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Mark Congdon Jr.
University of Maine, mark.congdon@maine.edu

Ian Mette
University of Maine, ian.mette@maine.edu

Andrea Mercado
University of Maine, andrea.mercado@maine.edu

Laura Lindenfeld
Stony Brook University, laura.lindenfeld@stonybrook.edu

Emily Tupper
graduate@maine.edu

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Mark Congdon Jr.
University of Maine

Ian Mette, Ph.D.
University of Maine

Andrea Mercado
University of Maine

Laura Lindenfeld, Ph.D.
Stony Brook University

Emily Tupper
University of Maine

This study investigated factors predicting the intentions of English Language Learner (ELL) teachers to use Google Earth for language development instruction. The researchers used quantitative research methods using an electronic survey (n=40), with a 28% return rate. Results indicated that attitude was a significant predictor of ELL teachers' intentions to use Google Earth during instruction in a rural New England state. Additional findings indicate that when comparing teachers who intended or were using Google Earth during instruction to those who did not, there were significant differences between groups. However, 95% of ELL teachers within this rural state received no training with Google Earth, and 85% reported wanting to know more about Google Earth for instruction. This study has implications for training programs and professional development for ELL instruction in rural states for the use of Google Earth as a communication instructional tool.

KEYWORDS: English Language Learners, inquiry-based pedagogy, technology

The drastic change in demographics in the United States has diversified public schools, specifically with regard to English Language Learner (ELL) populations, which has increased in public schools nationally and has reached over 4.7 million (National Center for Education Statistics, 2013). In rural communities, racial diversity continues to rise, as 26.7% of all U.S. rural population in 2013 is identified as being Latino or non-White, up from 17.8% in 2000 (Johnson et al., 2014). As a result, the ELL student population is expected to double by 2050

Mark Congdon Jr. is a Ph.D. candidate in the Department of Communication & Journalism at the University of Maine. Correspondence concerning this article should be addressed to Mark Congdon Jr. Address: University of Maine 5724 Dunn Hall, Room 420 Orono, ME 04469; Email: mark.congdon@maine.edu.

(Meskill, 2005). Since the Every Student Succeeds Act (ESSA) was passed into law in 2015 – a rewrite of No Child Left Behind (NCLB), and the adoption of more rigorous nationalized standards by many states – school leaders are required to acknowledge the need to improving the student achievement of traditionally disadvantaged students. This demand can be particularly challenging for rural schools, their leaders, and teachers to implement, particularly in communities that have traditionally supported homogenous student groups (Forner, Bierlein-Palmer, & Reeves, 2012).

New England states continue struggle to meet the needs of changing student demographics, particularly the educational needs of ELL students (Johnson et. al, 2014). The lack of attention policymakers has given to rural education is alarming in terms of demographic shifts in the numbers of ELL students entering these school districts. As ELL students continue to enroll in public schools that have not traditionally served linguistically diverse learners, it is imperative to understand the educational needs of ELL students in these communities, as well as the pedagogical tools that are effective with teaching these diverse students. Developing solutions is urgent for policymakers, researchers, and educators alike, particularly in rural states that have seen the recent rise in ELL student populations (Meskill, 2005; Theoharis, & O'Toole, 2011). One potential solution for school leaders to consider is the implementation of inquiry-based communication instructional tools, such as Google Earth, since these communication pedagogical tools have been shown to increase the language development and academic achievement and engagement of ELL students (Goldstein & Alibrandi, 2013; Reed & Railsback, 2003). The purpose of this study aims to better understand the relationship between rural New England ELL teachers' perceptions of an internet-based Geographic Information System – Google Earth – and their intentions of using them with to support ELL students' language development. The goal is to inform rural school leaders and teachers about such perceptions so that they may have a better understanding of how they might be able to develop and implement such inquiry-based communication instructional tools in their own schools to meet the needs of ELL students.

Towards an Inquiry-Based Pedagogy

Inquiry-based pedagogy is powerful instructional practice that is effective for ELL students to access curriculum (Maxwell, 2013). Prince and Felder (2006), discuss how inquiry learning begins when students are presented with questions to be answered, problems to be solved, or a set of observations to be explained. They explain that "students learn to formulate good questions, identify and collect appropriate evidence, present results systematically, analyze and interpret results, formulate conclusions, and evaluate the worth and importance of those conclusions" (p. 127). One way to incorporate inquiry-based activities in the classroom is to use instructional communication technologies for virtual visualizations, virtual field trips, and virtual fieldwork, also known as Geographic Information System (GIS) (Baker, 2005).

GIS is a pedagogical tool that allows students to study layers of topography in ways that can expose intriguing and unique patterns and processes by merging digital geography layers with digital attribute information (Donaldson, 2001). When incorporated into the educational curriculum of science, mathematics, English, and social studies, GIS tends to enhance the learning and development of students' analytical skills, communication skills, and critical thinking skills, as well as their academic performance (Bloom & Palmer-Moloney, 2004; Goldstein & Alibrandi, 2013; Kerski, 2001). Research has also shown that these pedagogical

strategies, which include visualization, representations, animations, project-based learning, cooperative learning, and accessing a student's prior knowledge, can improve the language development of ELL students, specifically with reading comprehension and spatial reasoning, (Pan & Pan, 2009; Reed & Railsback, 2003). The adoption of GIS communication technology in teaching has even indicated an improvement in ELL students' standardized achievement scores in reading and math, and in science and social studies courses (Goldstein & Alibrandi, 2013).

Numerous studies have examined teachers' perceptions of GIS instructional tools and their intentions to use them with their students (Donaldson, 2001; Goldstein, 2010), the development of Google Earth as an educational communication tool (Bailey, Ornduff, & Kennedy, 2009), and science teachers' perceptions of Google Earth in a rural New England state (Rice, 2014). However, little is known about ELL teachers' perceptions, that teach in a rural state, with using GIS technology to assist in the language development of ELL students. This study helps fill that void.

Theoretical Framework

In order to research the perceptions of ELL teachers using Google Earth, and the acceptance factors influencing their use of the communication technology within their teaching, the Decomposed Theory of Planned Behavior (DTPB) was utilized in this study. DTPB focuses on explaining the behavior of individuals based on the relationship between beliefs, attitudes, intentions, and behavior (Ajjan & Hartshorne, 2008). The constructs of this model that help to understand the reasons or factors explaining an individual's actions are attitudes, subjective norms, and perceived behavior control. DTPB focuses on the identification of beliefs and factors that influence these three constructs of behavior (Chennamaneni, Teng, & Raja, 2012). DTPB decomposes attitude into three variables – perceived usefulness, perceived ease of use, and compatibility (Ajjan & Hartshorne, 2008).

Numerous studies have shown that DTPB is a strong model for analyzing teachers' acceptance of communication technologies in their classes (Ajjan & Hartshorne, 2008; Capo & Orellana, 2011; Chennamaneni, Teng, & Raja, 2012; Chien, Wu, & Hsu, 2014; Montrieux et. al, 2014; Rice, 2014; Smarkola, 2008; Teo, 2013). For this study, three constructs from Capo and Orellana (2011), as well as Ajjan and Hartshorne (2008), were adopted. These are: 1) attitude is decomposed into perceived usefulness, perceived ease-of-use, and compatibility; 2) subjective norm is broken down into peer influence, parent influence, student influence, and superior influence; and 3) perceived behavioral control is decomposed into hardware access, technical support, professional technical support, and self-efficacy. As such, this theoretical framework can help better understand what factors influence the adoption of Google Earth, and help reveal explanations behind the decision of incorporating the software in teaching ELL students.

Research Questions
The study asks the following research questions:

RQ1: To what degree are ELL teachers in a rural New England state using Google Earth in their teaching?

RQ2: What attitudes do ELL teachers in a rural New England state possess regarding the use of Google Earth technology in their teaching?

RQ3: Which factors best predict the decision of ELL teachers in a rural New England state to adopt Google Earth for their teaching?

Methods

This study used an online quantitative survey methodology. Qualtrics software was used to distribute the online survey in the recruitment emails, and the survey was administered online using the Tailored Design Method (Dillman, Smyth, & Christian, 2014). An invitation to participate, including a link to the survey, was sent by email to participants, who were contacted via email weekly for four consecutive weeks. The survey closed at the end of the fourth week.

The sample of this study consisted of K-12 ELL teachers of public schools in a rural New England state, who were employed at the time of the study. Participants and their emails were defined using the state department of education (SDOE) data management system. All 145 in-service ELL teachers that could be contacted were invited to participate in the online survey via email. Once an individual responded to the survey, they were taken off the reminder email list and did not receive any more prompts requesting their participation. A total of 45 ELL teachers began the survey (31%) and 40 completed the survey (28%).

Materials, measures, and procedures

The survey instrument was adapted from Ajjan and Hartshorne (2008). Survey items were measured using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Face validity refers to the extent to which a test appears to measure the criterion it intends to measure (Reinard, 2006), and changes were made to ensure face validity while collecting the opinions of ELL experts (Ajjan and Hartshorne, 2008; Capo and Orellana, 2011; Smarkola, 2008). Based on face validity, questions measuring technical support and professional technical support were removed since they were not identified as pertinent for our sample of ELL teachers. ELL experts also established the suitability of language, item content, and questions to include and/or eliminate. This provided support for content validity, which provides evidence that the item being used is appropriate and comprehensive as it relates to our intended measurement concept, population, and use (Reinard, 2006).

Data analysis

Descriptive and inferential statistics were used to interpret the quantitative data collected for this study. Cronbach's alpha was calculated to test the internal reliability of the survey instrument. The results of these analyses are listed in Table 1. The alpha values ranged from 0.414 to 1.0. Due to having a smaller return rate and population size, Chi-square and t-test analysis were conducted using SPSS to examine the relationships among adoption factors.

Table 1: Survey Items by Construct

Variable	Survey Item	Cronbach's α (Adjusted α)
Actual Usage (ACT)	ACT1: I believe that I could communicate to others the consequences of using Google Earth in the classroom. ACT2: I would have no difficulty explaining why Google Earth may or may not be beneficial.	0.824 (0.824)
Intention to Use (INTU)	INTU1: I plan to use Google Earth wen teaching INTU2: I intend to use Google Earth with my class during this academic year. INTU3: I will add Google Earth to my class next academic year.	0.887 (0.892)
Attitude (ATT)	ATT1: Google Earth is useful in my teaching. ATT2: The advantages of using Google Earth outweigh the disadvantages of not using it. ATT3: Using Google Earth is a good idea.	0.842 (0.852)
Perceived Usefulness (USE)	USE1: I feel that using Google Earth will help my EL students learn more about the subject. USE2: I feel that using Google Earth will improve EL students' satisfaction with my teaching. USE3: I feel that using Google Earth will improve my EL students' grades. USE4: I feel that using Google Earth will improve EL students' feedback on my teaching. USE5: To help my EL students better learn the material, I will incorporate Google Earth in my teaching.	0.911 (0.913)
Perceived Ease of Use (PEU)	PEU1: I feel that using Google Earth will be easy. PEU2: I feel that using Google Earth will be easy to incorporate in my teaching environment.	0.414 (0.414)
Student Influence (STU)	STU1: EL students who influence my behavior think that I should use Google Earth in my teaching. STU2: EL students who are important to me think that I should use Google Earth in my teaching.	0.985 (0.985)
Superior Influence (SUP)	SUP1: my superior(s) who influence my behavior would think that I should use Google Earth in my teaching. SUP2: My superior(s) whom I report to would think that I should use Google Earth in my teaching.	0.968 (0.968)
Perceived Behavioral Control (BEH)	BEH1: Using Google Earth is entirely within my control. BEH2: I have the knowledge and ability to use Google Earth.	0.458 (0.478)

Variable	Survey Item	Cronbach's α (Adjusted α)
Hardware Access (HRD)	HRD1: Google Earth is compatible with the computer I already use in my teaching. HRD2: My EL students have access to the computers they would need to use Google Earth. HRD3: I can use Google Earth using any computer connected to the Internet.	0.700 (0.722)
Self-Efficacy (SELF)	SELF1: I would feel comfortable using Google Earth. SELF2: I could easily use Google Earth on my own. SELF3: I would like to know more about Google Earth as an educational tool.	0.902 (0.906)
Compatibility (COMP)	COMP1: Using Google Earth is compatible with the way I teach. COMP2: Using Google Earth fits well with the way I teach.	0.935 (0.937)
Subjective Norm (SN)	SN1: My peers are using Google Earth in their classroom. SN2: My superior(s) confirms my ability and knowledge to use Google Earth in my teaching. SN3: My peers think I will benefit from using Google Earth in my teaching. SN4: My superior(s) thinks it is important I use Google Earth in my teaching. SN5: My EL students think it is important I use Google Earth in my teaching. SN6: The parents of my EL students think it is important I use Google Earth in my teaching.	0.881 (0.881)
Peer Influence (PEER)	PEER1: My peers who influence my behavior would think that I should use Google Earth in my teaching. PEER2: Peers whose opinion I value would think that I should use Google Earth in my teaching.	0.922 (0.922)
Parent Influence (PAR)	PAR1: Parents who influence my behavior think that I should use Google Earth in my teaching. PAR2: Parents who are important to me think that I should use Google Earth n my teaching.	1.00 (1.00)

Results

Of the 40 ELL teachers who completed the study, 38 were female (95%) and two were male (5%). With regards to race/ethnicity, 37 of the participants identified as White (92.5%), one identified as American Indian or Alaska Native (2.5%), one identified as Hispanic, Latino, or Spanish origin (2.5%), and one identified as "other" (2.5%). Regarding age, 20 of the participants were 50 years old or older (50%), nine were between 30-39 years old (22.5%), six were 40-49 years old (15%), and five were under 30 years old (12.5%).

All participants were currently teaching in at least one public school grade (K-12) and most were also teaching multiple grades and subjects. The participants self-identified as teaching a variety of subjects, as 93% of participants reported teaching English; 78% mathematics; 78% social studies; 68% science; and 34% other subjects. The other subjects provided by respondents were "ELL teacher," "art classes," "language development", "communication", "health", and "whatever is needed." When asked to indicate the types of ELL programs that were provided in their school, 60% responded as having structured immersion programs. Here, ELL students are primarily taught in English and receive language development support with this program

structure being carefully planned by ELL teachers/staff and school administrators. 32% of participants reported that their school has non-structured immersion programs, where ELL students are taught in English only and receive language development support, but the way this is provided is not structured. Finally, 8% indicated that their school has a bilingual program where ELL students receive instruction in both English as well as their native language at different time periods during each day until they develop English language skills. Of all the participants, 37% indicated that they teach an equal amount of time in both the inclusion and resource educational setting, 34% teach in the resource setting only, 21% teach in the inclusion setting only, and 8% reported that they teach other. Participants in the study tended to have more teaching experience than less, as 39% had taught for 15+ years, 39% had taught for 6-14 years, 22% had taught 1-5 years, and 0% had taught for less than 1 year.

RQ1: Current Google Use

When asked if using Google Earth would help improve their students' learning, 69% of participants were positive in their responses. In terms of student satisfaction, 43% felt that Google Earth would increase their students' satisfaction with the class, while 14% felt that it would not increase their students' satisfaction. Moreover, only 19% agreed or strongly agreed that using Google Earth would improve student grades.

Additionally, 48% of ELL teachers surveyed felt that Google Earth could be easily incorporated in their teaching environment. With regards to teaching, 67% felt that using Google Earth was a good idea in general. However, 36% reported that Google Earth is useful in their own teaching, whereas 21% indicated that it is not. Moreover, 45% felt that Google Earth fits well with the way they teach, where 5% felt that it does not fit well. When asked about their general use of Google Earth, 90% of the teachers reported using or planning to use the technology. In regards to integrating the use of Google Earth with their teaching, 78% reported using or planning to use it, and 21% reported their intent to use Google Earth within the next school year. While a large majority of participants reported using or intending to use Google Earth, only 5% report receiving professional training on the use of Google Earth. Furthermore, 63% of participants indicated they would feel comfortable using Google Earth, and 85% of ELL teachers reported that they would like to know more about Google Earth as an educational communication tool.

RQ2: Attitudes

To better understand how ELL teachers' attitudes, influence, and shape the likelihood of adoption among them, we applied DTPB as a theoretical lens. Participants reported that their overall attitude of Google Earth is edging towards positive (M=3.41). However, when comparing ELL teachers who intend to use or are using Google Earth (M=3.43), to those who are not using or have no intention to use Google Earth (M=2.08), there are significant differences in attitudes between the groups. A Chi-Square test indicated that participants who are using or plan to use Google Earth reported significantly higher than those who do not intend to use it, that Google Earth is useful in their teaching ($\chi^2 = 22.67$, p < .001).

Moreover, compared to those who do not intend to use Google Earth, teachers who intend to use or currently using it significantly indicate that the advantages of using Google Earth outweigh the disadvantages of not using it ($\chi^2 = 14.30$, p = .003). In addition, those who are using or intend to use Google Earth, significantly believe that using Google Earth is a good idea compared to those who are not using or have no intention to use it ($\chi^2 = 13.39$, p = .001). Therefore, it appears that teachers who are using or intend to use Google Earth have much more positive attitudes towards using Google Earth in their teaching compared to those who do not use

or have no intention to use Google Earth. This is not surprising, especially since school leaders and educators who have positive attitudes or beliefs in meeting the diverse and cultural learning needs of their students tend to be more open about using various and more innovative approaches when educating their students (Theoharis & O'Toole, 2011). Table 2 summarizes the results in this section.

Table 2: Chi-square results for Attitude

Variable with Survey Items	Pearson Chi-Square	df	Sig.
ATT1	22.67	4	.000
ATT2	14.30	3	.003
ATT3	13.39	2	.001

RQ3: Factors that predict intention to use Google Earth

In order to determine what factors best predict ELL teachers' intention to use Google Earth in their teaching, a *t*-test was conducted to determine the difference between ELL teachers who are using or intend to use Google Earth and those who have no intention to use Google Earth. Results indicate that there was no significant difference between the ELL teachers who intend or are using Google Earth in their teaching (M=3.66) to those who are not using Google Earth (M=3.17) with perceived behavior control, *t* (39) = -1.95, p = .079.

However, results show that there are significant differences between ELL teachers who are using or intending to use Google Earth (M=3.71) compared to those who have no intention of using Google Earth (M=2.67), *t* (40) = -5.88, p < .001. When looking at subjective norms, it appears that there was no significant difference between the ELL teachers who are using or intending to use Google Earth (M=2.62), to those who have no intention to use Google Earth (M=2.25), *t* (40) = -1.874, p = .068. Therefore, teacher's attitude seems to be the best factor regarding ELL teacher's intention to use Google Earth in their teaching. Table 3 summarizes the *t* test results.

Table 3: *t* test results

	t	df	Sig.	Mean Difference	Std. Error Difference
BEHTOTAL	-1.806	39	.079	-.48851	.27048
ATTTOTAL	-5.877	40	.000	-1.04444	.17773
SNTOTAL	-1.874	40	.068	-.37222	.19861

Discussion

Of the respondents, only 5% reported that they had received some sort of professional training on using Google Earth, which stands in stark contrast to the 78% of participants that said they use or intended to use the technology. This has implications for school leaders, as much professional development training is needed, since most ELL teachers are not certain about how to incorporate Google Earth into their educational setting, the content that they teach, or grade level they support. These results suggested the ELL teachers might not be completely aware of the benefits of GIS communication technologies (i.e. Google Earth) for improving ELL student learning and achievement (Bloom & Palmer-Moloney 2004; Goldstein & Alibrandi, 2013;

Hagevik 2003; Kerski, 2001; Pan & Pan, 2009; Reed & Railsback, 2003). This has important implications for educational leadership and the ability for administrators to promote diversity and social justice for their ELL students in their schools (Theoharis & O'Toole, 2011).

Using a modified version of DTPB to analyze ELL teachers' intention to use Google Earth, teacher attitude was the only significant factor of an ELL teacher's intention to use Google Earth. There was no evidence that perceived behavioral or social norms impacted intentions to use. This is consistent with previous research that looked at STEM teachers' attitudes and intentions to use Google Earth in their teaching (Rice, 2014). When comparing ELL teachers who were using or intended to use Google Earth compared to those who did not, there was a significant difference between the two groups when looking at whether their peers are using Google Earth in their classroom. This suggests that ELL teacher development programs that seek to increase Google Earth technology acceptance should focus resources on developing positive teacher attitudes toward using Google Earth. Peers who are already using GIS pedagogical tools, like Google Earth, may be an important factor with this, as peer mentoring among teachers can be a powerful motivator with adopting educational tools into pedagogical practices (Bailey, Ornduff, & Kennedy, 2009; Capo & Orellana, 2011; Chien, Wu, & Hsu, 2014). ELL teachers in this rural New England state could want professional assistance, which would enable them to learn how to use Google Earth and how to incorporate it into their teaching. Workshops and other training materials delivered online, such as a webinar, could be helpful ways to deliver this training.

This research has does have limitations. First, accurate contact information was difficult to obtain for this population, especially since there is a limited pool of ELL teachers in rural states (Johnson et al., 2014) and in particular the rural state studied. The data system used for drawing the survey population included some teachers in the sample who were no longer teaching, who could not be used for the purposes of this study. Second, the low Cronbach's alpha that was obtained in the Perceived Behavioral Control measure (0.458) and for the Perceived Ease of Use (0.414) were below the typical acceptable limits for measure reliability. This suggests that future studies should further develop this measure. Despite this, the constructs were still used in the calculations for this study, suggesting that the results related to Perceived Behavioral Control and Perceived Ease of Use be interpreted cautiously. Third, the DTPB was modified based on face validity and content validity, resulting in questions that measured Technical Support and Professional Technical Support to be removed from the survey. Future studies may also want to develop this instrument further, especially when interested in studying teachers who teach in ELL and/or special education classroom settings. The final limitation is the small sample size due to the population. The specific rural New England state used in this study has low numbers of ELLs compared to other rural states, specifically those in the southwest United States (Johnson et al., 2014). This resulted in a smaller population and sample size. Hence, it is extremely possible that teachers from other rural states with higher ELL populations would respond differently. The study provides current information about ELL teachers' perceptions of Google Earth when teaching their ELL students in this rural New England state.

Conclusion

Previous research suggests that Google Earth would be useful for improving the academic performance of ELL students. This study assessed the attitudes and intentions of ELL teachers in a rural New England state towards the use of Google Earth in their teaching when

working with their ELL students. Results suggested these ELL teachers were overall positive about Google Earth but appeared to have relatively little knowledge about the usefulness of the tool for their students.

Future studies may want to increase the population and sample size, as well as use a mixed methodology approach when exploring ELL teachers' perspective on using Google Earth in their teaching. Further studies should also look at how ELL teachers are using GIS tools, which may inform the development of teacher training and development programs. Further research could also discuss how ELL teachers are using Google Earth to engage ELL students, specifically with a culturally relevant pedagogy. Finally, future research should look at principals and other school leaders' perception of, and intentions to, use Google Earth in their schools.

GIS communication technology is beneficial for ELL students and their learning when used with proper methods, materials, and purposes. Google Earth is a specific GIS communications tool that can be used in K-12 classrooms across all subject areas. This study demonstrates that some ELL teachers in this rural New England state are already using this technology to enhance their ELL students' language development and learning experiences. It also shows that these ELL teachers are interested in using Google Earth but need additional professional development. Given the focus on accountability for student learning at state and federal levels, new training methods should be developed and tested for ELL teachers in rural states to understand the true value of Google Earth regarding ELL students' language development and learning outcomes.

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