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Flipped Instruction with English Language Learners at a Newcomer High School

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Research on flipped instruction with English Language Learners (ELLs) is sparse. Data-driven flipped research conducted with ELLs primarily involves adult learners attending a college or university. This study examined the academic performance of secondary ELLs who received flipped instruction in an algebra course at a newcomer school compared to ELLs enrolled in the same course who received traditional instruction, and investigated ELLs' perceptions of flipped instruction. Findings indicate students enrolled in the flipped course enjoyed the course structure more than a traditional classroom and performed slightly higher than ELLs who received traditional instruction. However, there was no statistical significant mean difference in the academic performance from students enrolled in algebra with flipped instruction compared to students enrolled in the same course with no flipped instruction.

INTRODUCTION

During the 2013-2014 academic school year, an estimated 4.5 million English language learners (ELLs) (9.3% of the total population) attended public school in the United States (U.S.) (Kena et al., 2016). ELLs are one of the fastest growing student groups in U.S. public schools (Fry, 2008; Short & Boyson, 2012). In 2013-2014, Spanish was one of the most common languages spoken by ELLs (Kena et al., 2016), and in 2014, Hispanics made up 17.3% of the total U.S. population. According to projections from the 2014 U.S. Census Bureau, the Hispanic population in the U.S. is expected to reach 28.6% by 2060 (Stepler & Brown, 2016).

Newcomers contribute to the wide range of ELLs in U.S. schools. Newcomers are students who are new to the English language, the United States, (usually within one year of arrival), and its school system (Short & Boyson, 2012). Short and Boyson (2012), who conducted a national survey of secondary school newcomer programs, argued many newcomers face acculturation issues, making it challenging to engage with their schools, peers, and teachers. Newcomers often perform double the work of native English speakers in middle and high schools because they simultaneously study a new language and academic content, and often do so without the benefit of academic literacy and grade-level schooling in their first language (Short & Fitzsimmons, 2007).

Since 1996, the National Assessment of Educational Progress (NAEP) has collected data on ELLs in 4th and 8th grades. For all available years of data, the average math score for non-ELLs in 4th and 8th grades were higher than their ELLs' scores (Kena et al., 2016). Research suggests ELLs continue to underperform in math and reading/language arts compared to non-ELLs (Fry, 2008; National Center for Education Statistics, 2015a).

In a pilot study examining ELLs and math achievement, Abedi et al. (2004) reported, when compared with non-ELLs, ELLs spoke less often in algebra class and teachers called on native English speakers more often than non-native speakers. In 2015, 14% of ELLs in 4th grade math performed at or above proficient levels compared with 43% of non-ELLs, while 6% of ELLs in 8th grade math performed at or above proficient levels compared with 35% of non-ELLs (National Center for Education Statistics, 2015a).

ELLs are not only less likely than other students to score at or above proficient levels in math but also in reading/language arts (Fry, 2008). Evidence of English proficiency is a strong predictor of ELLs' math scores (Henry, Nistor, & Baltes, 2014). Students who read English well achieve higher math scores than those students who do not (Abedi & Lord, 2004). Since English proficiency impacts math scores, it is worth noting 8% of ELLs in 4th grade reading performed at or above national, proficient levels compared with 39% of non-ELLs. Only 4% of ELLs in 8th grade reading performed at or above proficient levels compared with 36% of non-ELLs (National Center for Education Statistics, 2015b).

Short and Boyson (2012) found 81% of newcomer programs offer math through sheltered instruction to ELLs from a wide range of language backgrounds. Sheltered instruction integrates both language and content instruction in the classroom. Short and Boyson (2012) also found 19% of newcomer programs offer math to Spanish-speaking students through native language instruction. Sheltered instruction and flipped instruction involve constructivist approaches to teaching and learning, continuous use of literacy domains including listening, speaking, reading, writing; active learning; and engagement and collaboration. Although Short and Boyson (2012) do not state whether sheltered instruction or native language instruction is more effective, teachers who use sheltered instruction with ELLs report improvement in ELLs' overall academic achievement (Batt, 2010) including higher math test scores (Friend, Most, & McCrary, 2009), literacy gains (McIntyre et al., 2010), and improved standardized reading scores (Friend et al., 2009).

Based on the rapid increase of ELLs in public schools, it is likely all teachers will have ELLs in their classroom at some point during their teaching career. The National Council of Teachers of Mathematics (NCTM) encourages educators to place great emphasis on student-centered learning strategies and students' independent investigations of math ideas in their classrooms to improve academic performance (Clark, 2013). One such student-centered approach for ELLs is flipped learning.

