skills to their own classrooms across a school year; looking for change over time in PD implementation. Pre and Post PD surveys were administered and data was collected from teacher's perceptions of what they knew, skills they can apply, and self-efficacy they have in teaching ELs in their classrooms at the beginning and end of the PD with a maintenance survey given at the end of the school year following the PD. Finally, focus groups were conducted to gain qualitative details about the application and implications of the PD on their teaching practices. These three data sources were analyzed for knowledge, understanding, and self-efficacy in teaching ELs. These align with Lucas and Villegas' (2013) guide to meeting the needs of ELs in today's classrooms.

Conclusion

Using Shulman (2013) and Lucas and Villegas' (2013) theories, a PD intervention was developed and evaluated that specifically built on the previous literature to support TLLs to meet the needs of ELs that they teach. The literature has shown that teachers must know how to teach content and language in tandem and have strategies to support ELs in

academic language development. Literature also showed that the most effective transfer and implementation of language strategies to use with students are learned when they are delivered through engaging content PDs that promoted collaboration and opportunities to engage in the strategies. These must also follow with continual support as teachers apply the learning in their own classrooms. All of these methods were incorporated in the PD for the study, and its success was evaluated using multiple sources of information (observations, surveys, and focus groups) to ensure that teachers not only applied what they learned from the PD, but also shared ways in which they were able to apply these to their teaching methods.

CHAPTER 3

Research Methods and Design

The achievement gap demonstrates that EL students are continuing to fall further behind their counterparts in both language and content instruction (Jimenez-Silva, Gomez, & Cisneros, 2014) however limited research had been done on STEMSS instruction and its impact on EL academic language development (WWC, 2017). Specifically, Cummins (2010) detailed the necessity for academic vocabulary to be taught in context to develop academic language. To address this hole in research, a mixed methods research study (Cobb et al. 2003) was used to assess the impact of a professional development (PD) series on EL strategies utilized in content instruction by STEMSS content-area teachers.

Setting & Participants

This PD was conducted at Arizona State University in partnership with the Arizona Geographic Alliance (AZGA) and the School of Geographical Sciences and Urban Planning. Participating teachers came from surrounding Title I schools who served English language learners. AZGA has been an outreach program for 25 years and has a large listserv of K-12 educators across the state who attend various PD events and receive weekly emails about upcoming PD opportunities, new lessons and resources, and grant or scholarship information that may be useful for Arizona educators. AZGA and the geography department wrote and received a U.S. Department of Education PD grant to expand their reach for five years by focusing on STEMSS (STEM plus social studies with a

specific emphasis on geography), with the focus on serving ELs in Arizona by providing free PD for teachers who work with this population and developing lessons and materials that better serve Teachers of Language Learners (TLLs). As the primary author of this grant, I utilized AZGA's reach and expertise while ensuring TLLs in Arizona had access to these resources.

This mixed-methods study focused on 15 TLLs who taught in K-12 content classrooms in Title I schools in Arizona during the 2018-2019 school year. These teachers were recruited using electronic flyers that included a link to the application through several PD listserves, including AZGA's listserve, and through printed flyers that were distributed at local conferences. TLLs voluntarily applied to participate in the study through an application process. The application asked for demographic information from the teacher and the school/students with whom they worked. Participants were from 7 different districts; 12 taught elementary, 1 taught middle school, and 2 taught high school; 5 teachers had taught 1-5 years, 2 teachers had taught 6-10 years, and 8 had taught more than 10 years; 6 teachers had a BA and 9 teachers had a MA; all participants had an SEI endorsement (1-credit course endorsement) and 3 had an ESL/BLE endorsement (6-8 intensive courses on ESL or BLE education).

Procedures

Teachers were recruited during the 2017-2018 school year through listserves, flyers, and word of mouth within the Arizona Geographic Alliance community and at local

conferences. Fifteen teachers submitted an application (see Appendix D) that included school demographics, number of ELs in the classroom, and teaching experiences. All teachers who applied were accepted.

An orientation was held prior to the 5-day institute that went over requirements for participation. This included the number of PD days required, writing, piloting, and publishing a lesson plan, and presenting their lesson plan both at a practice session in August and at their local school, district, or at a local conference. In addition, the pre-intervention KUSE survey was administered at the orientation.

Teachers then attended the five-day STEMSS institute (see appendix C for agenda) in 2018 along with 3 other days during the school year that included 3D printing, drones, author visits, primary sources, etc., among a variety of STEMSS PD choices. The institute covered two strategies each day with lessons and STEMSS experts enhancing the content knowledge and the strategies building upon this content to support implementation into their classrooms. A post-intervention KUSE survey was administered on the last day of the PD to assess skill growth during the institute.

Finally, the teachers drafted a lesson plan and presented it at a practice presentation session to their peers to get feedback on both the lesson and their presentation skills. This supported the teachers as they prepared to pilot, revise, and then publish their lesson plans during the school year. Teachers then presented their lessons within their district or at a local conference in their fall or spring semester. The lesson plan draft was collected for

analysis of the strategies employed in each lesson.

The timeline for the procedures included the following:

- Spring 2018: Developed PD sessions & agenda, recruited TLLs, held orientation, collected pre-KUSE survey
- Summer 2018: Conducted PD sessions, collected post-KUSE survey
- Fall 2018: Observed teachers at the beginning of the year (fall observation), teachers piloted lesson plans developed in PD, submitted final lesson plan
- Spring 2018: Presented lesson at conference/ district, did spring observation, collected snapshot surveys, maintenance KUSE survey, conducted focus group

At the end of the school year, a maintenance or follow-up KUSE survey was administered to participating TLLs to compare knowledge, use of strategies, and self-efficacy in supporting ELs in their classroom after teachers had implemented skills gained from the PD across the school year. In addition, fall and spring observations were conducted, snapshot surveys were collected, and a focus group was held in the spring at ASU to gather a well-rounded set of data to assess the effectiveness of the PD and change in pedagogical practices in the classroom over the course of one year.

Innovation

This PD innovation was focused on research-based strategies to support teachers' needs to apply PD learning immediately in their classroom by selecting 10 strategies that support academic vocabulary development in STEMSS content instruction. Strategies were

taught over an intensive 5-day institute, with days lasting from 8am to 4pm. All intervention participants attended the institute sessions together. The strategies that were taught during the institute included:

- Sentence frames,
- Timely quick chat/write,
- Relevant word walls,
- Authentic big books,
- Ten important sentences,
- Effective color-coding,
- Graphic organizers,
- Interactive notebooks,
- Engaging murals/graphic input charts, and
- Songs and chants.

These strategies were the primary focus of the 5-day, face-to-face intensive PD while integrating STEMSS content lessons modeled using each of the strategies. The sessions dissected each strategy to build theoretical knowledge of their usefulness followed by one or more STEMSS lesson modeling the integration. The remaining follow-up five days of the 10-day training included an orientation, a presentation session (for teachers to present the lesson they developed that included one or more of these strategies to their peers for feedback), and three “choice days” that built content knowledge. These choice days

could be in their field of choice (for example a science GeoDay trip or an author writer's workshop) to support extending STEMSS knowledge for teachers. As they reflected on the STEMSS content, TLLs were encouraged to connect one of the strategies to possible implementation of the lesson idea take-aways from the sessions. The pre-intervention KUSE survey was administered on the orientation day and the post-intervention KUSE survey was collected on the final day of the 5-day intensive institute. The KUSE survey was later given at the end of the school year again, once teachers had an opportunity to implement the strategies into their teaching.

The PD was developed in spring of 2018 and the schedule was refined multiple times to ensure a balance of theoretical and practical knowledge as well as multiple opportunities to learn STEMSS content and apply the content to best practices in teaching ELs before this study. This PD was conducted by myself, 2 grant personnel, and AZGA which included the AZGA co-coordinator and several AZGA TCs who shared model STEMSS lessons.

Measures

To answer the first research question, *to what extent did teachers apply and describe the impact of the PD on their knowledge, skills, and self-reported self-efficacy in teaching academic vocabulary through STEMSS content*, a pre, post, and maintenance KUSE survey was administered that was adapted from Thibault's (2017) KUSE survey. The original KUSE survey assessed efficacy and knowledge in integrating academic

vocabulary strategies into content instruction. Thibault adapted the KCU survey by Ci3T (Oakes, Lane, Jenkins, & Booker, 2013) and validated the survey using Cronbach's reliability analysis on three constructs: knowledge, use, and self-efficacy with reliability between .87 and .97 in all three areas. The survey collected initial data on knowledge, use, and self-efficacy in TLLs supporting academic language development in the classroom that they felt before the intervention was delivered, and then was compared to post-intervention and follow-up administrations of the same survey to compare growth over the year in knowledge, use, and efficacy after implementation of the strategies to support ELs in their teaching.

To answer the second research question, *how did teachers apply the 10 strategies that were taught in the PD throughout the school year*, fall and spring observations, lesson plans, periodic strategy usage "snapshot" surveys (two times during school year), and a focus group held in the spring explored how teachers had (or had not) applied the strategies they learned about in the PD into their daily classroom. One observation was conducted at the beginning of the school year (fall observation) as teachers were beginning to implement strategies gained from the PD. Teachers were then observed again at the end of the school year (spring observation), after teachers had a full school year to implement the PD strategies. The observation assessment tool that was used was the Observation Protocol for Academic Literacies (OPAL) developed and tested for validity and reliability through the Loyola Marymount University Center for Equity for English Learners (2013).

A lesson plan analysis on strategy implementation was originally planned to evaluate three different drafts of the participant lesson plans however only an analysis of the final published lesson plan was conducted to capture the true integration of the strategies into the final lesson plan itself. The process in developing the published lesson plan included TLLs developing a draft of their lesson plan for feedback immediately following the PD, revising the lesson based on feedback for the presentation day (in which they again receive feedback on the lesson plan and strategy implementation). Finally, they took their lesson to their classroom and piloted it. After presenting and piloting the lesson, they submitted a final lesson plan draft to be published on the Arizona Geographic Alliance webpage to share with their colleagues. This final submission was analyzed for strategy implementation. In addition to collecting strategy implementation through the lesson plan analysis, two times during the school year periodic “snapshot” surveys were sent to participants to collect information on how many times and in what content area they felt that they had used the strategies the previous week. These lesson plans and snapshots were analyzed on strategy usage in lesson planning, growth in understanding how to develop a lesson plan using these strategies, and usage of the strategies in their teaching across the school year following the PD innovation. This data also informed the questions asked during the focus groups conducted in the spring.

Finally, seven focus groups were conducted based on teacher availability at the end of the school year by the researcher to collect qualitative data on ways teachers believed

they applied the strategies in their classrooms. The focus groups lasted approximately 30 minutes and were audio recorded, transcribed, and coded. The data from two observations, two “snapshot” surveys, and the final focus groups were combined to inform what worked, why it worked, and how it worked.

Data Analysis

To answer: *To what extent did teachers apply and describe the impact of the PD on their knowledge, skills, and self-reported efficacy in teaching academic vocabulary through STEMSS content?* Pre, post, and follow-up KUSE survey responses were compared using a repeated measures MANOVA to examine changes across the three time points on the following constructs: knowledge, use, and self-efficacy of using the ten strategies when teaching content and language. To further understand the implications of the PD on teacher’s self-efficacy and knowledge, survey results were triangulated with qualitative data.

To answer: *In what ways did teachers apply the 10 strategies that were taught in the PD throughout the school year?* Fall and spring observations, lesson plan analysis, periodic snapshot strategy usages checklists, and focus group data were coded and analyzed; looking at actual implementation and interpretation of implementation of the 10 strategies into teaching pedagogy. All 10 strategies were coded across these data sets; looking for application examples, possible increased usage and reflective self-analysis of the strategies’ effectiveness in supporting ELs in STEMSS lessons.

