Abstract:

The number of English language learners (ELs) in schools has significantly increased over the last decade and teachers are not fully prepared to teach this growing population because of limited training and a lack of skills necessary to address academic needs in both language and content. This mixed-methods study explored the effectiveness of an online professional development (PD) for increasing the teachers’ knowledge, skills, use, and self-efficacy in teaching science, technology, engineering, math, and social studies (STEMSS) content and the English language in tandem through changing modalities with teachers’ perceptions of the approach used within the PD. Vygotsky's socio-cultural theory and Lave and Wenger's community of practice theory guided the development, documentation and analysis of the impact of the PD. Twenty-four Arizona K-12 teachers of language learners (TLLs) were recruited. The teacher participants completed a pre-survey, then the online PD, and, finally, a post-survey and interview. Dependent t-test results provided evidence that the PD significantly increased participants’ self-reported knowledge, use, and self-efficacy to support ELs’ academic vocabulary in teaching whether face-to-face or online. The impact of the PD on these three constructs was further supported with data-driven themes generated from the interview data which increased the trustworthiness of the findings. Participants overwhelmingly valued the peer interaction for increasing their knowledge and understanding of effective pedagogical practices and their self-efficacy in supporting ELs in their classrooms whether teaching in-person or virtually through new methodological approaches that changed pedagogical practices.

Keywords: STEM-ESL/BLE-PD-Strategies-eLearning, Distance language education, new methodological approaches, Distance Language Teaching

Introduction:

As a nation, it is crucial that a high-quality public education is provided for English language learners (ELLs) in schools (Archerd, 2013; Lucas, Strom, & Bratkovich, 2018; Tellez & Manthey, 2015; Weinstein & Trickett, 2016). The United States (U.S.) education system has been committed to addressing the academic and linguistic needs of culturally and linguistically diverse populations; however, with the growing ELL population in America, this has been a challenge (Archerd, 2013; Li, 2016; National Center for Educational Statistics, 2019; Weinstein & Trickett, 2016). In 2015, the United States Department of Education (USDOE) published a nationwide listing of teacher shortage areas, and English as a Second Language (ESL) and Bilingual Education (BLE) educators made the nationwide shortage list. Moreover, teachers have expressed a lack of training and preparation to meet the needs of ELLs (Archerd, 2013; Lucas, Strom, & Bratkovich, 2018; Szymanski & Lynch, 2020). The National Center for Education Statistics (2019) documented that more than 4.5 million students, 9.3% of K-12 students, were classified as ELLs during the 2013-2014 school year, up from 8.8% a decade earlier. Also, the USDOE (2019) Office of English Language Acquisition has reported that ELLs score significantly lower in the areas of reading and mathematics on national assessments.

Currently, Arizona public schools serve an estimated 85,000 ELLs (Arizona Department of Education, 2019). This high number of ELLs has brought about the necessity to account for the educational experiences of these students, both linguistically and academically. Many studies
(e.g., Garcia and Weis, 2017, Garcia, Lawton & Diniz de Figueiredo, 2010; Losen, 2010; Rumberger & Tran, 2010) have documented that the present state policy has had little effect on overcoming the ELL achievement gap in the state. With the increasing numbers of English learners, teachers of ELLs need to know essential issues specifically relevant to bilingual development: what to teach, how to teach it effectively, and how to assess and monitor achievement (Lucas, Strom, & Bratkovich, 2018). However, de Jong, Arias, and Sanchez (2010) have reported that teacher preparation of ELLs in Arizona has been significantly reduced since the establishment of restrictive policies in the state brought on by the passage of Proposition 203 in 2000, which mandated English-only instruction for ELLs. De Jong and colleagues (2010) explained that the effects of Prop 203 on new teacher preparation practices included the reduction of curricular requirements for teacher education from 24-27 credits in ESL and BLE programs to only three credits in the current Structured English Immersion (SEI) endorsement required for teachers in Arizona who will work with these students. This new number accounts for less than 10% of the preparation needed to effectively serve ELLs (de Jong et al., 2010). Because of this, additional professional development offered by local colleges, districts, and organizations often substitute for teachers’ lack of knowledge in serving ELLs by providing support for teachers of language learners (TLLs) as they navigate planning, instructing, and evaluating this population of students with whom they teach.