LITERATURE REVIEW

Flipped Learning

With flipped learning, the instructor creates video lectures and/or screencasts designed to teach students academic content outside of class. This frees up valuable class time for more engaging and collaborative activities facilitated by the instructor (Milman, 2012). Flipping the classroom builds on existing mobile technology and reinforces that learning does not have to take place in a brick-and-mortar establishment (Engin, 2014). Instead of focusing on presenting information, teachers focus on significant gaps in students' learning and help students connect the information they gathered outside of class into meaningful chunks during class (Lasry, Dugdale, & Charles, 2014). Flipped learning is successful when students are accountable and have proper support outside of class and complete the assigned preparation work (Chen-Hsieh, Wu, & Marek, 2016).

Drawing on a review of literature, Chen-Hsieh et al. (2016) noted flipped learning is aligned with studies showing the educational benefits of mobile technology. Mobile learning is effective in enhancing student motivation to learn and willingness to participate "because of the accessibility, portability, interactivity, and immediacy of mobile devices, leading to more autonomous and diverse learning" (p. 3).

Flipped learning is grounded in theoretical understandings of active learning (Hung, 2015). Active learning involves a "vast range of learning activities, instructional strategies, teaching methods, and any pedagogical approach that is intended to activate or develop the students' thinking in the learning process" (p. 82). Basal (2015) argued the flipped classroom is pedagogically sound because it emphasizes personalized-differentiated learning, student-centered instruction, and constructivism.

Flipped Studies

Researchers and practitioners who write about flipped experiences agree flipping often produces positive benefits and meaningful insights for teaching. Kostka and Brinks Lockwood (2015) surveyed students in their university flipped courses and found the videos used with their flipped instruction provided students the time needed to learn the material at their own pace. They argued, "If a student had been in class listening to an explanation of a concept s/he already knew, class would be less engaging and the student would likely lose interest" (p. 12). Kostka and Brinks Lockwood (2015) reported they enjoyed teaching more due to the energy and consultative relationships they cultivate with students in a flipped classroom.

Another area that contributes to an effective flipped classroom is instantaneous feedback provided during in-class group discussions and peer instruction (Fulton, 2012). While observing a high school math class, Fulton noted how group discussions and peer instruction helped teachers target and revise instruction on math concepts that students found difficult. Flexibility and real-time analysis in a flipped classroom allow for a true and immediate response to student needs (Fulton, 2012).

Teachers' immediate feedback and evaluation to students also contributed to a successful flipped learning experience for students in Chen-Hsieh et al. (2016) mixed methods study with undergraduate English majors in Taiwan. Students learned English idioms in an English oral training class with flipped instruction. The flipped instructional design of the course emphasized output materials (e.g., online written and audio posts). Findings from Chen-Hsieh et al. study revealed students succeeded at creating outputs by absorbing the preceding learning materials. Students actively used idioms in class and improved their idiomatic knowledge.

In a similar mixed methods study with undergraduate English majors in Taiwan, Wu, Chen Hsieh, and Yang (2017) examined the impact of an online learning community in a flipped classroom on English foreign language learners' oral proficiency. Findings revealed:

> "the online learning community in the flipped instruction not only led to meaningful learning while facilitating positive interaction and collaboration, but also enhanced participants' oral proficiency, making them more competent in learning activities, such as storytelling, dialogue interaction, class discussion, and group presentations" (p. 151).

Wu et al. argued participants learned more from the flipped instructional design because of the ample opportunities for conversational applications in authentic, supportive, interactive, engaging, and collaborative learning contexts.

Differentiated instruction was a major benefit in Davies, Dean, and Ball's (2013) flipped introductory-level college course on spreadsheets. Using a pretest posttest quasi-experimental mixed methods design, students enrolled in the course demonstrated learning gains due to greater differentiation of instruction. Class time was effective because it provided remedial assistance to students who needed extra help. Davies et al. also noted flipped learning allowed those with extensive technological backgrounds to move more quickly through the materials than those with limited backgrounds.

Vaughan (2014) also adjusted, expanded, and recreated in-class flipped activities to match students' needs and knowledge. Preservice teachers in Vaughan's (2014) exploratory study on flipped instruction demonstrated higher levels of reflection and inquiry in their coursework, and gained useful instructional strategies such as debating, cooperative learning, and problem-based learning. Vaughan reported students watched the out-of-class videos multiple times, and on several occasions watched the videos together with family members and/or had conversations about the videos outside of class with peers. Vaughan modeled, named, and discussed with students the instructional strategies she used during class. Students benefitted from the walk the talk teaching approach by the instructor because they saw instructional practices in action and were able to make critical connections from theory to practice. Vaughan believed this contributed to her effective use of flipped instruction.