CHAPTER 4

Data Analysis and Results

The results for this study use data from the quantitative KUSE pre, post, and maintenance survey results, as well as qualitative data from fall and spring classroom observations, snapshot surveys, lesson plans, and a TLL participant focus group.

Research Question 1

The quantitative data was collected using the KUSE pre, post, and maintenance survey before and after the innovation PD and at the end of the school year following implementation. This survey was used to answer the first research question: *To what extent did teachers apply and describe the impact of the PD on their self-reported knowledge, skills, and self-efficacy.* Before analyzing the survey, a reliability analysis of the survey instrument was conducted as a whole and for each of the three constructs to measure internal consistency and reliability. A Cronbach alpha analysis was conducted using SPSS (Cronbach, 1951). The results of the analysis are displayed in Table 1. In each of the constructs, the calculations of the Cronbach's alpha came back at more than .9, which demonstrated excellent internal consistency.

Table 1. *Knowledge, Use, and Self-efficacy of Strategies with .931 Reliability.*

Reliability Statistics

Construct	Cronbach's Alpha	N of Items
Knowledge	0.923	26

Use	0.918	26
Self-Efficacy	0.974	26
Knowledge, Use, and Self-Efficacy	0.931	78

As part of this study, the KUSE survey was administered to the 15 participants at an orientation that went over the research project, on the last day of the PD, and at the end of the school year after teachers had time to implement what they learned during the PD. A repeated measures MANOVA (see Tables 2 and 3) was conducted to compare T1 (pre-intervention), T2 (post-intervention), and T3 (maintenance assessment) on changes in all three constructs. As shown in both tables, participants rated their knowledge as significantly higher at T2 ($M=3.43, SD=.31; p < 0.001$) and T3 ($M=3.46, SD=.33; p < 0.001$) than at baseline (T1; $M=2.44, SD=.39$). However, there were no significant changes between T2 and T3 ($p = 0.836$).

Table 2. *Repeated Measures MANOVA Descriptive Statistics Results for Pre, post and Maintenance KUSE*

Descriptive Statistics

Variable	KUSE	Mean	Std. Deviation	N
Knowledge	Pre	2.44	0.39	15
	Post	3.43	0.31	15
	Maintenance	3.46	0.33	15

Use	Pre	2.39	0.38	15
	Post	3.11	0.36	15
	Maintenance	3.3	0.5	15
Self- efficacy	Pre	3.18	0.8	15
	Post	3.53	0.44	15
	Maintenance	3.75	0.32	15

There was also a significant increase in the use (understanding of how to use the strategies to support ELs academic vocabulary) from the pre-KUSE at T1 ($M=-2.39$, $SD=0.38$) to the post-KUSE at T2 ($M=-3.11$, $SD=0.36$; $p = 0.001$) and between T1 and T3 ($M=3.3$, $SD=.5$; $p < .001$), as well as between the T2 and maintenance-KUSE at T3 ($M=-3.3$, $SD=0.5$; $p = 0.023$). Participants rated their self-efficacy as significantly higher at T3 ($M=3.75$, $SD=0.32$) than at baseline (T1; $M=3.18$, $SD=0.8$; $p = 0.013$). However, there was no significant difference in self-efficacy from T1 to T2 ($M=-.353$, $SD=0.44$, $p = 0.388$).

Table 3. *Repeated Measures MANOVA KUSE Results Comparisons Across T1, T2, and T3*
MANOVA Pairwise Comparisons

Measure	(I) KUSE	(J) KUSE	Mean Difference (I-J)	Std. Error	Sig. .
Knowledge	1	2	-0.97	0.15	.000
		3	-0.99	0.12	.000

	2	1	0.97	0.15	.00
		3	-0.02	0.09	0.836
Use	1	2	-0.65	0.15	0.01
		3	-0.86	0.14	0.00
	2	1	0.65	0.15	0.01
		3	-0.22	0.08	0.23
Self-Efficacy	1	2	-0.24	0.27	0.388
		3	-0.49	0.17	0.13
	2	1	0.24	0.27	0.388
		3	-0.25	0.14	0.109

The data demonstrated that teachers gained both knowledge and understanding of how to teach ELs content using the strategies to support the ELs learning academic vocabulary. Also, TLLs increased their self-efficacy in using the strategies after participating in the PD and having a year to implement the strategies into their classroom. Self-efficacy did not improve immediately after the training at T2.

Research Question 2

Research question two looked at the ways that teachers applied the ten strategies that were taught during the PD throughout the school year. To answer this question, the qualitative data was collected through fall and spring observations, lesson plan analysis,

two snapshot surveys of strategies used during the year, and focus groups.

Observations. The fall and spring observations utilized the OPAL observation tool that measured strategy use at the beginning and end of the school year following the summer PD. The strategies and sample evidence to document the use are presented in

Table 4.

Strategy Observation	Fall	Spring	Evidence
Sentence Frames/Stems	6	11	Teachers understood how sentence stems could support students using academic vocabulary; Teacher would like a resource of specific Sentence Stems to use.
Quick Chat / Quick Write	10	15	Teacher utilized quick chat then quick write to support ELs using oral language then transferring to written language; Quick Chat/Quick Write supported chunking and understanding information.
Word Walls	5	12	Word walls, color-coding, and graphic input charts were used more intentionally to support ELs; Word Walls provided a resource to students.
Big Books	0	0	Big books reintroduced with understanding the value of using them. Teachers used big books to increase visual use for ELs.

10 Important Sentences	0	0	Ten Important Sentences was a completely new strategy for teachers; it increased teachers' intentional scaffolding for ELs; 10 Important Sentences not age-appropriate.
Color-Coding	1	5	Teacher utilized graphic organizers, color-coding, and graphic input charts to scaffold a challenging unit.
Graphic Organizers	10	11	Teachers used graphic organizers to make lessons more hands-on for ELs. Teacher utilized graphic organizers, color-coding and graphic input charts to scaffold a challenging unit. Graphic organizers helped students organize their understanding of the content.
Interactive Notebooks	0	9	Teacher used interactive notebooks and noticed the impact on students taking ownership of their learning.
Murals / Graphic Input Charts	0	1	Teacher utilized graphic organizers, color-coding and graphic input charts to scaffold a challenging unit and acknowledged students were gaining understanding using strategies.
Songs and Chants	0	1	Songs and Chants not age-appropriate.

Table 4. *Strategy Use Within the Classroom*

Lesson plan analysis. Each of the participants developed a lesson plan as part of the PD, beginning the brainstorming session during the PD experience and later presenting,

piloting, and publishing the lesson plan to share with other teachers after the PD was complete. Table 5 lists the lesson plans and identifies the strategies integrated across plans. An assumption was that by developing and piloting a lesson plan in their classrooms, teachers would begin to implement the strategies they chose to try into other lessons and eventually embed it into their ongoing teaching pedagogy. Four participants did not finish their lesson plans, so only 11 lesson plans were analyzed. Of the ten strategies focused on during the PD, three strategies were consistently integrated into the lesson plans—quick chat/quick write (QC/QW) 15 times; sentence starters/stems (SS) 6 times, and graphic organizers (GO) 10 times; four strategies were not integrated in any of the lessons (big books, ten important sentences, murals/graphic input charts, and songs and chants). Word Walls (WW) were integrated 3 times, and both color-coding (CC) and Interactive Notebooks (IN) were each integrated into the lesson plans once.

Table 5. *Lesson Plan Analysis*

Lesson Plans

TLL Participant	Strategies Implemented in Lesson Plan
Teacher A	QC, WW, QW, GO, SS, IN
Teacher B	Did not finish
Teacher C	Did not finish
Teacher D	QC, GO, SS,
Teacher E	GO, QC,
Teacher F	GO, QC, WW, QW,
Teacher G	Did not finish
Teacher H	GO, QC
Teacher I	QW, GO, SS, QC,

Teacher J	SS, GO, QW/QC
Teacher K	SS, GO, QC, CC, WW,
Teacher L	GO, QW, QC,
Teacher M	QC,
Teacher N	GO, SS, QC
Teacher O	Did not finish

Snapshot survey data results. Twenty TLL responses were recorded in total to the snapshot survey requests across the two times it was sent out (in March, eight TLLs responded and in April, 11 TLLs responded) with four TLLs completing it both times. The TLLs were asked to reflect on the previous week and document what strategies they used and how and why they used them. Table 6 documents their responses.

Table 6. *Snapshot Survey Data Results*

Snapshot Surveys

Strategies Prior Week	Number of Times Used	Usage Description Provided by Participants
Sentence Stems/Stems	Total: 17 March: 6 April: 11	Reading and cross-curricular to support vocabulary building and citing evidence to support writing; helps students get started right away.
Quick Chat / Quick Write	Total: 6 March: 3 April: 3	Cross-curricular to support understanding of what they just learned.
Word Walls	Total: 8 March: 4 April: 4	SS for visuals to support vocabulary in the study of historical figures.
Big Books	0	
10 Important Sentences	0	

Color-Coding	Total: 5 March: 4 April: 1	Cross-curricular and reading to identify and keep track of information needing clarification and to reinforce vocabulary for speaking and writing; for writing to identify parts of a five-paragraph essay
Graphic Organizers	Total: 16 March: 7 April: 9	Used for reading and science to show cause and effect relationships; math to organize information, provide models, and build understanding with teacher resources included; helps students chunk information.
Interactive Notebooks	Total: 13 March: 5 April: 8	Used for science to collect data and keep notebooks with both student and teacher-generated content; makes it easy to help students stay organized.
Murals / Graphic Input Charts	Total: 1 April: 1	Reflected on the impact of the group that used it versus the group that did not.
Songs and Chants	Total: 6 March: 2 April: 4	Used for math to remember facts.

Focus group data results. A total of seven focus groups were conducted to get all 15 participants' feedback using the interview questions, each one lasting 20-40 minutes with the majority being less than 30 minutes. The focus groups were recorded using two devices (one as a back-up), uploaded to Rev.com, and transcribed. They were then analyzed and coded according to strategy. The strategies and evidence of use of the strategies from the data collected are included in Table 7 below with quotes.

Table 7. *Focus Group Comments on Strategy Application*

Strategy	Evidence
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Sentence Frames/Stems	Teachers understood how sentence stems could support students using academic vocabulary. Teachers would like a resource of specific Sentence Stems to use.
Quick Chat / Quick Write	Teacher utilized quick chat then quick write to support ELs using oral language then transferring to written language. Quick Chat/Quick Write supported chunking and understanding information.
Word Walls	Word walls, color-coding, and graphic input charts were used more intentionally to support ELs. Word Walls provided a resource to students.
Big Books	Big books were reintroduced with understanding the value of using them. Teachers used big books to increase visuals for ELs.
10 Important Sentences	Ten Important Sentences was a completely new strategy for teachers. The 10 Important Sentences increased teachers' intentional scaffolding for ELs; 10 Important Sentences not age-appropriate
Color-Coding	Teacher utilized graphic organizers, color-coding and graphic input charts to scaffold a challenging unit.
Graphic Organizers	Teachers used graphic organizers to make lessons more hands-on for ELs. Teacher utilized graphic organizers, color-coding and graphic input charts to scaffold a challenging unit. Graphic organizers helped students organize their understanding of the content.

Interactive Notebooks	Teacher used interactive notebooks and noticed the impact on students taking ownership of their learning.
Murals / Graphic Input Charts	Teacher utilized graphic organizers, color-coding, and graphic input charts to scaffold a challenging unit and acknowledged that students were gaining understanding using the strategies.
Songs and Chants	Songs and Chants not age-appropriate

Strategy use across data sources. Table 8 summarizes the documented use of each of the ten strategies within the lesson plans, the fall and spring observations, the snapshot survey results, and the self-reflection of what the TLLs learned from the PD as shared in the focus groups. Each number represents each occurrence of use/mention of the strategy within the data set.

Table 8. *Data Synopsis of Research Strategies Used by the Participants (LP=Lesson Plans, Fall (observation), Spring (observation), SS=snapshot surveys, FG=Focus Group)*

Qualitative Data

<i>Recorded Use of Strategies</i>	<i>LP</i>	<i>Fall</i>	<i>Spring</i>	<i>SS</i>	<i>FG</i>
Sentence Stems	6	6	11	17	20
Quick Chat / Quick Write	15	10	15	6	14

Word Walls	3	5	12	8	12
Big Books	0	0	0	0	5
10 Important Sentences	0	0	0	0	2
Color-Coding	1	1	5	5	5
Graphic Organizers	10	10	11	16	15
Interactive Notebooks	1	0	9	13	10
Murals / Graphic Input Charts	0	0	1	1	1
Songs and Chants	0	0	1	6	4

Sentence Stems

Sentence stems were one of the three most-commonly-used strategies across the data sources and increased in use over the course of the study. Sentence stems were implemented in six of the TLLs' lesson plans following the PD. They were then observed six times during the fall observation. There was an increase of use during the spring observations where sentence stems were observed 11 times. At the spring observations, various teachers demonstrated an increase or change in use of the strategy. Teacher E (A-0

are used to identify specific teachers) began with an observation from a lesson that was very structured with minimal student input at the beginning of the year; thus, being more of an observer of learning. Teacher E, in the spring observation, taught a lesson that had students engaged with the content from the beginning and then utilizing sentence stems in addition to quick chat, graphic organizers, and word wall strategies at the end of the year to engage with the content that was clearly connected to the standards and objectives shared with the students. Teacher I's lesson, observed in the spring, also utilized multiple strategies while students were actively engaged in the content using key vocabulary and sentence stems using the vocabulary to develop their own tool to then reflect on the content. In this lesson, reading, writing, speaking, and listening were all used to engage in the content as a whole group, in small groups, and individually, providing a wealth of opportunities to use academic vocabulary to learn the content. Teacher F used silent time with no supports and no interaction in lab work during the fall observation. During the spring observation, however, Teacher F provided a visual with sentence stems and a hand-out vocabulary chart for the independent lab work and then allowed students to engage with a peer at the end of the lesson to gather additional information as needed. Teacher M used questioning in the lessons, however, during the fall observation, if students did not respond to a question, it was skipped, whereas during the spring observation, the question was then explained and elicited a whole-class discussion to answer (drawing from reminders of content in the video using sentence stems). The ELs were supported through oral language

development, which, in turn, developed a deeper understanding of academic vocabulary when supported and scaffolded utilizing the sentence stems and interactive notebook strategies among others. Teachers C and O both were observed in the spring having students work in groups to complete the assignment, ask questions using sentence stems, and build knowledge; so, although the classrooms were loud, the students were engaged with meaningful dialog. Teacher L included partner, small group, and whole-group discussions throughout the lesson observed in the spring while using sentences stems and a word wall to support academic vocabulary use. These opportunities observed in the spring observations documented increased and more intentional use of the strategies to support oral language in the classroom.

During the focus groups, sentence stems were mentioned 20 times according to the transcript analysis. Various TLLs shared examples of how they were applied to support ELs in the classroom and how TLLs used sentence stems to teach content. One teacher described how “sentence stems give the students the tool to use vocabulary so they can tell me their ideas. I think the sentence stems for me has been the most useful and the most widely used after the PD.” During a separate discussion, a teacher described using the sentence stem strategy. She described how sentence stems helped the students focus on academic language. The teacher mentioned that while not every kid needed to have that stem, enough of her “kids were new to English” or had other language needs that incorporating sentence stems was very helpful. Furthermore, she stated, “So, for me it

really was making sure that I used the quick chat first and then once they had talked about it, formulated their sentences, got that sentence stem going, and then sat down and have them write it. I mean, that was big.”

A dual language teacher emphasized how she was able to support teaching content to a class where everyone was learning the language. In using sentence stems, she felt like she could use them alongside other strategies. Another teacher excitedly shared,

“The students are finally grasping that it's not just, yes; that there's more to a conversation than just yes and no. The sentence stems have been vital in here to help them grasp that and to see how a student can go from yes and no to fully giving like evidence and the idea of the question with the evidence and then somebody else saying, ‘Hey, I have more to add to that.’ It's truly been tremendous.”

Another teacher described benefits from the PD including the sentence stems and how she increased usage,

“The biggest takeaway I came out of the PD with was supporting what I'm doing already in my classroom. I used several of the strategies already, but I really wasn't sure if I was using them right or if they were even effective and now I know how to use them effectively. For example, I used word walls, graphic organizers, and quick writes. I did those pretty regularly in my classroom, so it was a lot of support already, but I can better utilize the strategies now. From new information that was given, I liked sentence stems. I used them periodically; now I use them consistently, probably three days a week for research writing, for journaling, and for my pre-emergent students. I'm always giving them sentence stems, and I found out that it's okay to give them sentence stems. Because again, before I might give them one, but I thought I was kind of cheating, and now I know I'm not. I'm supporting them.”

A thoughtful reflection from another teacher was,

“The PDs were effective. One of the things that I took away from the PD was sentence stems. That is one of the things that now do on a daily basis, and we've taken that beyond just an ELA. We use it in math, and we use it in science. I think it helped not only me, but it helped the students as I shared how they should answer

questions or how they should begin sentences that now they actually continue a conversation while practicing talking about the content.”

The three snapshot surveys collected data on what strategies teachers reported using at two specific times during the school year. Of the 20 snapshot surveys returned across the three times it was sent out, 18 responses said sentence stems were utilized the previous week. They were used across subject areas and to support vocabulary building. One teacher also mentioned that integrating sentence stems helped students engage in content discussions right away. There was one teacher who determined that a challenge to using the sentence stems was the need for a list or resource that had example sentence stems for the teacher to pull from and implement across the curriculum.

Quick Write/Quick Chat

The Quick Write/Quick Chat strategy was also one of the top three strategies used and was implemented in 15 TLLs’ lesson plans following the PD. They were observed ten times during the fall observation and 15 times during the spring observation. During the observations, it was observed that Teacher L originally used quick chat in her teaching but with her spring lesson the quick chat was more meaningful and utilized to respond to specific parts of the lesson using key vocabulary on a word wall while also recording the discussion in an interactive notebook and then color-coding the evidence from the text used during the math lesson. Teacher K had students come up with examples from their own lives to define the vocabulary in the lesson, do a quick chat in small groups, and then record the examples shared in their interactive notebooks. Finally, Teacher D had students work

in pairs exploring movement and design with manipulatives. The core lesson was focused on discussing, exploring, investigating, and sharing findings to later record and document after multiple opportunities to orally engage with their peers in quick chats.

Quick write/quick chats were also one of the three most used strategies with teachers acknowledging the usefulness and providing examples of how they applied the strategy into their classroom to support their students' learning. The quick chats were self-reportedly used seven times across the two snapshot surveys. They were used across multiple subject areas, and one teacher commented that the strategy supported understanding of what students just learned. During the focus groups, quick chat/quick writes were mentioned 14 times. One teacher shared in the focus group that "the biggest take away for me in my position as a reading coach and going into classrooms really was the 'quick write' and the 'quick chat,' only doing it the opposite way, doing it with the quick chat first and then the quick write. English speakers may not need to have that accommodation made for them, but our EL kiddos need to hear it. They need to say it." The observations and focused groups collected examples of how these were used more intentionally to support ELs learning of content and language.

Graphic Organizers

Graphic organizers were the final top three strategy used in the study. They were implemented in ten TLLs' lesson plans as a result of the PD. They were then observed ten times during the fall observations and 11 times during the spring observations. An example

was Teacher A who used questioning in the fall observation but expanded the questioning by having students reflect on prior day lessons for example, “remember what milli is?” Teacher A then directed the students to a class graphic organizer on the wall that defined and illustrated the measurement and had a student share out their collective information from a previous lesson in the spring observation. The teacher then had students turn to their neighbor and do a quick chat of something that could be measured using millimeter—building on prior knowledge from the previous lesson and building on real-world application of student examples from their own experiences and body of knowledge. This example demonstrates the increased use of strategies to build connections to prior learning. It also demonstrated that the student’s lives and experiences were used to build connections with the content. This provided a practical application of the PD content to the classroom to support ELs by using the strategies to teach content using academic language and building academic vocabulary knowledge through interactions with the content. Many of the strategies were demonstrated in the Spring observations alongside graphic organizers, including songs/chants. Teacher I had students create a graphic organizer as a group; discussing the content, what the students needed to learn within the content including identifying and defining key vocabulary, and providing examples to help them remember the content by brainstorming in groups to then have the students use the graphic organizer to complete independent work.

The graphic organizers were self-reported as being used 16 times across the two

snapshot surveys. They were used across multiple subject areas with one teacher sharing that they were used for reading and science to show cause and effect relationships where another used them for math to organize information, provide models, and build understanding with teacher resources included. Another teacher mentioned how graphic organizers helped the students to chunk information. In the focus groups, fifteen mentions of graphic organizers were recorded. One teacher used graphic organizers to assist students and said,

“I think things like graphic organizers have been helpful. When we first started, we were using specific graphic organizers, so students understood how to use them. Once they finally got an understanding of how to use them, then they could choose which one they thought that they would use. Then, after that, they were able to create their own. It could be exactly like that picture up there or say it was Valentine’s; we’re doing something where they can create a heart and turn it into one of those graphic organizers. They kind of made it their own. That was something very helpful.”

Finally, a teacher discussed how knowing how to use the strategies helped her understand how to support and teach language while teaching content. “Mine borders on the line of the engineering design and the scientific method and always they kind of cross each other and then... I mean, hey, we’re doing science, and we’re doing processes while working on vocabulary and language; to me, that’s a win-win.” These reflections demonstrated new and refreshed understanding of strategies to support the effective instruction of content while supporting academic language and vocabulary development.

In reflecting on graphic organizers in a separate focus group, a secondary teacher really recognized how to use graphic organizers, stating,

feel that this year I used thinking maps, which is a form of graphic organizer, to increase comprehension of short reading passages in Spanish. This indicates a lot using a tree map to identify the who, the when, the how in the story, and having that visual for them was very important. When they had to answer questions about the story, they could refer to it very quickly, and I think that was really helpful.”

This and the previous reflections provided multiple examples of how teachers applied the PD knowledge of the strategies into their classrooms. Graphic organizers were the most common strategy used in the study, with a slight increase in use from the lesson plan analysis and fall observation to the spring observation and focus groups. Most teachers were familiar with this strategy and found new ways to utilize the strategy to support teaching content and language in their classrooms. The descriptions of how this strategy was used were more detailed, and teachers demonstrated self-efficacy in sharing their successes in using this strategy.

Word Walls

Word walls, color-coding, and interactive notebooks had some increased use throughout the study. Word Walls were implemented in three of the TLLs’ lesson plans following the PD. They were observed five times during the fall observation with increased use to 12 times in the spring observation. Teacher B moved from not using any of the ten strategies in the PD and lecturing using a doc cam to using a word wall to point out vocabulary during the lecture, using a graphic organizer to have students respond to the lecture, and quick writes to answer key questions posed in a video during the lecture in the post-observation. Also, many other teachers had students refer to the word walls already on

display if needed for class discussions, group work, and in their writing. The snapshot data revealed eight instances where word walls were reported and reflected upon. They were used in math, science, and in one case, social studies for visual support to the vocabulary in a study of a historical figure.

As shared in the focus groups, several teachers described the addition of using various strategies, the increase of using strategies, and being aware of the strategies to use to support their teaching. One teacher reflected,

“I’ve done a few of them. Word walls was presented in a new way because I tend to do the front loading of word walls, but to let the students actually start putting their words up when we’re reading a text and all they do is if they don’t know a word, they just write it on a note card and stick it up, and then we have a quick discussion on it.”