Study

Through a mixed methods case study, exploration of the what, how, and why of the effectiveness of the PD on teacher’s knowledge, skills, and self-efficacy was explored, critiqued, analyzed, and documented. The theoretical frameworks of Vygotsky’s (1978) sociocultural theory and Lave and Wenger’s (1991) community of practice theory provided the foundation for examining how and why the design of the online professional development should be effective. These theories guided the development of the PD and the TLLs’ experiences in the PD while also informing the instruments used. Figure 1 shows how these theoretical frameworks informed the research method, innovation, tools, and analysis to best support the study. Findings of the study illuminate implications of the PD for TLLs, their pedagogical practices, and their self-efficacy in supporting ELLs as a result of participation in the online STEMSS PD.

Figure 1

Theoretical Framework Informing Research Study

The quantitative portion of the study included a pre- and post-survey based on the Knowledge, Self-efficacy, and Understanding (KCU) study from Oakes et al. (2018), adapted...
from Lane and Oakes (2012). This tool was modified as the Knowledge, Use, and Self-Efficacy (KUSE) survey and evaluated for reliability and validity by Chavez-Thibaut (2017). Cronbach analyses of the survey (see Table 1) surpassed the .70 reliability threshold with all three constructs testing between .87 and .97 (Chavez-Thibaut, 2017). The KUSE tool was selected for this study as the variables measured aligned with the purpose, methods and need of the study.

Both quantitative and qualitative questions guided the study. The quantitative research question and hypotheses that guided the study was:

**RQ1.** What gains from pretest to posttest did TLLs report regarding their STEMSS knowledge, use, and self-efficacy to support ELs’ academic vocabulary development as a result of their participation in the online STEMSS professional development?

The qualitative research question that further guided the study was:

**RQ2.** What are teachers’ perceptions of how the STEMSS PD impacted their knowledge and skills and the lesson plans developed?

### Table 1

**Cronbach Analysis Reliability Statistics**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha Pre</th>
<th>Cronbach’s Alpha Post</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>0.923</td>
<td>.908</td>
<td>25</td>
</tr>
<tr>
<td>Use</td>
<td>0.918</td>
<td>.897</td>
<td>25</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>0.974</td>
<td>.809</td>
<td>25</td>
</tr>
<tr>
<td>Knowledge, Use, and Self-Efficacy</td>
<td>0.931</td>
<td>.875</td>
<td>75</td>
</tr>
</tbody>
</table>

**Results**

The target population for the study was Arizona K-12 teachers who have ELs in their classroom. Information and invitations were posted on personal social media sites and to the Arizona Geographic Alliance listserv, which reaches hundreds of teachers. The sample included 24 TLLs who teach in a K-12 classroom, have ELs in their classrooms, and voluntarily signed up to participate in the study. Participants were required to submit a lesson plan and complete the pre-survey prior to accessing and completing the online PD. As part of the PD, participants submitted a final lesson plan. Upon completion of the PD, participants completed the post-survey and participated in an interview.

Of the 24 participants, six teachers were between 22 and 32 years of age, seven teachers were between 33 and 43 years, and 11 were 44 years of age or older. Seven of the participants were in their first five years of teaching, three had taught more than five years but less than ten, and 14 had taught more than 10 years. Ten reported they were in their first five years of teaching ELs, three had taught ELLs for more than five but less than 10 years, and 11 TLLs had taught ELs for more than 10 years. It is interesting to note that nine participants had a bachelor’s degree, 14 had a master’s degree, and one had a doctoral degree. Fourteen of the participants held a Structured English Immersion (SEI) endorsement, and eleven had either an English as a second language (ESL) endorsement (seven teachers) or a bilingual (BLE) endorsement (six teachers). Seven participants reported no endorsements to support ELLs. Finally, 12 participants were currently teaching in a general education classroom while all others teaching in a language-supported classroom. These demographic characteristics of the participant sample can inform and allow researchers to draw conclusions regarding generalizability to the larger TLL population or other samples (Bergman, 2008).
RQ1. The first research question posed was: What gains from pretest to posttest did TLLs report regarding their STEMSS knowledge, use, and self-efficacy to support ELs’ academic vocabulary development as a result of their participation in the online STEMSS professional development? The null hypothesis was rejected in that there was one or more significant differences from pretest to posttest in knowledge, use, or self-efficacy to support ELs’ academic vocabulary development as a result of TLLs’ participation in the online STEMSS professional development.