In contrast to students' positive academic achievement with flipped instruction, secondary students enrolled in Clark's (2013) math class demonstrated eagerness and excitement being in a flipped classroom, but did not show significant changes in their academic performance when compared to students taught under a traditional approach. Although all students in Clark's study described their role in the flipped classroom as active, students verbalized their concerns over the flipped content, which may have contributed to the ineffective use of flipped learning. Clark (2013) wrote:

> Not only was a new approach to learning introduced to the students, but extremely challenging content was also presented to them. While the students noted their preference for the flipped model of instruction, they felt the instructional approach should have been introduced to them during easier content in order to lessen the demands and challenges of having to learn both a new approach and extremely difficult content. (p. 109)

Regardless of the content being taught in a flipped classroom, Jensen, Kummer, and Godoy (2015), who used a comparative quasi-experimental research design with undergraduate students in flipped and non-flipped classrooms, concluded students in flipped classrooms do not result in higher learning gains compared with the non-flipped classroom when both utilize an active learning, constructivist approach to teaching.

As seen in the literature above, more and more research is being published on flipped learning. There remains, however, no scientific research base to indicate exactly how well flipped learning works (Goodwin & Miller, 2013). Much of the research on flipped learning, argued Davies et al. (2013), is only beginning to be published and is often based on contextually situated learning circumstances. Studies often lack measures of student learning (e.g., false comparisons of active learning in flipped classrooms to traditional lecture courses with no active learning) (Lape, Levy, & Yong, 2015). Current studies on flipped learning are limited because so many potential causative mechanisms are being changed between treatments (e.g., shifting to active learning, including additional technology), which make data analysis difficult, if not impossible (Jensen et al., 2015). Hung (2015) agrees and wrote, "no conclusive or generalizable findings on flip teaching can be derived from the current literature, due to insufficient empirical validation across contexts" (p. 83).

Data-driven flipped research conducted with ELLs primarily involves adult learners attending college or university (Basal, 2015; Chen-Hsieh et al., 2016; Engin, 2014; Han, 2015; Hung, 2015; Leis, 2015). Research using flipped learning with adult ELLs indicate the use of flipped instruction improves academic performance for language learning, increases motivation to learn English, increases writing skills and oral fluency, increases innovative changes in attitudes, participation and engagement in learning activities, and satisfaction toward learning English (Basal, 2015; Chen-Hsieh et al., 2016;

Engin, 2014; Han, 2015; Hung, 2015; Leis, 2015; Wu et al., 2017). This study contributes to the literature by expanding the use of flipped instruction with ELLs enrolled at a secondary newcomer school, and adds to the lack of empirical research that indicates exactly how well flipped learning works.

RESEARCH PURPOSE AND QUESTIONS

This study examined the academic performance of secondary ELLs who received flipped instruction in an algebra course at a newcomer school compared to ELLs enrolled in the same course who received traditional instruction, and investigated ELLs' perceptions of flipped learning. The research questions included:

1. Do secondary, newcomer ELLs who receive flipped instruction in an algebra course perform higher or lower than ELLs who complete the same course with traditional instruction?
2. What are ELLs' perceptions of flipped learning?

METHODS

Context

The study occurred during the 2014-2015 and 2015-2016 academic school years at a newcomer, public high school in the southwest. A newcomer school or newcomer program is designed for newly arrived immigrants primarily at the secondary school level who have little or no English proficiency and have limited or no formal education in their native countries. The high school in this study is the only newcomer school in the state. During the 2014-2015 academic school year, there were nearly 65,000 ELLs enrolled in the school district, and there were 170 ELLs enrolled at the high school.

The high school is also the only zoom high school in the school district. A zoom school is a school with a high percentage of students who have limited English proficiency and are the lowest performing academically. Zoom schools have an extended school year and receive additional financial and professional development resources to boost the academic performance of ELLs. We chose to conduct our research in a math class because of low math proficient levels from ELLs across the United States. The availability of, interest in, and use of technology by the math department where the study occurred also influenced our decision to use flipped instruction in a math class.

Participants

Thirty-nine students enrolled in one of three sections of Algebra I taught during the 2015-2016 academic school year received flipped instruction. The class had 20 male students and 19 female students, including 19 freshmen, 16 sophomores, and four juniors. Thirty-six students spoke Spanish as their first language. Three students spoke Tai, Tagalog, or Amharic, the official language of Ethiopia, as their first language.

The average age of students was 16 years old. All students completed two semesters of Algebra I. Students' English proficiency levels ranged from Entering, Beginning, to Developing (WIDA ACCESS for ELLs, 2014). Because all algebra sections were taught with flipped instruction during the 2015-2016 academic school year, we decided to compare data to students who completed the same course during the 2014-2015 academic school year with no flipped instruction.

John, the co-researcher, taught all sections of the algebra course during the 2014-2015 and 2015-2016 academic school years. John had been teaching math for three years at the high school where the study took place, and taught math for 11 years in the school district. John speaks fluent Spanish, routinely uses technology in the classroom, and completed the state required courses to add a Teaching English as a Second Language (TESL) endorsement to his teaching license. John was familiar with flipped learning but had no experience flipping a course.

Procedure

Students' parents or guardians signed the consent form for their child to participate in the study. The consent form was available in English and Spanish. The students who spoke Tai, Tagalog, and Amharic used the English version of the form and did not require translation. Students in the flipped class received a brief introduction to flipped learning at the beginning of the fall 2015 semester. The introduction involved reviewing the consent form, discussing examples of flipped learning and the benefits and challenges they may experience from participating in the study. Students understood their test scores in Algebra I with flipped learning would be collected. Students also understood they needed to complete a post-survey at the end of the academic school year. All students acknowledged they owned or had access to mobile technology to watch the instructional videos. The school provided iPads before and after class for students who could not access their own technology outside of class.

Students met daily throughout the academic school year. On a typical day, class time was 63 minutes. Students received direct instruction at the beginning of class, completed in-class assignments on a computer, utilized graphing calculators, and participated in groups with problem-based learning activities. Students received flipped instruction every week for the entire 2015-2016 academic school year. Students were required to watch teacher-created videos outside of class or before or after class. The academic content was the same in both classes from both academic school years and was aligned with state algebra standards. Students completed weekly quizzes, monthly tests created by the teacher, and a district-produced exam, administered twice a year after each semester.

John used *Explain Everything*, an online, interactive, screencasting whiteboard, to create 26 instructional videos. John narrated the videos in English and imported them as mp4 files into Blendspace, a website that allows teachers to create and curate resources and allows students to access lessons online. The videos ranged in length from five minutes to 10 minutes. No outside evaluator examined the videos for accuracy and engagement before students viewed them.

We performed a quality assurance checklist before the flipped course went live. The checklist involved checking all hyperlinks in the course to be certain they connected to the internet, playing all videos to be certain the audio levels and pictures were optimal, and enrolling all students in Blendspace. Students received a tutorial on how to access the course and the learning material located online. Students received guiding questions in English to assist them with the videos, and learned other learning strategies such as note taking and how to work along on the math problems while watching with the videos.

Data Collection and Analysis

To gain insight into the academic performance of ELLs at a newcomer high school who received flipped instruction and gain insight into their perceptions of flipped instruction, we collected two data sources. The first data source answered the first research question and included final grades from both classes. The second data source answered the second research question and included responses to a survey on flipped learning, administered online to students on the last day of the spring 2016 semester.

We created the survey in Qualtrics, online survey software, to measure students' perceptions of flipped learning. Our survey modeled a similar survey used in a flipped study with undergraduate multimedia students (Enfield, 2013), and contained a total of 19 close-ended items. We deleted items in Enfield's survey that did not pertain to our study, and changed the academic content in our survey to algebra. Survey items focused on four constructs based on relevant flipped learning literature, including motivation, effectiveness, engagement, and enjoyment (Chen-Hsieh et al., 2016). All survey items included Likert-style response scales with a minimum score of one and a maximum score of five. Although students were studying English as another language, we decided to translate the survey into Spanish and administer it in English and Spanish so students understood the survey items.

An educational technology researcher who has published on flipped learning reviewed the survey and offered editorial revisions. Cronbach's alpha (α) for the entire survey was .888. An acceptable alpha value should be above .70 (DeVellis, 2003). The original survey used in this study contained 20 items; however, the Cronbach alpha for the engaging construct with three items was low (.392), so we deleted the survey item, *I was engaged in the flipped classroom more than I would have been in a traditional classroom*, and the Cronbach alpha for the engaging construct increased to .589. It is common with short scales (fewer than 10 items) to find low Cronbach alpha values (e.g. .5) (Pallant, 2010). With short scales, it may be more appropriate to report the mean inter-item correlation for the items. An optimal range for the inter-item correlation is between .2 to .4 (Pallant, 2010). The inter-item correlation for the engaging construct with two items was .427.

The motivation construct in our survey contained four items, which produced a Cronbach alpha of .682. Since the inter-item correlation for the motivation construct was .331, which falls within the recommended range for inter-item correlation, we decided to keep all survey items in the motivation construct. Our enjoyment construct only contained one item; therefore, no Cronbach's alpha was needed. Table 3 includes Cronbach's alpha scores and inter-item correlations for the appropriate survey constructs.

Quantitative data from the final grades were analyzed in SPSS. Descriptive statistics were generated and independent sample t tests were performed to assess mean differences between students' academic performance. To avoid researcher bias, a non-participant colleague with experience in quantitative methodologies reviewed the data and agreed with the findings.

FINDINGS

This section contains a discussion of the findings in relation to the research questions. The first research question asked, Do secondary, newcomer ELLs who receive flipped instruction in an algebra course perform higher or lower than ELLs who complete the same course with traditional instruction? The average final grade from students enrolled in both classes was low for both academic semesters. Descriptive statistics of final grades from students enrolled in Algebra I with flipped instruction compared to students enrolled in Algebra I with no flipped instruction reveal a slightly higher average final grade from students who studied under the flipped model of learning (Table 1).

Table 1
Descriptive Statistics of Final Grades

Group	Semester	N	*M*	*SD*	Mean Difference
Class with flipped instruction	Fall 2015	39	68.92	11.41	5.77
Class with no flipped instruction	Fall 2014	39	63.15	15.77	
Class with flipped instruction	Spring 2016	39	67.87	13.26	6.43
Class with no flipped instruction	Spring 2015	39	61.44	16.40	

To assess mean differences in academic performance from students enrolled in Algebra I with flipped instruction and students enrolled in Algebra I with no flipped instruction, independent sample t tests were conducted on students' final grades from both semesters in the academic school years. Table 2 provides the findings. Findings revealed no statistical significant mean difference in academic performance from students enrolled in Algebra I with flipped instruction compared to students enrolled in the same course with no flipped instruction, $t(76)=1.85$, $p>.05$ (fall semester); $t(76)= 1.91$, $p>.05$ (spring semester).

Table 2
Independent Sample t-Tests of Academic Performance

Group	Semester	M	*SD*	*t*	df	*p*
Class with flipped instruction	Fall 2015	68.92	11.41	1.85	76	.068
Class with no flipped instruction	Fall 2014	63.15	15.77			
Class with flipped instruction	Spring 2016	67.87	13.26	1.91	76	.060
Class with no flipped instruction	Spring 2015	61.44	16.40			

Note: Statistically significant ($p < .05$)

The second research question asked, what are ELLs' perceptions of flipped learning? A survey on students' perceptions of flipped learning was administered to students with constructs of motivation, effectiveness, engagement, and enjoyment. All survey items contained Likert-style response scales with a minimum score of one and a maximum score of five. Based on survey data, students, overall, were motivated to learn algebra (M=3.35), believed flipped instruction was effective (M=3.61), were engaged with flipped instruction (M=3.56), and enjoyed the course structure more than a traditional classroom (M=3.64).

Twenty students were motivated (n=12) or more motivated (n=8) to learn algebra because of the videos. Twelve students were neutral in their response, while seven students reported being less motivated (n=4) or not motivated (n=3) to learn algebra because of the videos. The majority of students were neutral (n=17) on both items in the survey that asked how the use of quizzes and tests impacted their motivation to watch the videos. Additionally, seven students reported being less motivated (n=5) or not motivated (n=2) to watch the videos because of quizzes, and seven students reported being less motivated (n=4) or not motivated (n=3) to watch the videos because of tests.

Findings revealed an equal number of students (n=15) found the videos either challenging (n=12) or very challenging (n=3) and not challenging (n=2) or somewhat challenging (n=13) in learning algebra, and nearly all of the students (n=30) found the videos very helpful (n=19) or helpful (n=11) in learning algebra. Findings also revealed students found the videos helpful (n=13) or very helpful (n=16) in improving their English speaking skills, and helpful (n=11) or very helpful (n=13) in improving their English writing skills. Similar findings revealed students found the in-class activities helpful (n=10) or very helpful (n=9) in improving their English speaking skills, and helpful (n=14) or very helpful (n=5) in improving their English writing skills.

Students reported the use of strategies while watching the videos, note taking and working along with the videos, were helpful (n=15; n=23 respectively) and very helpful (n=15; n=12, respectively). The third strategy provided to students, answering questions while watching the videos, did not receive as favorable responses. The majority of students were either neutral (n=16), or found the strategy somewhat helpful (n=3) or not helpful (n=1). In the end, 18 students either agreed (n=14) or strongly agreed (n=4) to the survey item, *I learned more in the flipped classroom than I would have in a traditional classroom*. An equal number of students (n=18) selected neutral for this survey item, one student selected disagree, and two students selected strongly disagree.

Findings also revealed the videos were either very engaging (n=7) or somewhat engaging (n=15) for the majority of students, and the in-class activities were either engaging (n=16), somewhat engaging (n=15), or very engaging (n=5). Twenty-four students reported they enjoyed the flipped classroom more than being in a traditional classroom. Fourteen students were neutral in their response to whether or not they enjoyed the flipped classroom more than a traditional classroom. One student strongly disagreed and preferred a traditional classroom to a flipped classroom. Table 3 contains descriptive statistics from the survey.

Table 3
Descriptive Statistics from the Perceptions Survey

Survey Items By Construct	Mean	Standard Deviation	Cronbach's Alpha	Inter-item Correlation
Motivation Construct			.682	.331
14. How did the use of videos impact your motivation to learn algebra?	3.46	1.17		
15. How did the use of quizzes impact your motivation to watch the videos?	3.28	1.03		
16. How did the use of tests impact your motivation to watch the videos?	3.31	1.13		
17. How did the use of in-class activities impact your motivation to learn algebra?	3.33	0.84		
Effectiveness Construct			.850	
1. Did you find the videos challenging in learning algebra?	3.03	1.09		
3. Did you find the videos helpful in learning algebra?	4.13	1.06		
4. Did you find the videos helpful in improving your English speaking skills?	3.62	1.33		
5. Did you find the videos helpful in improving your English writing skills?	3.46	1.12		
6. Did you find the in-class activities challenging in learning algebra?	3.41	0.82		
8. Did you find the in-class activities helpful in learning algebra?	3.85	0.93		
9. Did you find the in-class activities helpful in improving your English speaking skills?	3.49	1.44		
10. Did you find the in-class activities helpful in improving your English writing skills?	3.33	1.08		
11. Did you find note taking while watching the videos helpful in learning algebra?	4.10	0.88		
12. Did you find working along with the videos helpful in learning algebra?	3.87	0.92		
13. Did you find answering the questions provided while watching the videos helpful in learning algebra?	3.64	1.06		
20. I learned more in the flipped classroom than I would have in a traditional classroom.	3.44	0.91		
Engaging Construct			.589	.427
2. Did you find the videos engaging in learning algebra?	3.56	1.02		
7. Did you find the in-class activities engaging in learning algebra?	3.56	0.82		
Enjoyment Construct				
18. I enjoyed the flipped classroom more than I enjoy being in a traditional classroom.	3.64	0.74		

N=39

DISCUSSION

This study examined the academic performance of secondary ELLs who received flipped instruction in an algebra course at a newcomer school compared to ELLs enrolled in the same course who received traditional instruction, and investigated ELLs' perceptions of flipped learning. The average final grade from ELLs who studied with flipped instruction was 68.4, which was slightly higher than the average final grade, 62.3, from ELLs who did not study with flipped instruction. Based on the average final grades alone, ELLs who received flipped instruction in Algebra I performed higher than ELLs with traditional instruction. Flipped learning, however, did not produce a statistical significant mean difference in the academic performance from ELLs enrolled in Algebra I with flipped instruction compared to ELLs enrolled in the same course with no flipped instruction, $t(76)=1.85$, $p>.05$ (fall semester); $t(76)= 1.91$, $p>.05$ (spring semester).

Although the average final grades from both classes were passing grades, they were below average and support research that ELLs are much less likely than other students to score at or above proficient levels in math (Fry, 2008). Students' academic performance in algebra were not surprising since newcomer students are held to the same accountability standards as native English speakers while they are just beginning to develop English proficiency and are simultaneously studying core content areas (Short & Boyson, 2012). ELLs who have not learned basic literacy skills at a young age may not have the background knowledge in content areas teachers expect them to have learned (Robertson & Lafond, n.d.). Despite the below average final grades in algebra, it is interesting to note 18 students either agreed (n=14) or strongly agreed (n=4) to the survey item, *I learned more in the flipped classroom than I would have in a traditional classroom*. An equal number of students (n=18) selected neutral. We anticipated the majority of responses to this survey item would have been below neutral simply because of their grades.

With low levels of literacy in English, newcomers are not prepared for secondary level texts and assignments and are vulnerable to academic failure (Short & Boyson, 2012). ELLs low levels of English literacy may have contributed to their low-level math grades. ELLs may not have fully understood the language in which the math assessments were written. The linguistic complexity of test items may threaten the validity and reliability of achievement tests, particularly for ELLs (Abedi, 2002).

The only assessments used to determine ELLs' final grades in this study included quizzes, tests, and exams. Overall, students were neutral (n=17) on both items in the survey that asked how the use of quizzes and tests impacted their motivation to watch the videos. Haynes (n.d.) reminds us that problem solving in math is not just language but a thought process. ELLs may be more concerned with getting the correct response than with the process, and they may not be able to justify their answers. Not being able to justify answers on quizzes and tests may have contributed to students' responses to the motivation survey items on quizzes and exams and ultimately may have impacted their motivation to watch the videos.

With regard to ELLs' perceptions of flipped learning, survey items focused on four constructs based on relevant flipped learning literature, including motivation, effectiveness, engagement, and enjoyment (Chen-Hsieh et al., 2016). Findings revealed an equal number of students (n=15) found the videos either challenging (n=12) or very challenging (n=3) and not challenging (n=2) or somewhat challenging (n=13) in learning algebra. It is unknown how students interpreted the word challenging and whether or not the videos were difficult or contained adequate rigor to enhance learning. Researchers should define or translate keywords in surveys that ELLs may not understand or may find confusing.

The majority of students (n=22) found the videos either very engaging (n=7) or somewhat engaging (n=15), and nearly all of the students (n=30) found the videos very helpful (n=19) or helpful (n=11) in learning algebra. This finding supports similar findings from Hung's (2015) research using flipped instruction with adult ELLs. Hung reports the learning environment had a positive impact on ELLs, helped ELLs attain better learning outcomes, develop better attitudes toward their learning experiences, and engaged them in the learning process. When digital content is integrated into the curriculum, a change in the learning process occurs that is characterized as being problem- or project-oriented, student-centered, relevant, and productive (Tapscott, 1999).

Overall, students found the videos and in-class activities helpful in improving their English literacy skills. These findings did not surprise us since practice in speaking and writing as well as reading and listening contribute to the overall improvement of second language knowledge. An abundance of exposure to oral and written language permits ELLs maximum language and content learning (Peregoy & Boyle, 2017). No formal assessments, however, measured students' pre and post English speaking and writing skills as result of viewing the videos and participating in class.

Findings revealed ELLs who experienced flipped instruction performed no better than ELLs who did not receive flipped instruction. Findings from the independent sample t-tests were close to being statistically significant (see Table 2). We believe a larger number of participants coupled with controlled student accountability for completing out-of-class preparatory work and ongoing instructional feedback during flipped teaching may have produced significant findings.

Student Accountability

There was no control of the home or out-of-class environment in which students watched the videos. Although the majority of students reported the strategies used while watching the videos were helpful, it is unknown if students indeed watched the videos before class and utilized the strategies, and whether or not the excessive number of videos led to boredom and affected students' decisions to watch the videos or not. It is also unknown if ELLs fully understood the language used in the questions to guide their video viewing, which could have affected their responses to the strategy items in the survey. Students' responsibility for completing the flipped learning activities outside of class is essential (Wu et al., 2017).

If students do not have the proper support outside of class and do not complete out-of-class assigned work, the teacher cannot engage students at an advanced level inside the classroom (Chen-Hsieh et al., 2016). Videos used outside of class should be interactive not only to increase students' interest but also to ensure students are prepared for in-class work (Kostka & Brinks Lockwood, 2015). Teachers should identify students who do not watch videos and intervene with students who do not complete their flipped learning commitments outside of class (Chen-Hsieh et al., 2016). It is also important for ELLs to understand they can and should apply the learning strategies used at home and in class with flipped learning in other courses.

Ongoing Instructional Feedback

Since flipped learning deviates from traditional, rote approaches to teaching and learning (Enfield, 2013; Keene, 2013), it is not surprising that students' perceptions of flipped learning were favorable. Rather than present traditional lectures to students during class, they interacted with their peers and the teacher every school day for the entire academic school year.

No one, however, besides John, the instructor and co-researcher, monitored the in-class interaction that occurred in the flipped classroom. Additionally, John received limited feedback on the in-class activities and assignments that complemented the out-of-class flipped learning. The majority of students were neutral (n=20), less motivated (n=3), or not motivated (n=1) to learn algebra because of the in-class activities. It is unknown if the in-class assignments, interactions, and activities were in fact meaningful to students and enhanced their English literacy skills to learn algebra.

Creating authentic, interactive, in-class activities and assignments that stimulate critical thinking and motivate students to expand their curiosity with content that began outside of class can be a challenge for first-time flippers. Enfield (2013) argues a challenge for novice teachers who flip is how to effectively use class time, which may be especially challenging for teachers who are accustomed to direct instruction. Having a constant connection with students is critical with flipped learning. The time spent in class should be more important than the videos used outside of class (Basal, 2015).

RECOMMENDATIONS FOR FUTURE RESEARCH AND PRACTICE

Teachers who flip and teachers who are considering a flipped approach to teaching may benefit from meeting with colleagues or technology specialists who have experience flipping before they teach their first flipped lesson. The planning and preparation of in-class activities done by a team of experienced flippers could foster growth in choosing appropriate and engaging activities for classroom time. Recommendations and revisions to a lesson, unit, or video from the team should be considered accordingly. Future researchers should study the relationship between the teacher who flips and the support team that mentors and document their experiences building a flipped curriculum.

Since English proficiency is a strong predictor of ELLs' math scores (Henry, Nistor, & Baltes, 2014), it is necessary for teachers and researchers who work with ELLs in a flipped classroom to develop in-class activities that continuously allow ELLs to practice and improve their English literacy and interact with each other using their new language. Given the importance of effective class time with flipped learning, school administrators and researchers should routinely observe teachers who flip, and provide ongoing feedback on the delivery of in-class activities and strategies used to facilitate learning, interactions between students and the teacher, and the use of scaffolding and assessment.

Teachers should view video analytics in learning management systems that house videos for flipped lessons. This will allow teachers to better understand how students use and interact with the videos. Video analytics will not only generate data on when and how many times a student accesses a video, but will also allow teachers to see when students are pausing, what part of the video they repeat, and how long it takes to get through the video (Enfield 2013). Collecting these data can help teachers develop in-class activities that target specific content from the videos that may need scaffolding during class.

Future researchers and teachers who flip may need to eliminate or edit lengthy videos. Bergmann and Sams (2014) recommended videos be no longer than 60-90 seconds per grade level. For example, if a teacher makes a video for 10th graders, the video should be less than 15 minutes. Researchers and teachers can create videos with students who already completed the course. Students can actively explain content, work independently or in small groups, and interact with the teacher in the videos. This may motivate new students in a flipped class to watch the videos. Since the videos are an essential component of flipped instruction, researchers and teachers may have to build in out-of-class time in a computer lab where students either watch the videos on their own or watch the videos together as a class or in small groups.

It is also recommended that future researchers study the academic achievement in a flipped classroom by gender to determine if differences exist between sexes, and when working with ELLs, researchers should study the effect of ELLs who are grouped with native English speakers for in-class activities and assignments. Researchers should consider grouping ELLs with native English speakers and require them to watch the videos together. Data should be collected on the group dynamics and students' understanding of the video content. Working side by side with a native English speaker may help improve literacy skills and academic content development. Longitudinal studies on ELLs who experience flipped instruction throughout their schooling (e.g., freshmen year through senior year of high school) can also shed light on the effectiveness of flipped instruction.

Lastly, future researchers who flip with ELLs should study the effects of flipped instruction on K-12 ELLs' literacy skills. This study focused on measuring academic performance in math and did not collect ample data to measure ELLs' gains in literacy. Given ELLs' low levels of English literacy may contribute to low-level math grades (Abedi, 2002), research in this area would contribute to the lack of literature on flipped instruction in general and, more specifically, add to the lack of literature on flipped instruction with K-12 ELLs.

LIMITATIONS

It should be noted with any kind of research, participants might share information they believe the researchers want to hear rather than share accurate information that represents their experiences and perspectives. As discussed above, there was no student accountability for watching the videos outside of class and no ongoing instructional feedback during the flipped teaching. We believe these limitations may have contributed to the finding that flipped instruction had no significant effect on the academic achievement of ELLs. If students in fact watched the videos out of class and had more in-class time to interact with the teacher and each other, flipped instruction, in theory, should have produced significant gains in students' learning rather than raise more questions on the effectiveness of flipped instruction with ELLs.

We also recongize there was no pre-test used at the beginning of the study to show whether or not ELLs had comparative knowledge levels of algebra before the semester began. Although the survey was reviewed by an educational technology expert with experience in flipped instruction, the survey itself was not properly validated. We recognize there were limitations with a few survey items as well. The survey item, *I was engaged in the flipped classroom more than I would have been in a traditional classroom*, was deleted from the survey's engaging construct due to an unacceptable Cronbach's alpha coeffcient. The item should be rewritten to increase the realiability of the construct. The enjoyment construct only contained one item. Additional items in the enjoyment construct would have allowed us to calculate the reliability of the construct.

Additionally, final grades may not accurately measure learning because students may receive points for simply participating in class or may lose points for turning in assignments late or missing class. Teacher-created assignments and exams can also be poor measures of learning if the teachers are not experts in measurement. Cheating can also be an issue on classroom-administered tests and assignments more so than on standardized tests, which may contribute to an inaccurate overview of students' performance. Future researchers should compare standardized test scores from ELLs who receive flipped instruction to standardized scores from ELLs who receive no flipped instruction. This may provide a more accurate overview of students' performance in a flipped classroom.

CONCLUSION

Flipped instruction allows teachers to become facilitators of knowledge and blend direct instruction with constructivist learning pedagogies that offer differentiated, student-centered learning. Overall, this study found ELLs enjoyed the course structure but found no significant effect on the academic achievement of ELLs in a flipped classroom. There is a need for more empirical research on flipped learning at all grade levels and across all disciplines. Until researchers are able to provide reliable data on flipped learning and student achievement, the best we can do is to ask, "do the purported benefits of flipped classrooms reflect research-based principles of effective teaching and learning?" (Goodwin & Miller, 2013, p. 78).

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