She (DL teacher) later reflected,

“This year, I also had a Spanish wall, and I stayed away from calling it a grammar wall. It was more of a vocabulary wall, where any new word that we would study, we would put it up on the wall, and it was also attached to a picture. And I just, adding to what (another teacher said) has said about adding artifacts to the wall was important, and putting labels to it, and kind of showing them the kids, ‘Oh, if you were to do a diagram, you label things.’ These word walls really helped students use the vocabulary more often in class.”

In total, word walls were mentioned 12 times during the focus groups. The use of word walls increased a great deal from the implementation into the lesson plans and fall observations to the spring observations, self-reported snapshot surveys, and focus group discussions. The trend was that some teachers increased their knowledge on how to use the word walls to support ELs, and others reported a connection in using the word walls with

content, teaching content, and language in tandem.

Color-Coding

Color-coding was implemented in a single TLL's lesson plans and was observed once both in the fall and spring observations in a combination with other strategies. An increase in the use of word walls, graphic organizers, and color-coding strategies as well as some use of the other strategies from the fall and spring observations found TLLs moving from direct instruction with little student interaction with the content other than listening to engaging in the content through questioning, recording, discussing, highlighting, and documenting. Teacher L integrated color-coding with interactive notebooks to have students show evidence of how they found their answers in math in the fall observation. Teacher J had students illustrate vocabulary with examples and then had students add to the interactive notebooks with highlighting and peers explaining and clarifying using quick chats in groups in the spring observation. Color-coding was mentioned six times during the snapshot surveys in cross-curricular teaching. In one case, a teacher used the strategy in reading to identify and keep track of information needing clarification and to reinforce vocabulary for speaking and writing, and another teacher commented that the strategy was used for writing to identify parts of a five-paragraph essay. Color-coding was recorded five times during the focus-group discussions. One teacher explained,

“Color coding was great. I actually came back to that about halfway through this last school year. After teaching my lesson late into the school year, I was looking for new strategies, and I thought, how can I help the students more, and the strategy I decided to use was color coding.”

The color-coding strategy only had one teacher who initially included the strategy into their lesson plan and another who used the strategy during the fall observation. The fact that a range of teachers did not first implement the strategy into their lesson may have contributed to the lesser implementation and use later in the school year. However, the strategy did show a small increase in use, with most teachers integrating this strategy with another method such as graphic organizers and interactive notebooks.

Interactive Notebooks

Interactive notebooks were implemented in three of the TLL's lesson plans following the PD. Though not observed during any fall observations, they were observed nine times in the Spring. The primary use in the Spring observations was during science lessons, where the teacher included hand-outs and diagrams to learn the content. The snapshot data revealed 13 instances where interactive notebooks were reported and reflected upon. They were used across multiple subjects with a specific example used in science to collect data and keep notebooks with student and teacher-generated content. The teacher explained how it made it easier for students to stay organized.

In the focus groups, interactive notebooks were mentioned ten times. These instances included addressing the reasons for using the strategies, as one teacher asserted that,

“It (the strategy PD) was extremely helpful for me. I don't have a whole lot of EL students, but the vocabulary is extremely important, whether you're an EL or not, so things like the interactive notebooks and having them write down vocabulary terms and write a sentence using it in the context has been really helpful. I think that's

helped them a lot this year. We've started Latin Roots this year, which is really hard, even for the teachers. As a teacher, I have to look up in the dictionary how to pronounce some of the words. So, I think having a notebook of the words that they learned throughout the year will really help them see how far they've come."

A teacher at the same school who is a dual language teacher concluded that:

"The word walls, the graphic organizers, the hands-on language learning that students can also put their learning in their science journal so they get to look at it again and again, and can feel it a different way. I think we've had a great year, and I've had interns come in, and they're happy with how much science we do, which is much more because I can teach language with the science."

In the same focus group, a teacher bolstered,

"I used interactive notebooks with my students this year, and it was really fun to see the things that went well and talking with my other colleagues they wanted to skip the mural part. And I'm like, 'No, guys,' because, I said, 'If you do this, it's a visual for them, and they get to echo it... it also helps your EL students,' and I go, 'It's another way for them to learn.'"

These examples of application, seeing the benefits, and sharing what they have learned with fellow teachers exemplify self-efficacy in teachers knowing how to support their students' language through content teaching.

Interactive notebooks, though not used as much as sentence stems, quick chat/write, and graphic organizers, had the largest growth from the beginning of the study to the end. Only one teacher implemented this strategy in their lesson plans, and no teachers demonstrated the use of interactive notebooks in the fall observations. However, nine teachers used the strategy in the Spring observations, 13 TLLs also self-reported use in the spring, and ten comments about the strategy were shared during the focus groups. In addition to the increased use, TLLs utilized interactive notebooks with several of the other

strategies, including sentence stems, quick chat/quick write, word walls, color-coding, and graphic organizers, demonstrating an integrated approach to using these strategies to build knowledge.

Big Books

Big Books, 10 Important Sentences, Murals/Graphic Input Charts, and Songs and Chants had minimal to no use in the study. Big Books were not integrated into any of the lesson plans, were not observed during the observations, and were not reported in the snapshot surveys; however, they were mentioned five times during the focus groups. One teacher suggested, “Big books were reintroduced to me. I had not done big books for 20 years, and I got away from it but after doing the PD, I rediscovered their effectiveness.” Another dual language teacher emphasized how she was able to support teaching content to a class where everyone is learning the language. “I feel like going through big books, and picture books and kind of have students pick out pictures that they do not recognize, and use the sentence stems to try out the language with me asking, ‘How can you say that in a new language that you’re acquiring?’ and students can kind of build a vocabulary for the story from there which has been so important.” Big Books was one of the least used strategies with no use documented or reported until the focus group. The teachers reported that they saw value in using the big books to support academic vocabulary development but did not actually implement the strategy into their classroom.

10 Important Sentences

The 10 Important Sentences strategy was also not observed or noted until the focus group discussions where they were mentioned twice. One teacher shared that she did not feel they were age-appropriate for her first-graders and another commented when sharing about learning new strategies during the PD, “Ten important sentences is one that I hadn’t heard of, and I wasn’t aware or hadn’t thought of before and so that kind of expanded my knowledge of how to support vocabulary using a new strategy to use. So, it was definitely beneficial.”

Another teacher liked how,

“..everything was just so comfortable using them. Oh, and then the ten important sentences. I found articles for my students on the topics that they wanted to do and then I had them highlight, they came up with a thesis or a claim statement and then they had found ten important sentences from there, and then they took those ten important sentences and made a website based on them, which was great scaffolding of readings.”

The 10 important sentence strategy was also one of the least frequently used strategies; however, teachers did note the value in the strategy. One teacher did say that this strategy was a completely new concept that may have contributed to the lack of immediate implementation relative to strategies that teachers were more familiar with.

Murals/Graphic Input Charts

Murals and graphic input charts were not implemented in any lesson plans nor observed in any fall observations. They were observed once in the post-observations, reflected on once in the snapshot surveys, and mentioned once in the focus groups. One teacher reflected,

“And what I find, too, is if I do the mural along with the students, it kind of gets them more invested in it, and they understand the content more as you’re describing what you’re writing together. I have two sections of kindergarten, and I saw this reflected just yesterday. In the afternoon, I didn’t do the mural with the students, and I don’t think they were as attached to or learned the vocabulary because we both didn’t create it together and talk about it.”

Teachers who found that they were able to have a go-to resource to teach content were better able to support their students’ learning, and were confident in sharing their knowledge with their colleagues. One teacher revealed,

“I think when I left the PD, it made me really excited to do a lesson on World War II. We were reading ... the novel that we read that I did my lesson plan on. I needed to give them some front-loading information on World War II and the Holocaust. And so, seriously, I just went through the list of strategies, and so when we started doing research, we made graphic organizers, then we did color-coding of their brainstorming so that they had them into three different levels ... or three different topics. Then we went into graphic input charts where then they took the information, and they made it onto a website.”

Murals and graphic input charts were not utilized in the fall observations and only implemented/reported once each in the spring observations, snapshot surveys, and focus groups. Though briefly shared as to the value in using the murals/graphic input charts, TLLs reportedly used the strategy rarely, if at all.

Songs and Chants

Songs and chants also were not implemented in any lesson plans or observed during the fall observations. A song was integrated and observed once during a Spring observation. Teacher N used a song to build understanding of the content while supporting academic vocabulary knowledge. Songs and chants were recorded six times during the snapshot

surveys during a Spanish lesson and in math and science classes. Four times they were mentioned in the focus groups. There was one teacher who did not feel comfortable using the strategy so that comfort may have been a factor.

Summary of Results for Research Question 2

Figure 1 shows the strategies as a word cloud, emphasizing the frequency of their use by size. The data collected in this study shows an overwhelming use of four of the strategies (sentence stems, quick chat/write, word walls, and graphic organizers) and an underwhelming use of four strategies (big books, 10 important sentences, murals/graphic input charts, and songs and chants). The observations and lesson plans similarly reflect the self-reported use of the most used strategies with three of the under-used strategies (big books, color-coding, and songs/chants) being reported as being used more often than was observed and recorded in the published lesson plans. As described in the focus groups, the most commonly used strategies had some history with the teachers, and they were able to apply new knowledge in using them effectively whereas the challenging strategies, teachers reflected either were time-consuming or did not apply to their age group or their teaching style.

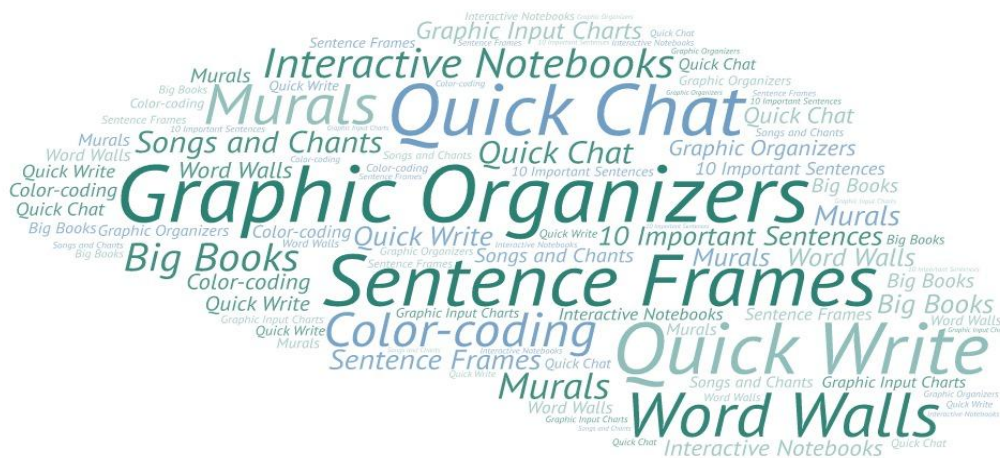


Figure 1. Research strategy use by participants data word cloud.

In conclusion, teachers increased their knowledge and skills immediately following the professional development program, and maintained those gains through the end of the school year. Teachers did not show increased self-efficacy immediately after the PD, but did report more self-efficacy after a year of implementation. Teachers also described the impact of the PD strategies as beneficial in supporting them to teach STEMSS content to ELs in the classroom while increasing use of eight of the ten strategies.

CHAPTER 5

Discussion

The purpose of this study was to document and analyze the impact of the STEMSS STRATEGIES Professional Development to Support Academic Language Acquisitions on TLL's knowledge, skills, and self-efficacy in supporting EL's academic language development in the classroom, and exploring how they use these strategies within the classroom. A ten-day face-to-face STEMSS professional development was conducted by recruiting 15 TLLs from Arizona public schools to voluntarily participate in the PD to improve their effectiveness in teaching language learners STEMSS content. Data was collected through pre- and post-KUSE surveys, classroom observations, snapshot surveys, lesson plan analysis, and focus groups. Chapter 5 reflects on this study through an explanation of results, limitations, implications, and lessons learned.

Explanation of Results

This section will address the results of the data through the lens of both Shulman's (2013) framework and Lucas and Villegas' (2013) model by considering the research questions that guided the investigation. In reflecting on the innovation and research through these lenses, the data is more meaningful as it aligns with research that supported the study while building new knowledge for future work.

Knowledge, Understanding and Self-efficacy

The STEMSS innovation was designed to increase content, pedagogical, and

curricular knowledge (Shulman, 2013) to support TLLs in the classroom by integrating the training of ten strategies into a content-rich PD. Content knowledge is the reason many teachers sign up for PD on their own time (Tanguay, Bhatnagar, Barker, & Many, 2018). They are interested in gaining knowledge that directly relates to the standards they must teach and often sign up for PDs that have the “wow” factor in teaching content that is engaging and exciting for students (Furtado, 2010). Fifteen TLLs attended the STEMSS PD that brought in experts in the STEMSS field to provide relevant content that directly related to real-world learning. The primary focus of the STEMSS PD addressed Shulman’s (2013) pedagogical knowledge by using STEMSS content while modeling effective EL strategies that clarified why the methods worked in supporting academic language. Teaching pedagogical practices that required the strategies to be explicitly taught, modeled, reviewed, and applied to STEMSS content drove the PD agenda and data collection in this study. Finally, curricular knowledge supported the application of the PD as TLLs implemented what they learned in the classroom by developing and piloting a lesson plan that integrated both content and language standards. This component of the innovation ensured that teachers, at minimum, applied what they learned in one lesson taught to their students following the PD.

The KUSE survey measured their change in knowledge, understanding in the use of these strategies, and self-efficacy of teaching content to support EL’s academic vocabulary development. Before the PD, TLLs rated themselves at an average of 2.53 (out of a 5-point

scale) in their knowledge in teaching STEMSS and in using the strategies to support ELs while teaching STEMSS. At 2.53, teachers felt like they had some knowledge before the intervention, which was likely due to their prior experience or training, but that there was also room for growth. By the end of the PD, the same TLLs rated themselves significantly higher than at baseline with an average of 3.44/5.0 on the same survey, and at the end of the school year at an average of 3.5/5.0 showing that the TLLs agreed or strongly agreed that they had considerable self-reported knowledge in teaching STEMSS to ELs at the post-intervention and follow-up time points. Similarly, teachers self-reported that they developed, used, identified, and assessed the strategies when teaching STEMSS at an average level of 2.51/5.0 at baseline, 3.12/5.0 post-PD, and 3.37/5.0 after a year of implementing what they learned in their teaching. These significant increases of knowledge and use of strategies to support ELs in the classroom suggest that the PD supported TLLs knowledge and skills in teaching content and language in tandem. Vogt (2009) backs this result; stating that TLLs must be trained to increase knowledge in teaching both content and language to ELs.

Self-reported self-efficacy did not change significantly from pre- to post-PD (3.26/5.0 to 3.57/5.0); however, it did change significantly from baseline to after teachers had a year to implement what they learned (3.78/5.0). These results aligned with Ertmer and Ottenbreit-Lefwich (2010) and Hennessy, Ruthven, and Brindley's (2005) research, which explained that teachers need time and the opportunity to apply what they have

learned before they can become confident in these skills. So, while the teachers gained knowledge and skills during the PD, they did not gain self-efficacy until they had a chance to implement what they learned the following school year. These results, though a significant change over time, would be interesting to explore after another year of teaching ELs to see if more time for implementation would increase self-efficacy.

Strategy Application

The second research question dove into how the teachers applied the strategies, first starting with the lesson plan development during the PD and the continued piloting of the lesson that ensured teachers applied the strategies into their classrooms (Lucas & Villegas, 2013). Eleven lesson plans were completed and piloted, each with one or more strategies integrated into the instruction. Three strategies were used by the majority of the teachers whereas two strategies were included once and four strategies were not included at all. In reviewing how the strategies were integrated, the strategies that used the least amount of time to prepare for were most frequently used (sentence stems, quick chat/quick write, and graphic organizers). The four strategies that were not included in any lesson plans take additional time to develop, prepare for, or implement (big books, 10 important sentences, murals/graphic input charts, and songs/chants). This demonstrates that one of the most important limiting factors in implementing strategies might be the time investment in preparation for each strategy.

During the focus groups, teachers reported learning the value of using the strategies

with ELs in content instruction and felt that they had found ways to use them in their current curriculum intentionally. Through practice, they recognized the potential benefits to the students, and self-reported that they increased the use and application of the strategies to other subject areas beyond the lesson that they originally developed as part of the PD. This was also demonstrated through the snapshot surveys and observation data. All ten strategies were mentioned within the focus groups, and overall, 88 strategy implementation and reflection comments were mentioned and discussed during these sessions. Teachers not only shared that they applied the strategies, but they shared with enthusiasm the ways that they found them useful through teaching and learning experiences and how they increased their knowledge and self-efficacy in the process.

In reflecting on each strategy, big books required the teacher to prepare materials for students to develop a page that was compiled into a big book with the content carefully divided so that each student was responsible for different content that they provided to the collective source of a big book. Though one teacher explained that they were reintroduced to big books and learned the value of using them during the focus group, big books were not observed in any classes, or reported as being used by any participants throughout the year. In addition to time investment, which may have limited the application of this strategy, it may be that not enough modeling was used in the PD to emphasize the process and benefits that may make the time investment worthwhile. Though the same amount of time was given to share each strategy, in future PDs, it may be useful to develop a Big

Book through one of the hands-on STEMSS lessons presented as a model.

Ten important sentences were also not implemented and only mentioned in the focus groups as a value-added strategy. This, too, may have been due to insufficient modeling in the PD. To use the ten important sentence strategy, teachers must identify approximately ten sentences (can be less depending on the reading passage and level of reading) and highlight or focus on these sentences to teach the content when scaffolding for ELs. If making photocopies, this can be an easy task using highlighters. However, another roadblock may be that teachers do not see how they can do this within a textbook. If the PD had modeled this strategy using highlighter tape in a book and then had teachers try it, it might have been more effective in showing that this strategy does not take a great deal of extra time or effort. This additional training element could also increase the use of color-coding, which had slightly higher use than the ten important sentences, but still limited application.

Murals/graphic input charts also may have needed additional modeling in the PD. Only one teacher was observed using this strategy during spring observations, one teacher reported using it in the snapshot surveys, and one teacher commented on the benefit of the strategy in the focus groups. This strategy does take additional time in preparation, as teachers need to gather materials, images, and additional content that can be used to develop the murals/graphic input chart. The teachers also need practice and have confidence in using this strategy. This can be built into the PD but would add a great deal

more time. More time should be dedicated to this strategy in future PD training by putting teachers in small groups where they each get to contribute information to the mural/chart while also getting to practice using the strategy. It would also likely be useful to have ongoing training via webinars or a social media platform where new ideas and examples can be posted as a place for teachers to share successes or resources they find. This would not only provide additional training and materials but reminders of the strategies that can support TLLs working with their ELs.

Songs and chants had a slightly higher rate of use than these previous strategies but were still limited with only one instance during spring observations; six teachers reported using them through the snapshot surveys, and four mentioned the strategy in the focus groups. One teacher reported not feeling comfortable using the strategy with older students. Confidence in using songs and chants is a roadblock that is unique with this strategy because teachers reported feeling like they needed to have a good voice or be able to perform for students. Though this is not always the case in using the strategy, this idea removed this method as a viable option for some teachers. A recommendation would be to model how a teacher can use a video of someone else singing and/or teaching the song or chant to students as well as sharing song and chant resources and examples with each other through social media platforms and ongoing support sharing and discussions.

Sentence stems was a strategy that was successfully implemented with an increase of use from six instances observed in the fall observations and lesson plans to 11 instances

observed in the spring; 17 instances were reported in the snapshot surveys, and 20 mentions in the focus group. Even with the increase of use, one teacher reflected on the time it took to come up with sentence stems and requested to have several provided so that TLLs had a list of go-to stems to use across the curriculum. The participant shared, “I was searching for sentence stems, and I wish there were some nice pre-constructed on the computer sentence stems that I can just put up rather than having to recreate them, and to have them in EL format for different levels.” TLLs repeatedly mentioned that their time is limited, and it is critical to assist with time-saving techniques when teaching about each of these strategies. Also, the need for resources and supports was another overarching theme with several teachers reflecting during the focus group on the benefits of the PD and resources provided to support teaching ELs in the classroom, along with the need for more. In future PDs, it may be helpful to include additional supports in sessions that build resources among them. For example, teachers could get into grade-level groups and develop a pool of sentence stems to use in their classroom so that all teachers in that grade group level can use the same sentence stems during the school year.

Graphic organizers were another resource that was increasingly used throughout the year, and there were multiple comments on the benefit of this strategy. The TLLs mentioned that they appreciated the graphic organizer ideas as a new resource and that they also increased their use of the graphic organizers they already had available. In reflecting on the PD, many teachers shared ideas and graphic organizers they had used in their

classrooms as the session on graphic organizers was presented. Also, a packet of several graphic organizers was shared with lesson plans that demonstrated how they were used. By providing this resource, it made the organizers easy to implement. This added go-to resource, in addition to teachers already being aware of this strategy, might be why the teachers utilized this strategy and increased use across the year (10 in lesson plans, and 10 observed in the fall to 11 observed in the spring, 16 self-reported in the snapshot surveys, and 15 mentions in the focus group).

Quick chat/quick write and interactive notebooks both showed an increase as well, with sentence stems, and graphic organizers being the most prevalently used strategies both at the beginning of the study and in growth by the end of the school year. These are all easy to implement with little preparation time and were familiar to the teachers before the PD; thus, along with the training that reminded them of them, and how to apply them in this context, these might be reasons why they were most often used.

Both qualitative and quantitative data were triangulated and showed complementarity in what was found across data. Creswell (2014) stated that triangulation corroborates the evidence that enhances accuracy and authenticates the findings. The KUSE quantitative results showed that TLLs significantly grew in both knowledge and use of these strategies immediately after the PD and knowledge, use, and self-efficacy by the end of the school year. The data collected during Spring observations showed an increase of use after TLLs had time to implement strategies in their teaching. This response is found

research when implementing PD into pedagogical practices (Kennett & Hanzuk, 2014).

The delay may also be a result of increased self-efficacy in teaching ELs as reported in the KUSE maintenance survey. Some possibilities that could increase strategy use in the future would be additional support in PD through webinars or social media platforms, modules that demonstrate the strategies, and an ongoing dialog with the teachers on what was being done and what was working so that the TLLs can learn from what the other teachers are doing while they are teaching (rather than as a focus group after the year). Zwiép, Benken, Nguyen, and Hakim-Butt (2014) discussed the process of TLLs constructing pedagogical approaches as they gain experiences and that ongoing collaboration assists in developing and integrating new knowledge and skills. This ongoing collaboration within the cohort may increase the use of the strategies and change in pedagogical practices in teaching language and content in tandem to support ELs.

Benefits and Challenges

Several benefits that TLLs found as a result of participating in the PD was the ability to integrate the strategies into their current instruction methods, the ease of using the strategies, the additional resource in planning lessons, and simply the strategies themselves and their added knowledge to support teaching and learning in the classroom. References to the strategies as a resource tool was reiterated through multiple quotes; seeing the benefits of the PD used in their own teaching practices. These collective benefits demonstrated the usefulness of the strategies and the PD to teach the teachers how to use the strategies in their classrooms.

The TLLs found some strategies to be harder to implement based on personal teaching styles and age-appropriateness according to their understanding of the strategy. Some teachers stated challenges and recommendations such as providing a resource page of all the strategies and examples of how to use them; reiterating the time element of using strategies that can be used without having to navigate, prepare in advance, or think up grade-level examples to use.

Limitations

There were five limitations that may have impacted the results of this study. These included (a) the small sample size, (b) the limited pre-PD data collected to better demonstrate where TLLs were in knowledge, use, and self-efficacy prior to the PD, (c) the lack of standardization in observations, (d) the in-person PD during the summer limited which TLLs could attend the training, and (e) possible additional supports/trainings/experiences. These limitations are explained in more detail below.

The first limitation is the number of TLLs that participated in the study. The initial goal was to have a minimum of 24 TLLs, but only 15 participated in the final study. With a K-12 spectrum of TLLs, 15 represented only a limited number of elementary, middle school, and secondary teachers who worked with ELs. A larger group of teachers, and/or limiting the grade spectrum, would be advisable for future research on the effectiveness of the PD on a target audience. The current cohort ranged from K-12 with small numbers in each group (K-5 had seven TLLs, 6-8 had six TLLs, and there were two high school TLLs).

To more effectively assess the benefits of the strategies on a target population, studying the impact on one of these three grade categories might provide better insight on what strategies are effective for a group of teachers that have similar teaching circumstances.

The second limitation was the lack of baseline data before the intervention. The pre-KUSE was collected before the innovation; however, the first observation was not collected until after the PD. It would be more impactful to observe the TLLs before the PD, in the spring before summer break, to better collect pre- and post-data on observed teaching behaviors in the classroom. Also, a pre-lesson plan would have been beneficial to see what strategies teachers used in their lesson planning before they were trained in embedding strategies throughout their lesson planning process.

The observations themselves also needed to be more prescribed and narrow in scope to be able to compare and examine strategy applications across the school year. In reflecting on the research methods, observing TLLs throughout the year showed some change in their application of strategies from the fall to spring observations, however much less than might have been anticipated after being exposed to all ten strategies. This may be a limitation of the observation methods, which did not always capture comparable lessons at both observation points. For example, one lesson was a didactic vocabulary lesson for a science topic where the next lesson involved students working on an independent writing assignment that they had begun several days prior. Though strategies can be used in both, it does not truly compare strategy use change over time since the spring observations did

not observe similar lessons/formats. What was observed, however, were TLLs utilizing these strategies in the spring observations with intention, increased frequency as a collective group, and within STEMSS lessons. Across the group of TLLs, 32 strategies were used in the fall observations (out of 15 observations), with only half of the strategies being used at least once. During the spring observations, 64 strategies were used (out of 15 observations) with all but two strategies observed at least once. This may have been due to the time teachers needed to recognize opportunities to implement strategies and increased self-efficacy in their implementation. Teachers may have also tried a few strategies and noticed the impact they had on ELs learning content when language was supported. The increased use of all of these strategies supports Lucas and Villegas' (2013) linguistically responsive teacher education model to support scaffolded content instruction with these linguistically and culturally responsive pedagogical practices. So, once TLLs saw the effectiveness of a strategy, it may have increased the use of that specific strategy more than trying others.

In addition, some teachers conducted a formal vocabulary lesson initially and then a follow-up science lesson during the spring observation; this made it difficult to see how teachers might have changed pedagogical practices when the lessons were different in content and format. In the future, it would be better to observe a science or math lesson, for example, and then do the same as the end of year observation to compare 'apples to apples.' Another possibility would be to observe an engaging lesson (opening/beginning part of

lesson), or group lesson, or practicing of skills lesson, once again to compare lessons of similar purpose or format to see what had changed.

A fourth limitation was the location and time of the PD. This PD required teachers to give up a specific week during their summer to attend an intensive, full-week professional development at Arizona State University. This may have limited participation due to travel and other commitments. A possible alternative for future studies could be to conduct an online or hybrid PD that utilizes current technologies to allow for TLLs to participate from any location or around other obligations.

Finally, the TLLs may have had additional support, training, or experiences within their district throughout the school year that could have had an impact on their use or lack of use of the strategies. Some teachers are frequently looking for new ideas, sharing resources, or attending PDs and, considering the participants voluntarily enrolled in the PD connected with this research, it is possible that they chose to attend other related PDs throughout the year. Additionally, districts often offer and sometimes require internal PD. Future research may have TLLs document this additional support to consider the implication of having PDs on the same subject.

Implications

Four main implications for practice can be drawn from this study: (a) teacher education needs to provide knowledge about and practice with ELs to better prepare teachers for the classroom, (b) PD for in-service teachers needs to be broader and deeper,

(c) policy for ELs needs guidance and support from teachers and experts in the field, and
(d) collaboration is essential to support ELs.

The first implication for practice addresses teacher preparation. The increasing number of ELs in the classrooms indicate that all teachers need training. However, the limited available training is not enough (de Jong, Arias, & Sanchez, 2010). Teacher preparation programs need to not only provide basic historical knowledge and brief examples of how to support ELs through a single SEI course, but need to incorporate the teaching of strategies and then have opportunities to apply and practice these strategies with ELs in internships. This suggests then that students needs to be placed in classrooms with ELs while learning strategies.

The second implication for practice is that the PD for in-service teachers needs to be broader and deeper. This will ensure TLLs gain knowledge in strategies to support ELs in content instruction. Kim's (2016) research reiterated the need for both new knowledge and practice using the new knowledge was essential for implementation. TLLs must be given opportunities during the PD to practice and apply the strategies to their own grade level/content area; to connect the new knowledge with pedagogy to bridge how they will use it in their classroom. The synthesis of results from this study encourages additional and broader use of this and similar PDs to support TLLs across the state. Similarly, the results indicate that going deeper and providing more time during the PD to practice the strategies to build solid connections to their own teaching are essential.

The third implication for practice addresses policy. De Jong, E., Arias, M.B. &

Sanchez, M.T. (2010) clearly demonstrated the change in teacher preparation when policy was changed. Policy must be in place for teacher preparation programs to include necessary training for ELs. To move beyond historical knowledge of ELs in schools and brief overview of EL supports in a single SEI course, policy must require increased knowledge of why and how to support ELs and then a related internship that allows for the application of these supports. TLLs need time to connect to and apply these strategies to learn how to use them and policy needs to support this time. In addition, to ensure policy reflects current needs, teachers and experts need to be part of the development of policy.

Finally, the fourth implication of practice is the need for collaboration. Jimenez-Silva and Olson's (2012) work included the essential components of collaboration in supporting ELs. To support ELs, all key stakeholders must work together to identify needs, best practices, expertise, professional development, and resources to support TLLs so that they can support ELs in the classroom. Teachers can't do it alone, they need to work with parents, administration, policymakers, and experts to safeguard while ensuring the equitable education of ELs.

There are also many related areas for further research. Two of these areas include (a) examining the indirect effects of this intervention on ELs academic achievement, and (b) broadening the reach of the PD if converted to a hybrid or online program to reach more TLLs across the state who may not be able to attend an intense week-long face-to-face training.

A longitudinal study of the TLLs receiving this PD would be useful to explore

student data within these teachers' classrooms over several years to see if the change in teachers' knowledge and skills increases the academic performance of the students in these classrooms. This study could conduct annual KUSE surveys and focus groups on learning how the TLLs' changed in supporting ELs over time and allow them to reflect on how they thought the PD played a role in this change. The insight gained from continued study of this group might include questions on what other professional development training they received, ways that they would have liked to be supported following the PD, and implications of their change in pedagogical practices on their students' successes in academic achievement.

Another potential area of research is the expansion of its availability to teachers outside of the Phoenix, Arizona area. Currently, this is an in-person, week-long professional development experience. In order to reach more TLLs within and outside of the state, the next step in developing this PD is to make it more accessible to remote populations. The content and follow-up support through lesson plan piloting and publishing, as well as possible continued PD and collaboration could be replicated through an online or hybrid platform with an interactive forum to dialog and interact with each other and share experiences. The surveys, lesson plan analysis, and focus groups conducted via Zoom could also allow for similar research with a more geographically diverse group of teachers. Teachers could submit short video clips using strategies in their classrooms or could journal about their experiences to document the steps they took to implement the

strategies. These logistical changes, as well as the possible continued PD and collaboration support, would provide an avenue to continue the PDs with more intention and accessibility to a wider geographic population of TLLs across the state.

Lessons Learned

I grew a great deal from this experience as an action researcher. More specifically, I learned (a) the power of action research on the researcher, and (b) the value of becoming a researcher to impact change. Through the Leadership and Innovation doctoral program, I learned through research. The carefully planned course work and research cycles built my understanding of research, action research specifically, and how to build a study that can measure interventions in a systematic way. This process helped to strengthen my own knowledge, skills, and self-efficacy in conducting research that is organized, beneficial, and impactful. I learned how to organize my thoughts into research questions that were directly connected with theoretical frameworks and methods. I then learned how to conduct a study that was not only beneficial to the field but the participants. Finally, I learned how to conduct research that was impactful to the body of knowledge in understanding if and how innovation may benefit other TLLs in the field. These supported experiences helped me grow as a researcher and provided invaluable skills that I will be able to use in my career.

Most importantly, I learned how becoming a researcher has enabled me to impact change in a way I never was able to as an instructor. Teaching has been a passion since I first completed my undergraduate degree, and was able to make an impact on 30

individuals each year. Moving to the college teaching level allowed me to have a greater impact by working with future teachers, guiding them to discover and perfect best practices for teaching and learning in their future classrooms. Through these experiences, I have always identified methods, strategies, or ideas that have made an impact on a small scale while encouraging others to “research” the phenomenon to tell the stories of success to a broader audience and hopefully impact more teachers and students. I now have the enhanced skills to conduct my own research to make this impact on the education world. This line of research will be further explored through additional cohorts, all while continuously improving the innovation and evaluation methods to better tell the story of successes and challenges in supporting TLLs who have the opportunity and responsibility to impact ELs. Through this and future research, I can impact change at a much larger level and look forward to doing so.

Conclusion

High-quality public education is crucial for all students in America. With the increase in linguistically diverse student populations, teachers must have the skills, knowledge, and self-efficacy to be able to meet the needs of this diverse population. Teachers must identify academic language strategies that can be embedded in integrated curriculum and assess these strategies for effectiveness so that they can be implemented in the classroom to support ELs. The purpose of this study was to document and analyze the impact of the STEMSS STRATEGIES Professional Development to Support Academic

Language Acquisitions. The results indicate that the PD was successful at increasing TLLs knowledge, skills, and ultimately self-efficacy and that TLLs used more of the strategies that were taught during the PD across the school year. Given the importance of supporting a growing body of linguistically diverse students, this research takes a first step in helping TLLs support these students with best practices in the classroom.

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APPENDIX A:
KUSE SURVEY

KUSE

My name is Karen Guerrero and I am a doctoral student in the Mary Lou Fulton Teachers College at ASU. As part of my coursework and grant to support my research, I have developed a survey that will be used to collect data for future work related to this project.

Thank you for completing this PRE-Assessment for our STEMSS CRUISE EL grant-funded program. Your perspective is valued and will help me develop quality PD experiences for the benefit of English Learners and Dual Language Learners. All information will be treated as confidential. You will create a reproducible ID to link study measures, while maintaining your confidentiality. Please use the following to create your ID: use the first three letters of mom's first name (or dad is there is no mom) and the last four digits of your phone number (for example, Jane and 123-4567 = JAN4567). The results of this study may be used in pre-dissertation work within Spring 2018 coursework, reports, presentations, or publications but your name will not be used. Results will be shared in the aggregate form. You may choose not to respond to any question or end your survey at any time.

If you have any questions or concerns regarding this pilot study or this survey, please contact Karen Guerrero at Karen.Guerrero@asu.edu or 480-580-1556, or my advisor, Dr. Edward Sloat at esloat@asu.edu. If you have any questions about your rights as a participant in this research, please contact the Chair of Human Subjects Institutional Review Board (IRB) through the ASU Office of Research Integrity and Assurance at 480-965-6788.

Email address *

This form is collecting email addresses. [Change settings](#)

ID: use the first three letters of mom's first name (or dad is there is no mom) and the last four digits of your phone number (for example, Jane and 123-4567 = JAN4567)

After section 1 Continue to next section

Section 2 of 5

Knowledge of Concepts

Please rate the concepts listed below using the criteria provided. In this section, please, decide how knowledgeable you are about each principle. Please mark only one box per row.

I am knowledgeable about...

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
Developing academic language across science content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing academic language across technology content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing academic language across engineering content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing academic language across math content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing academic language across social studies content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using e-tools to develop academic vocabulary across STEMSS content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Using word walls to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using sentence starters/sentence frames to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using color coding to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using interactive notebooks to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using quick chats/quick writes to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using big books to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using songs and chants to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using murals and graphic input charts to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using 10 important sentences to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using graphic organizers to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identifying key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assessing key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The funds of knowledge and familial cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The linguistic community cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to support ELs/DLs' academic language at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to sustain my commitment to meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to be confident in meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to be collaborative in meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How to take leadership roles within my school community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, how to increase parent, family, and community engagement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

After section 2 Continue to next section ▼

Section 3 of 5

Use of Concepts

Please rate the concepts listed below using the criteria provided. In this section, please rate how you use each concept in your teaching. Please mark only one box per row.

In my teaching, I...

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
Develop academic language across science content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across technology content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across engineering content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across math content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across social studies content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use e-tools to develop academic vocabulary across STEMSS content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using word walls to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use sentence starters/sentence frames to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use color coding to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use interactive notebooks to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use quick chats/quick writes to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use big books to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use songs and chants to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use murals and graphic input charts to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use 10 important sentences to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use graphic organizers to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identify key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incorporate funds of knowledge and familial cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incorporate linguistic community cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support ELs/DLs' academic language at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Am sustain my commitment to meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Am confident in meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Am collaborative in meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take leadership roles within my school community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Actively engage parents, families, and community members

After section 3 Continue to next section



Section 4 of 5

Self Efficacy and Concepts

Please rate the concepts listed below using the criteria provided. In this section, please rate how certain you are in your ability to use or implement each concept.

In my teaching, I am certain I can...

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
Develop academic language across science content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across technology content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across engineering content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across math content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop academic language across social studies content using specific strategies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use e-tools to develop academic vocabulary across STEMSS content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using word walls to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use sentence starters/sentence frames to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use color coding to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use interactive notebooks to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use quick chats/quick writes to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use big books to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use songs and chants to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use murals and graphic input charts to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use 10 important sentences to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use graphic organizers to develop academic language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identify key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess key academic vocabulary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incorporate funds of knowledge and familial cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incorporate linguistic community cultural wealth of ELs/DLs' families	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support ELs/DLs' academic language at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sustain my commitment to meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meet the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Be collaborative in meeting the needs of AZ's diverse population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take leadership roles within my school community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Actively engage parents, families, and community members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 5 of 5

Demographics

What is your age?

I am currently a ...

- Pre-Service Teacher Term 5
- Pre-Service Teacher Term 6
- Pre-Service Teacher Term 7
- Pre-Service Teacher Term 8
- Inservice Teacher (currently working as a teacher)
- Paraprofessional
- Other

I am currently working with English learners *

- Yes
- No

How many years of experience do you have working with English learners? *

Are you fluent in a language other than English? *

Yes

No

Maybe

Do you currently hold an SEI endorsement? *

Yes

No

Not Sure

Do you currently hold an ESL Endorsement? *

Yes

No

Not sure

Do you currently hold BLE Endorsement? *

Yes

No

If you are a preservice teacher, are you seeking an ESL Endorsement?

- Not Applicable
- Yes
- No
- Not sure

If you are a preservice teacher, are you seeking a BLE Endorsement? *

- Not Applicable
- Yes
- No
- Not sure

How many years of teaching experience do you have? *

What is your highest level of education?

- Associate's degree
- Bachelor's degree
- Master's degree
- Doctoral degree
- Other...

I have taught in the following programs (Check all that apply): *

- SEI
- ELD
- Bilingual pre-2000
- Dual Language 1 way
- Dual Language 2 way
- Special Education
- General Education
- Other...

I currently teach in the following type of program (Check all that apply): *

- SEI
- ELD
- Bilingual pre-2000
- Dual Language 1 way
- Dual Language 2 way
- Special Education
- General Education
- Other...

Thank you for participating in this survey. If you have any questions or would like to provide additional information, please contact Karen.Guerrero@asu.edu or 480-580-1556. Survey adapted from KCU by Malissa Chavez-Thibault, Ed.D.

APPENDIX B:
OPAL OBSERVATION

OBSERVATION PROTOCOL FOR ACADEMIC LITERACIES | OPAL®

The OPAL is a research-based tool for observing teacher practices and classroom interactions from sociocultural and language acquisition perspectives. Academic literacies are defined as a set of 21st century skills, abilities, and dispositions developed through the affirmation of and in response to students' identities, experiences and backgrounds.

Components of Empowering Pedagogy	Implementation Scale	Evidence and Next Steps
	Low 1-2	Med 3-4
	High 5-6	Not Observable n/a
RIGOROUS & RELEVANT CURRICULUM		
The curriculum is cognitively complex, relevant, challenging and appropriate for linguistically diverse populations.		
1.1 Engages students in problem solving, critical thinking and other activities that make subject matter meaningful. 1 2 3 4 5 6 n/a	Evidence	Next Steps
1.2 Facilitates student and teacher access to materials, technology, and resources to promote learning. 1 2 3 4 5 6 n/a		
1.3 Organizes curriculum and teaching to support students' understanding of instructional themes or topics. 1 2 3 4 5 6 n/a		
1.4 Establishes high expectations for learning that build on students' linguistic and academic strengths and needs. 1 2 3 4 5 6 n/a		
1.5 Provides access to content and materials in students' primary language. 1 2 3 4 5 6 n/a		
1.6 Provides opportunities for students to transfer skills between their primary language and target language. 1 2 3 4 5 6 n/a		
CONNECTIONS		
Teachers are mindful about providing opportunities for students to link content to their lives, histories, and realities to create change.		
2.1 Relates instructional concepts to social conditions in the students' community. 1 2 3 4 5 6 n/a	Evidence	Next Steps
2.2 Helps students make connections between subject matter concepts and previous learning. 1 2 3 4 5 6 n/a		
2.3 Builds on students' life experiences and intends to make the content relevant and meaningful to lives. 1 2 3 4 5 6 n/a		

Teacher Name _____
 Grade _____
 Subject _____
 K-12 Grade _____
 Lesson Focus _____
 Date _____

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OBSERVATION PROTOCOL FOR ACADEMIC LITERACIES | OPAL[®]

Components of Empowering Pedagogy	Implementation Scale				Evidence and Next Steps
	Low 1-2	Med 3-4	High 5-6	Not Observable n/o	
COMPREHENSIBILITY					
Instruction allows for maximum student understanding and teachers utilize effective strategies to help students access content.					
<p>3.3 Uses scaffolding strategies and devices (i.e. outlines, webs, semantic maps, compare/contrast charts, KWL) to make subject matter understandable.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>3.2 Amplifies student input by: questioning / restating / rephrasing / expanding / contextualizing.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>3.3 Explains key terms, clarifies idiomatic expressions, uses gestures and/or visuals to illustrate concepts.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>3.4 Provides frequent feedback and checks for comprehension.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>3.5 Uses informal assessments of student learning to adjust instruction while teaching.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p>	Evidence		Next Steps		Student Grade Subject EL/D Level(s) Lesson Focus
INTERACTIONS					
Varied participation structures allow for interactions that maximize engagement, leadership opportunities, and access to the curriculum.					
<p>4.1 Facilitates student autonomy and choice by promoting active listening, questioning, and/or advocating.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>4.2 Makes decisions about modifying procedures and rules to support student learning.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>4.3 Effectively communicates subject matter knowledge in the target language.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p> <p>4.4 Uses flexible groupings to promote positive interactions and accommodations for individual and group learning needs.</p> <p style="text-align: center;">1 2 3 4 5 6 n/o</p>	Evidence		Next Steps		


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APPENDIX C:
PD AGENDA

Agenda
Alliance Summer Geography Institute (ASGI)
 Science, Technology, Engineering, Math and Social Studies (STEMSS) Institute 2021
 Arizona State University | School of Geographic Sciences & Urban Planning | Tempe, AZ

June 25 Monday	Activity Coor, Room L1 88	Presenters
8:00-8:50	Welcome Grant Goals – Introduction	Karen Guerrero, TC Dr. Margarita Jimenez-Silva, TC Gale Ekiss, TC
9:00-9:30	Engaging ELs and Their Families in Meaningful Ways Margarita Jimenez-Silva is an associate professor and director of teacher education at the School of Education in University of California, Davis. Her research focuses on preparing and supporting teachers to work with culturally and linguistically diverse learners, especially in addressing emergent bilinguals' linguistic and academic content development.	Dr. Margarita Jimenez-Silva, TC 
9:30-9:45	GeoBucks	Gale Ekiss, TC
10:00-10:50	How do STEMSS and E-Learning Go Together	Gale Ekiss, TC Karen Guerrero, TC
11:00-11:50	ScienceTelling Documenting Your Story with a Lego Persona	Karen Guerrero, TC
11:50-12:30	Lunch (In Room 5501) You may eat there or in L1 88	
12:30-1:30	Strategy Session 1: Sentence Frames and Timely Quick Chats or Writes	Karen Guerrero, TC Dr. Margarita Jimenez-Silva, TC
1:40-2:30	What is Geography? http://alliance.la.asu.edu/InternetClass/BecomingFamiliar4.14/Publish/WhatIsGeogGala/index.htm	Gale Ekiss, TC
2:40-3:40	Model Lesson: Aqueducts and Aquaduckies In this lesson students solve a problem: How to get water to flow through use of an aqueduct. They will see how gravity plays a large role in the flow of this water while they will also practice the skills of an engineer. https://geoalliance.asu.edu/aqueduct	Danna Lagerquist, TC
3:50-4:40	Model Lesson: Sail Like an Egyptian In this lesson students will learn the importance of conserving resources, and the different types of resources in the world. They will learn the method and practices that engineers go through when designing objects. Finally, students will be asked to work as a group of engineers by following the engineering design model to design the most stable and fastest invention that does not use gasoline or electricity to navigate the Nile River. https://geoalliance.asu.edu/SailEgypt	Heather Moll, TC
4:40-5:00	Video Journal Reflection	Karen Guerrero, TC Dr. Margarita Jimenez-Silva, TC
5:30-7:30	Dinner: Slide Night (3 slides to share in 1 minute) —catered in Coor	Everyone

June 26 Tuesday	Activity Coor, Room L1 88	Presenters
8:00- 8:40	Welcome and Introductions of Day Two Staff	Gale Ekiss, TC
8:45-10:15	Introduction to Primary Sources <ul style="list-style-type: none"> Thinking Historically and Geographically What is a Primary v. Secondary Source Geographical Questions v. Historical Questions School Begins https://www.loc.gov/item/200264745/	Jason Neenos, TC Dennis Rees, TC Amber Amaya, TC Jessica Medlin, TC
10:15-10:30	Break	
10:30-11:30	Using LOC website <ul style="list-style-type: none"> Demonstration of LOC Bookmarking Copyright Issues Primary Resource Analysis Tools by LOC http://www.loc.gov/teachers/primary-source-analysis-tool/ <ul style="list-style-type: none"> Exploration Time Using the AzGA Website <ul style="list-style-type: none"> GeoLens Worksheets Available Drop-down GeoLens Worksheets http://geoalliance.asu.edu/geolens	Jason Neenos, TC Jason Neenos, TC Dennis Rees, TC Jason Neenos, TC Amber Amaya, TC Dennis Rees, TC Jason Neenos, TC
11:30-12:15	Lunch (In Room 5501)	
12:15-1:00	Using Primary Sources with a Geographic Lens: Cartoons https://www.loc.gov/item/2002719044/	Dennis Rees, TC
1:00-1:45	Using Primary Sources with a Geographic Lens: Documents https://www.loc.gov/item/rbpe.07902500/	Jessica Medlin, TC
1:45-2:00	Break	
2:00-2:45	Using Primary Sources with a Geographic Lens: Audio-Visual https://www.loc.gov/item/00694367/	Jason Neenos, TC
2:45-3:30	Using Primary Sources with a Geographic Lens: Maps https://www.loc.gov/item/08687134/	Amber Amaya, TC
3:30-3:45	Break	
3:45-4:45	Model Lesson: Desert Views: First Impressions Travelers on the Gila Trail In this lesson, students are introduced to primary source material by reading descriptions written by overland travelers on the Gila Trail. They will understand the ways in which early travelers viewed aspects of the desert environment. https://geoalliance.asu.edu/desertviews	Carol Warren, TC
4:45-5:00	Evaluation and Door Prizes	Gale Ekiss, TC

June 27 Wednesday	Activity Union Stage, Memorial Union and Coor, L1 88	Presenters
8:00-8:50	Geospatial Technology – Drones and more!	Craig Turner
9:00-10:50	Giant Map Training or GeoTools—GeoCaching and IRTs and More	Ana Parra, TC Andrea Barker, TC Dianne McKee and Katina Lopez- Ventura, TC
11:00-12:30	Using Break Out Boxes to Facilitate Learning or Visit to Mars Interdisciplinary A	Ana Parra, TC Andrea Barker, TC
12:30-1:00	Lunch (Union Stage MU)	
1:00-1:50	Strategy Session 2: Ten Important Sentences and Effective Color Coding Strategy	Karen Guerrero, TC
2:00-2:50	Model Lesson: Monarch Mystic Migration In this lesson students will investigate the mystery of how the monarch finds its way to Mexico each year. Students will explore a hypothesis that scientists use to theorize, explore, and ponder this mystery. Students will learn how the earth's magnetic pull plays a part in monarch navigation, by exploring and creating compasses with magnets. https://geoalliance.asu.edu/Monarch	Ana Parra, TC
3:00-3:50	Strategy Session 3: Relevant Word Walls and Authentic Big Books	Karen Guerrero, TC
3:50-4:15	Video Journal Reflection	Everyone
4:15-5:00	Dinner and Travel	
5:00-8:00	Evening at OdySea Aquarium 9500 East Via de Ventura Scottsdale, AZ 85256 Loop 101 – Via de Ventura https://www.odyseaaquarium.com	

Agenda

Alliance Summer Geography Institute (ASGI)

Science, Technology, Engineering, Math and Social Studies (STEMSS) Institute 2018
Arizona State University | School of Geographic Sciences & Urban Planning | Tempe, AZ

June 28 Thursday	Activity Coor, Room L1 88	Presenter
8:00-8:50	Ask a Biologist	Dr. Charles Kazilek
9:00-9:50	Model Lesson: Helper Ants written by Brandie Luna In this lesson students will learn how to work together as a team and build a bridge for the ants to cross. They will also be practicing prepositions that denote location.	Amber Amaya, TC
10:00-10:50	Strategy 4: Graphic Organizers and Interactive Notebooks	Karen Guerrero, TC Dr. Margarita Jimenez- Silva, TC
11:00-11:50	ETools and Blogging: Sharing Your Story	Karen Guerrero, TC Dr. Niccole Cerveny
11:50-12:30	Lunch (In Room 5501)	
12:30-1:30	Extremes and Oddities of Weather	Dr. Randy Cerveny
1:40-3:40	Preparing for Natural Disasters	Dr. Erin Saffell Dr. Niccole Cerveny
3:40-4:00	Coaching Plans	Karen Guerrero, TC
4:10-4:40	Benefits of Being a TC and Colorado River Days	Gale Ekiss, TC
4:40-5:00	Video Journal Reflection	
At home	Homework: Research lesson standards, write Overview and Purpose, Sketch out lesson plan	Everyone

Agenda
Alliance Summer Geography Institute (ASGI)
 Science, Technology, Engineering, Math and Social Studies (STEMSS) Institute 2018
 Arizona State University | School of Geographic Sciences & Urban Planning | Tempe, AZ

June 29 Friday	Activity Coor, Room L1 88	Presenters
8:00-8:50	How to Write a Lesson in Binko Format	Gale Ekiss, TC
9:30-11:00	Planetarium and SESE	Meg Hufford, Coordinator, School of Earth and Space Exploration
11:00-12:15	Lunch	
12:15-1:00	How to Present in Binko Format and Spotting Binko	Gale Ekiss, TC
1:15-2:10	Model Lesson: Hohokam Communities: Taking Risks and Making Trade-offs In this lesson, students will analyze and interpret archaeological data in order to rank ancient settlements according to criteria related to sustainability. Students will also gain a better understanding of the Hohokam as a culture of master canal builders and experienced farmers. And finally, students will gain insight into Arizona's present population density and the risks and trade-offs made to sustain the current communities.	Andrea Barker, TC
2:10-2:50	Lesson Idea Sharing (homework from Thursday) in Small Groups	Gale Ekiss, TC
3:00-4:15	Work on lessons with Mentors	
4:15-6:00	Next Steps, KUSE Online Survey, Focus Groups, and Video Journal Reflection	Karen Guerrero, TC Dr. Margarita Jimenez-Silva, TC

Agenda
Alliance Summer Geography Institute (ASGI)
 Science, Technology, Engineering, Math and Social Studies (STEMSS) Institute 2018
 Arizona State University | School of Geographic Sciences & Urban Planning | Tempe, AZ

August 18	Activity	Person Responsible
9:00-9:15	Welcome back and Explanation of today's schedule Location TBA	Gale Ekiss, TC
9:30-10:45	Presentation 1 45 min for lesson 10 min to write reflection 20 min to share observations	
11:00-12:15	Presentation 2 45 min for lesson 10 min to write reflection 20 min to share observations	
12:15-12:50	Lunch	
1:00-2:15	Presentation 3 45 min for lesson 10 min to write reflection 20 min to share observations	
2:30-4:00	GeoBuck Auction Celebration	Dr. Malcolm Comeaux

APPENDIX D:
PD APPLICATION



2017-18 STEMSS Human Journey Institute – APPLICATION FORM

Please type or print clearly.

Name _____
Last First Middle Initial

Mailing Address _____
Street City Zip

Home Phone _____ email _____
Area Code used the most (we need to reach you all year long)

School Name & Address _____
Name

_____ Street City Zip

School Phone _____ School District _____
w/ Area Code

School email _____ For identification purposes (birth month, day of the month) _____

What is the ethnic mix of your school?
 ___% Asian American
 ___% African American
 ___% Latino/a American
 ___% Native American

How many English Learners do you usually have in your classroom?

Is your school classified as Title I? Yes No (circle one)

Grades and classes that you teach: _____

Special skills that you bring to the institute: _____

Topics you hope this institute addresses: _____

ATTACHMENTS -- Please include the following with this application:

- 1) Your **resume** condensed to **one page**.
- 2) A **one page, typed essay** outlining:
 - a) Why you believe STEMSS (Science, Technology, Engineering, Math, & Social Studies) education is important.
 - b) How you currently teach social studies in your classroom. How you currently teach STEM subjects in your classroom.
 - c) How you expect to benefit from participating in the 2017-18 STEMSS Institute.
 - d) And how you will use what you learn in this institute with your English learners as well as your English proficient students.
- 3) **Two letters of reference** (these can be mailed or emailed separately):
 - a) From your principal, arrange a letter of reference that addresses your skills in the classroom, plus your district's willingness to facilitate your presentation of **at least one** staff development workshop in your district. This letter should also include information about your ability to work with English language learners.
 - b) From a colleague, seek a letter that discusses your classroom effectiveness and rapport with fellow educators. We are looking for people who play well with others. Teachers applying from the same school may not write letters for each other.
- 4) A **check** for \$100 made out to the Arizona Geographic Alliance. This money will be refunded in its entirety
 - a) if you cancel in writing by Nov. 16, 2017,
 - b) if you are not chosen as a participant, or
 - c. at completion of all institute sessions.
- 5) The completed **Application Form** including **2 Letters of Reference**.
- 6) The completed **KCU Survey**.

DEADLINE to apply: November 1, 2017.

Send to:
 Arizona Geographic Alliance
 ASU School of Geographical Sciences & Urban Planning
 P O Box 875302
 Tempe, AZ 85287-5302
 Or FAX to: 480-965-8313 c/o Gale Ekiss
 Or email Gale Ekiss at Gale.Ekiss@asu.edu

- ✓ I agree to participate in all sessions.
- ✓ I will sign all National Geographic documentation for research.
- ✓ I will keep a video/photo journal beginning Dec 2, 2017.
- ✓ I will create and present an original STEMSS lesson (based on Arizona Geography, ELL and STEM standards) at the August 18, 2018 session.
- ✓ I will pilot and assess my original STEMSS lesson in my classroom and revise it based on feedback.
- ✓ I will recruit another teacher to pre and posttest his/her students on the same lesson content and skills but NOT teach the lesson.
- ✓ I will submit my revised lesson for online publication.
- ✓ I will train other teachers in my school district based on what I have learned at this institute.
- ✓ I will be active in the Arizona Geographic Alliance.
- ✓ I will attend GeoConference on 9/22/2018.
- ✓ I understand that I will receive the stipend when all requirements are met (deadline 10/1/2018)

Signature _____

APPENDIX E:
IRB APPROVAL



EXEMPTION GRANTED

Dawn Lambson
 Geographical Sciences and Urban Planning, School of
 480/215-5401
 Dawn.Lambson@asu.edu

Dear Dawn Lambson:

On 4/11/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	STEMSS CRUISE EL
Investigator:	Dawn Lambson
IRB ID:	STUDY00007806
Funding:	Name: US Department of Education (DOEd), Grant Office ID: T365Z170170
Grant Title:	T365Z170170;
Grant ID:	T365Z170170;
Documents Reviewed:	<ul style="list-style-type: none"> • STEMSS Child Assent Form , Category: Consent Form; • STEMSS Control Teacher Recruitment Script, Category: Recruitment Materials; • STEMSS EL Post-Program Focus Group Protocol, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Post-Cafe PD Event Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • STEMSS Teacher Consent Form, Category: Consent Form; • PPVT4 Test Description, Category: Technical materials/diagrams; • Teacher Needs Assessment, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Post-Program Final Survey, Category: Measures (Survey questions/Interview questions /interview

	<p>guides/focus group questions);</p> <ul style="list-style-type: none"> • STEMSS CRUISE EL IRB , Category: IRB Protocol; • STEMSS Institute Pre&Post Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • STEMSS Parental Consent Form, Category: Consent Form; • OPAL Observation Debriefing Conversation Guide, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • STEMSS Control Teacher Consent Form, Category: Consent Form; • Focus Group Needs Assessment Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • OPAL Protocol , Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • KUSE Pre & Post Survey 3.26.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • STEMSS Teacher Recruitment Script, Category: Recruitment Materials; • OPAL Observation Protocol Overview, Category: Technical materials/diagrams; • GrantNotificaionAug2017, Category: Sponsor Attachment;
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The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (1) Educational settings, (2) Tests, surveys, interviews, or observation on 4/11/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Margarita Jimenez-Silva
Ronald Dorn
Norma Hernandez



Karen Guerrero