Table 2
KUSE Paired-Sample T-Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Post-Pre</td>
<td>0.991</td>
<td>0.453</td>
<td>0.092</td>
<td>10.726</td>
<td>23</td>
<td>.000.</td>
</tr>
<tr>
<td>Use Post-Pre</td>
<td>0.910</td>
<td>0.412</td>
<td>0.084</td>
<td>10.815</td>
<td>23</td>
<td>.000.</td>
</tr>
<tr>
<td>Self-Efficacy Post-Pre</td>
<td>0.614</td>
<td>0.463</td>
<td>0.094</td>
<td>6.501</td>
<td>23</td>
<td>.000.</td>
</tr>
</tbody>
</table>

Note: SPSS Paired-sample t-test of pre and post survey data collection

Evaluation of the Findings

The STEMSS PD had a significant impact on TLLs’ knowledge, use and self-efficacy in supporting ELLs in the classroom. Figure 2 is a simplified chart of the connections across data collection methods and the triangulation of data supporting the trustworthiness of the findings.

Figure 2
Triangulation of data using constructs and perceptions

RQ1. The TLLs reported significant gains from pretest to posttest regarding their STEMSS knowledge, use, and self-efficacy to support ELs’ academic vocabulary development. Vgotsky’s (1978) cognitive development socio-cultural framework guided the use of and analysis of the KUSE survey, using the survey as a pre-data set prior to the STEMSS PD and immediately
following completion of the PD as a post-data set. The survey assessed prior and post knowledge, use, and self-efficacy in teaching academic vocabulary to ELs and assessed cognitive development and change in practice due to the online PD. The null hypothesis was rejected and the data supported the alternative hypothesis.

The results of the gains in knowledge and use of strategies were not surprising based on studies by Hinde et al. (2005; 2007) and Dorn et al. (2005) who both conducted studies with similar PD interventions for GeoLiteracy and GeoMath while looking at growth in knowledge in teaching integrated content. The results were also expected in light of Vygotsky’s theory (1978) that the social interaction during the STEMSS PD would support cognitive development during the PD and Lave and Wenger’s (1991) concept of community of practice, which allows for knowledge to be co-constructed through peer interaction. What was surprising was the significant increase in self-efficacy after only a single PD series. Though knowledge and understanding of how to use the strategies could be gained in a short time, it was surprising that self-efficacy measures had significant gains before teachers had time to fully implement the new knowledge into teaching over the course of a semester or year. Although Lorenze et al. (2018) supported the increase of self-efficacy from engaging PD that offered new knowledge, the question of whether this would be reflected after a single PD was unknown. Bandura (1997) explained self-efficacy reflects the TLLs’ beliefs that they are capable and prepared to teach through motivation, well-being, and personal accomplishment. This study did not allow for enough time to provide for personal accomplishment over time to implement the new knowledge in the classroom to fully reflect the PD’s effectiveness for increasing self-efficacy; however, this result is a demonstration that the participants were able to self-assess their ability to increase self-efficacy through a minimal application of the concepts in their own classrooms.

RQ2. Teachers’ application of the knowledge gained from the PD was demonstrated by their integration of strategies into their lesson plans and was reflected in their perceptions of how the STEMSS PD impacted their knowledge and skills as well as self-efficacy which were elaborated on through interviews. Lave and Wenger’s (1991) community of practice guided the development of the STEMSS PD as well as the intent of using interviews to gain a deeper understanding of how TLLs identify as teachers of ELs and to document cognitive development growth to support ELs in the classroom. The three constructs of interest - knowledge, use, and self-efficacy - were used to initially code the interviews; however, through additional coding, the fourth theme united the theoretical framework of the study with effective PD procedures utilizing peer engagement to build knowledge, use, and self-efficacy in supporting ELs. Bengtsson’s (2016) third and fourth stages include the comparing of original data through triangulation and the compilation of data by bringing subjects together to draw realistic conclusions. The three constructs of interest that carried over into the perceptions shared through the interviews were intertwined with the fourth theme of peer interaction. The value of peer interaction perceived by the TLL participants connected to not only Lave and Wenger (1991) but also to (a) the language acquisition best practices of Collier and Thomas (2014), (b) the culturally and linguistically responsive learning environments that are language rich by Mendez, Crais, Castro, and Kainz (2015), and (c) the use of technology to support language through interaction with peers and content language promoted by Lessaux, Kieffer, Faller, and Kelley (2010). Zawacki-Richeter and Latchem’s (2018) cross-decade research mining analysis was reflected in the STEMSS PD development through reflective practices, instructional technology, online instruction, and collaborative learning. These same focus areas were reflected in the outcome as described in the interview analysis of participant engagement in the study with an emphasis on the impact that collaborative learning had on the knowledge gained. As a result, the findings are consistent with the existing research and theory that guided the study.
Conclusion:

Given the STEMSS PD is an effective, research-based, voluntary professional development model to increase knowledge, use, and self-efficacy in supporting ELs in the classroom, the most overarching recommendation stemming from the findings is that this PD model should be broadly offered to teachers with ELs in their classrooms to further impact TLLs’ abilities to teach content and language in K-12 schools. In consideration of continued implementation of the PD outside of the constraints of research, a second recommendation is for a pre and post self-administered and graded survey to be integrated into the PD for TLLs to self-evaluate their growth in knowledge, use, and self-efficacy as they begin to apply the skills to their pedagogical practices. This survey would promote TLLs’ process of adding new knowledge to prior knowledge (Vygotsky, 1978). In addition, continued development of this PD for TLLs could be aligned further with experiential and shared learning. Initially, Hinde et al. (2005; 2007) and Dorn et al.’s (2005) PD planning and implementation protocol guided the development of this STEMSS PD using real-world experiential learning, expansion of technology-embedded practices to utilize available tools and resources to support teaching and learning. Investigations and applications of new knowledge to classroom instruction and collaboration with colleagues on making meaning of this new knowledge while sharing how they will apply it in their teaching can build on the already effective foundation the PD was built on. The current study, to include the design and development of the STEMSS PD development, research procedures, and knowledge and use findings were aligned with both the GeoLiteracy (Hinde et al., 2005; 2007) and GeoMath (Dorn et al., 2005) findings, both of which were not specific to TLLs; thus, this study expanded the generalizability of these PD methods. Findings were also similar to Mejí’s (2016) on PD that embeds sociocultural and community of practice theories in knowledge, attitudes and self-efficacy. This alignment supports the recommendations for practice to further provide the STEMSS PD to teachers and to utilize the PD protocols when developing PD for teachers to support effective PD practices for TLLs.

Drawing from the qualitative results and the need for additional resources for TLLs on the strategies embedded in the STEMSS PD, another recommendation is to add more examples to the current PD modules and develop a go-to guide based on the PD modules that teachers can easily access while developing lessons for their content areas. Darling-Aduana and Heinrich (2018) demonstrated the need for technology tools and resources to develop integration of content instruction using strategies and could continue to guide the go-to resource that builds on the PD so TLLs have access, beyond participating in the PD, by using a tool to support what they learned in the PD. This recommendation also is supported by and could be modeled after Alenmdar et al.’s (2018) STEM PD that went beyond modeling and collaboration by adding continued support following the PD.

There is currently a high need by teachers for time-efficient, effective PD and resources that are accessible online and can support changing modalities that teachers face while teaching during COVID. Teachers may change how they teach, moving from face-to-face, hybrid, and online within days or weeks and can also be teaching within multiple modalities all at once (Chamberlain et al., 2020). The recommendations to modify and enhance the STEMSS PD while building go-to resources that teachers can use as a support after completing the PD can further address this need.

Another recommendation for practice, drawn from the findings of TLLs’ expressed need for even greater peer collaboration, is to support development of a teacher consortium that provides a venue for TLLs to continue to collaborate and share ideas. This consortium could be led by a teacher organization, a local college or university, or could be in collaboration with a grant program that supports teachers. A Teachers of Language Learners Learning Community (TL3C) grant-funded project implemented a consortium as a sub-project to support TLLs and found that the consortium was one of the successful outcomes of the grant (Coughlin, Jimenez-Silva, & Guerrero, in press). With the PD being available online, it would be logical and widely accessible...
and make it viable for a consortium of continued support for teachers by teachers to be facilitated to further the effectiveness and reach of the PD.

A recommendation for practice related to the potential policy impact of this research would be to disseminate this research at local and state venues and to use the STEMSS PD findings to push for change to teacher preparation and support for teachers through PD offered at local and state levels. Not only do teachers need to be aware of change in program model offerings for ELs at their schools, but more ELs will be in the regular content classrooms more hours of the day; all teachers need to be prepared with tools and strategies to support ELs in all content areas at all levels. Lorenze et al. (2018) demonstrated teacher self-efficacy in supporting students was dramatically increased through PD that offered new knowledge and content and directly related to promoting an integrated curriculum that was meaningful and necessary to the teaching practice. The STEMSS PD and increased PD offerings for TLLs could further support this claim. The push for disseminating the research and getting the PD into the hands of TLLs across the state is essential. This could also be more broadly disseminated and available across the U.S. due to the e-learning format of the training and collaboration.

References:


