

## ***Mobile Learning and its Effects on Academic Achievement and Student Motivation in Middle Grades Students***

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### **Abstract**

This experimental research investigates the academic achievement and motivation of 104 sixth grade social studies students when incorporating mobile devices into the classroom. Specifically, this study was designed to test the use of mobile devices as a more effective approach to student learning than using paper materials. In addition, the current study specifically examined changes in students' perceptions of learning, interest in learning and academic motivation when incorporating mobile devices into classroom instruction. The findings show that motivation can be enhanced when incorporating mobile devices. Yet, the current study found no effect of mobile learning on higher academic achievement in this sample. This study sheds light on the importance of mobile devices in the classroom. The findings encourage the use of mobile devices due to their effect on motivation, which may offer an interactive classroom environment where students feel enthusiastic and eager to learn.

**Keywords:** Mobile Learning, Mobile Devices, Engagement, Academic Achievement, Interest, Perception of Learning, Academic Motivation.

### **Introduction**

In recent years, cell phones and other mobile devices have at times been banned in public school classrooms due to the potential disruptions that could arise. Many believed mobile devices to be a problem because of potential student abuse, such as cheating, texting, and sexting. However, as educators began to see the need for students to be able to communicate with parents in certain situations and the potential instructional benefits, students in many cases were eventually able to carry mobile devices into the classroom. Some school districts have gone even further and now regularly allow students to use personal technology in the classroom, while others hold firm to their technology bans. The question that plagues many districts is whether or not mobile devices belong in the classroom and whether or not their use can contribute to students' learning.

A number of studies have been conducted on the use of mobile devices in the classroom. Some studies have found that mobile devices, when used appropriately, may impact students' academic achievement, as well as students' dispositions towards learning (Huang, Lin & Cheng, 2010; Lu, 2008; Thomas & Orthober, 2011). Such findings, along with the proliferation of educational technology tools and platforms over the last two decades, have led to the integration of a variety of forms of technology in the classroom and new instructional strategies. Yet other findings suggest mobile devices either have no long term effect on academic achievement or that they hinder learning (Froese et al., 2012; Lu, 2008; Sung & Mayer, 2010). Additional research is needed to better understand the effects of mobile learning on academic achievement and student motivation.

### ***Academic Achievement***

The number of experiments that have been conducted to determine how to support learners using mobile devices in and out of the classroom has been rapidly expanding. However, a consensus on the most effective methods has not yet been reached. Thomas and Orthober (2011) found that sending English and Latin students text-messages after class about course related topics, including daily reminders of assignments and tests, appeared to increase student preparedness and task completion. Additionally, 92% of students reported finding the daily text reminders as useful in helping them complete their assignments successfully because they were able to quickly and conveniently communicate with their instructor after school hours. While this specific finding was based on a self-reported measure of students' perceptions of their performance, it nevertheless speaks to their view of how the technology impacted their achievement in class.

Huang, Lin and Cheng (2010) found that the incorporation of mobile devices into an elementary botany class contributed to slightly higher post-test scores than those students who completed the same activity with a book. In a similar yet smaller study, Lu (2008) examined the effectiveness of using a mobile device compared to paper learning with students in Taiwan learning English. The experiment revealed both groups made significant progress from the pre-test, but post-test scores showed evidence of a higher gain in vocabulary knowledge on immediate quizzes among the mobile groups. However, when tested weeks later, any advancements in learning due to mobile devices were lost and both groups' gains were not significantly different.

Another study examined teacher perceptions of students' academic achievement when mobile devices were incorporated into the classroom (Navaridas et al., 2013). The researchers found that 53% of teachers surveyed at different grade levels perceive mobile devices as greatly impacting student learning in their classroom. Approximately 38% of those teachers surveyed believe mobile devices have significantly impacted learning in their classroom. In contrast, 9% of teachers responded that mobile devices made no difference in the learning in their class. However, no data was provided to verify the data on teacher perceptions and students' actual academic advancements.

There is concern over the potential disruptions that could arise when mobile devices are introduced into the learning environment. For example, Froese et al. (2012) tested college students in Kentucky and discovered evidence that students who freely sent text messages during instruction scored 27% lower than students who silenced their phones during instruction. Such inappropriate use by students may negatively impact learning because it may split their attention, therefore diminishing retention of the material. Sung and Mayer (2010) suggest that mobile technology itself is not sufficient to the increase in student learning; rather it is the method of delivery that is significant. Given the mixed research on the topic, additional research is needed to determine the impact mobile devices may have on student academic achievement when compared to paper-based learning.

### ***Student Interest in Mobile Learning***

Educators today are using technology to engage students and encourage students to learn. Numerous studies have shown evidence of increased interest to learn when mobile devices are incorporated into the learning environment. Huang, Lin and Cheng (2010) found that incorporating mobile devices into an elementary botany class significantly impacted students' dispositions, including more positive perceptions towards the activity when using mobile devices. When incorporating a mobile activity

only 6% of students in mobile groups reported disliking the learning activity whereas 25% of students in traditional settings reported disliking the learning activity. These researchers argue that the inclusion of mobile devices alone significantly impacted students' interest towards the subject and learning.

Other research has shown that teachers perceive an increase of student interest and activity when incorporating mobile devices (Navaridas, Santiago, & Tourón, 2013). When incorporated into the learning environment, Burkhardt and Cohen (2012) found mobile devices to be an effective tool for classroom polling, which increased student engagement and participation by forcing each student to respond to classroom questions. Sung and Mayer (2013) found that participants using mobile devices were more satisfied by their learning activities than participants using desktop computers. Both groups reported a higher interest in studying from mobile devices.

Brett (2011) has argued that there may be strong negative perceptions for the use of text messages for learning purposes when students were not convinced of the value of mobile learning. The participants in multiple studies felt that their mobile devices were personal devices, and when overused, mobile learning was an intrusion of their personal time and technology (Brett, 2011; Gedik, Hanci-Karademirci, Kursun & Cagiltay, 2012).

### *Aspects of Motivation*

Technology is often incorporated into the learning environment in hopes of motivating students with a platform they are already familiar with. Research offers an insight into the potential correlation between mobile devices and student motivation. For example, during a study comparing a mobile learning system to a textbook, teacher and researcher observations found higher engagement, enthusiasm and motivation among mobile users (Huang et al., 2010). Likewise, mobile devices may be used to encourage students to study the content (Gedik et al., 2012). In a small study of Turkish high school students, participants responded that receiving daily mini-mobile lessons by text message increased students' motivation to study the subject outside of class. Worm and Buch (2014) found that electronic learning with competitive elements led to an increase of motivation to outperform peers. Mobile learning may have an impact on student motivation that encourages student learning inside and out of class.

Various studies show evidence that competition incorporated into mobile learning may further increase motivation and engagement. Worm and Buch (2014) incorporated competition widgets into electronic learning modules for a large group of medical students. Participants from the competition modules scored significantly higher on quizzes and post-test than the control group who had no elements of competition with their learning modules. Other research examined mobile learning's effects on intrinsic motivation (Ciampa, 2014). Evidence was found that incorporating mobile devices into the learning environment led to a significant impact in student mastery when students were encouraged to compete against their prior scores. After a period of twenty minutes, observers reported each participant improved prior scores by half. This level of indirect competition greatly influenced students' motivation to learn and master content. Likewise, studies have reported that younger students, as compared to adults, have a higher increase in motivation to learn when competition is incorporated into computer based learning activities (Leen & Lang, 2013).

### ***Summary of Literature***

Studies on mobile learning provide diverse evidence on the effectiveness of mobile devices on actual academic achievement (Froese et al., 2012; Huang et al., 2010; Lu, 2008; Sung & Mayer, 2010; Thomas & Orthober, 2011). Further, there is differing information on the impact of mobile learning to increase student interest in the classroom (Huang et al., 2010; Burkhardt & Cohen, 2013; Brett, 2011). However, mobile devices are considered a motivating factor for learning according to both teachers and students (Huang et al., 2010; Gedik et al., 2012; Navaridas et al., 2013). Additional research is necessary to better understand the use of mobile devices in the classroom and its effects on students' academic achievement and motivation.

### ***Current Study***

The current study was intended to explore the impact of mobile learning in middle school students' academic achievement and motivation. Specifically, this study was designed to test the use of mobile devices as a more effective approach to student learning than using paper materials. In addition, the current study investigated students' motivation to use mobile devices. This experimental study may drive future instruction based on findings on academic achievement and motivation. As there was conflicting research on the topic of mobile learning, conclusions drawn from the current study may offer evidence that expands our understanding of mobile learning in the middle grades classroom. Since benefits have been identified, classroom lessons may be delivered more frequently through mobile devices.

### **Method**

#### ***Contextual Factors***

This study was conducted in the southeast area of the United States in the state of Georgia. The area is a northern suburb of the Atlanta metropolitan area. According to the United States Census Bureau, it is estimated that the county's 2013 population was 195,405 (2014). The county has a median annual household income of \$87,585. The school district is one of the ten largest school districts in Georgia.<sup>1</sup> Between 2005 and 2010, the school district was ranked as one of the fastest growing school districts in United States. At the county level, the major demographics are Caucasian 71%, Hispanics 13%, and Asian 10%. The area is more affluent than most surrounding areas.

As of August 2013, the middle school that was the focus of this study had approximately 954 students.<sup>2</sup> The racial demographics were as such: 77% White; 13% Asian; 5% Hispanic; 3% multi-racial; and 2% Black. The school had 49% female students. There were no ELL/ESOL students serviced at the school. Less than 7% of its students were economically disadvantaged. Approximately 33% of the school's students were served within the gifted program, while 7% of its students received disability services.

Four sixth grade social studies classes were the subject of this study. Participants came from two co-taught classes with one certified teacher and a paraprofessional and two classes taught by the same certified teacher. Within each class, some students were serviced by the special education department.

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<sup>1</sup> Citation withheld to protect the identity of the school system.

<sup>2</sup> Citation withheld to protect the identity of the school.

104 participants were included in the study. Of the participants, 61% were male and 16% of students were serviced by the special education department. There were 59 students in the control group and 45 in the treatment group.

### ***Material and Measures***

#### *Content materials*

Sixteen passages and 67 questions from Georgia CRCT Test Prep 6<sup>th</sup> Grade Social Studies: Teaching the Georgia Performance Standards, which covers objectives related to Latin America, were used as the content for the daily interventions. Each of these was converted to an electronic format for reading on mobile devices by the experimental group. The passages and questions were selected from a sixth grade norm-referenced study aid book. The control group read from the study aid book itself. The passages ranged from one paragraph to one page. The Flesch–Kincaid readability test ranks the passages from grade levels 7 to 12.

#### *Achievement measure*

In order to assess the subjects' knowledge of the given objective, a twenty-five multiple choice teacher-made test was administered as a pre and post assessment. The assessment was created from assessments contained within *Georgia's Exploring Our World*, (Boehm, 2012), *Georgia CRCT Test Prep 6th Grade Social Studies Teaching the Georgia Performance Standards* (Mullins, 2009), *6th Grade Social Studies* (Marsh, 2008) and *Georgia Milestones Assessment Guide: Grade 6* (Georgia Department of Education, 2014). Scores from the teacher-made assessment were used in the statistical analysis. The teacher-made assessment covers Georgia Performance Standards on geography, government, economy and history of Central America and the Caribbean.

#### *Motivation measure*

A 5-point Likert Scale questionnaire is provided in Appendix 1 and was used as a pre and post assessment. This questionnaire, adapted from Wigfield and Guthrie (1997) as well as Brett (2011), assessed students' motivation and attitudes prior to any intervention and again after the intervention. Specifically, the survey measured students' motivation to learn social studies using mobile devices. The constructs designed for the motivation survey are perceptions of student learning, interest in mobile learning, academic motivation and motivation through competition. The questionnaire contained twenty items with five choices: strongly agree, agree, neutral, disagree and strongly disagree. The questionnaire contained positively and negatively worded items to ensure reliability.

### ***Procedures***

There were two groupings in this study, consisting of four classes total, two treatment groups and two control groups. The classes involved were sixth grade social studies classes.

One group consisted of one on-level treatment group and one on-level control group. This group was taught by a certified teacher. The on-level classes were compared to each other on pre and post achievement and motivation measures.

The other group consisted of one co-taught treatment group and one co-taught control group. This group was taught by the same certified teacher along with a paraprofessional. The co-taught classes were compared to each other on pre and post achievement and motivation measures. These co-taught

classes were compared this way for two reasons: to compare students of similar ability levels and to control for teacher effects.

All classes followed the same curriculum and read the same content material. The pre-test was administered to all groups prior to any instruction. The intervention occurred 15 minutes per day for five days a week for a period of three weeks for a total of 16 class periods and approximately 4 hours. A post-test was administered to all groups following the three week period.

#### *Control group*

The control groups read the same passages and answered the same multiple choice questions as the treatment groups. Students were directed to independently read the material and questions from the textbook and answer the multiple-choice questions on a separate sheet of paper. Questions were in writing and after a period of ten minutes, the questions were read aloud from the textbook by the teachers and the correct response was discussed aloud as a whole-group.

#### *Treatment group*

The treatment groups used mobile devices to log in to an online learning platform used by the subject district. Once logged in, students were directed to open the teacher's classroom page and independently read the daily passage from their mobile devices. Students then answered the same multiple choice questions electronically by selecting the answer that was correct. Questions were in writing and after a period of 10 minutes, the questions are read aloud by the teachers. Responses were then discussed as a whole class. Thus, the majority of variables, such as the reading selections, test items, and post-reading discussions, were the same for both groups. The difference was the independent variable- the treatment group's use of mobile technology to complete the tasks.

### **Results**

All analyses were conducted using ANCOVA to measure the change in student achievement and motivation for learning while controlling for initial levels. For each analysis the dependent variable was either the post-survey or post-achievement measure and the covariate was either the pre-survey or pre-achievement measure. The condition was the group status. In the end, there was no statistically significant difference in the students' academic achievement between the control and treatment groups. However, there was a statistically significant difference between the treatment and control groups' change in their perception of learning, interest in learning and academic motivation.

#### *Academic Achievement*

ANCOVA was used to measure the overall achievement between the control and treatment groups. The dependent variable was the post-achievement measure and the covariate was the pre-achievement measure. Overall, after combining the collaborative and the non-collaborative treatment group and collaborative and non-collaborative control groups' achievement data, there was not a statistically significant difference,  $p = .687$ , between the control and treatment groups' growth from the pre-test to the post-test.

The control and treatment groups were compared, using ANCOVA, to measure the students' retention of knowledge from the post-achievement measure to a second post-achievement measure given two weeks after the unit concluded. The dependent variable was the second post achievement measure given two weeks after the unit concluded. The covariate was the first post-achievement

measure. There was no statistically significant difference,  $p = .071$ , between the control groups and the treatment groups retention of knowledge. Each group retained knowledge in similar proportions. The pre and post achievement scores for each group are illustrated in Figure 1 below.

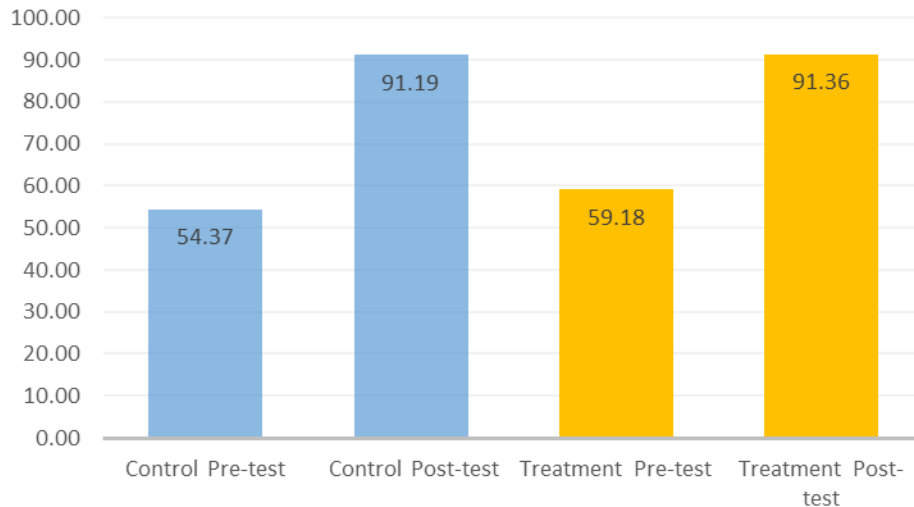


Figure 1 Mean academic achievement

**Perception of Learning**

An ANCOVA was used to compare the change in students’ perception of learning. When the control groups were compared to the treatment groups, there was a statistically significant difference between groups change in students’ perception of learning,  $p = 0.050$ . The dependent variable was the post-survey mean score for the constructs on perception of learning. The covariate was the students’ pre-survey measure constructs. There was a difference by condition, in which the students felt like the mobile device had significance in their learning. The treatment group showed a greater change in their perception of learning as compared to the control group. Means and standard deviations for the perception of student learning analyses can be found in Tables 1 and 2.

Table 1 Perception of student learning with pre-survey measures as the covariate; control versus treatment

Condition	Mean	Std. Deviation	N
Control	4.1314	0.73455	59
Treatment	4.4018	0.51472	45
Total	4.2484	0.65965	104

Table 2 Perception of student learning with pre-survey measures as the covariate; control versus treatment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16.331 <sup>a</sup>	2	8.165	28.949	0.000
Intercept	7.629	1	7.629	27.047	0.000
PerceptsPREtest	14.464	1	14.464	51.279	0.000
Condition	1.113	1	1.113	3.945	0.050
Error	28.488	101	0.282		
Total	1921.874	104			
Corrected Total	44.819	103			

a. R Squared = .364 (Adjusted R Squared = .352)

***Interest in Mobile Learning***

To compare students' interest in mobile learning, ANCOVA was conducted using post-survey mean scores for the construct of students' interest in mobile learning. There was a statistically significant difference between groups,  $p < 0.001$ , when comparing the change in students' interest in mobile learning. The dependent variable was the mean score on the post-survey construct for students' interest in mobile learning and the covariate was the pre-survey measure constructs. There was a difference by condition, in which the students reported they had an increased interest in learning when using mobile devices. The treatment group showed a greater change in their interest in mobile learning as compared to the control group. Means and standard deviations for the interest in mobile learning analyses can be found in Tables 3 and 4.

Table 3 Interest in mobile learning with pre-survey measures as the covariate; control versus treatment

<i>Condition</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>N</i>
Control	3.8807	0.89402	59
Treatment	4.3407	0.53414	45
Total	4.0797	0.79019	104

Table 4 Interest in mobile learning with pre-survey measures as the covariate; control versus treatment

<i>Source</i>	<i>Type III Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Corrected Model	38.858 <sup>a</sup>	2	19.429	77.090	0.000
Intercept	6.211	1	6.211	24.644	0.000
InterestPREtest	33.456	1	33.456	132.747	0.000
Condition	5.587	1	5.587	22.170	0.000
Error	25.455	101	0.252		
Total	1795.294	104			
Corrected Total	64.313	103			

a. R Squared = .604 (Adjusted R Squared = .596)

***Academic Motivation to Use Mobile Devices***

When comparing the change in students' academic motivation, there was a statistically significant difference between groups,  $p = .007$ . ANCOVA was used to make the comparison with the mean scores from the post-survey measure constructs on academic motivation to learn using mobile devices as the dependent variable and the pre-survey measure constructs as the covariate. There was a difference by condition, in which the students reported they had increased academic motivation in learning when using mobile devices. The treatment group showed a greater change in their academic motivation to use mobile devices as compared to the control group. Means and standard deviations for the interest in mobile learning analyses can be found in Tables 5 and 6.

Table 5 Academic motivation with pre-survey measures as the covariate; control versus treatment

<i>Condition</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>N</i>
Control	3.8898	0.86761	59
Treatment	4.0833	0.55902	45
Total	3.9736	0.75276	104



Table 6 Academic motivation with pre-survey measures as the covariate; control versus treatment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15.312 <sup>a</sup>	2	7.656	17.961	0.000
Intercept	14.997	1	14.997	35.182	0.000
MotivationPREtest	14.357	1	14.357	33.680	0.000
Condition	3.243	1	3.243	7.607	0.007
Error	43.052	101	0.426		
Total	1700.438	104			
Corrected Total	58.365	103			

a. R Squared = .262 (Adjusted R Squared = .248)

The pre and post disposition data for both groups for each of the four constructs can be found below in Figure 2.

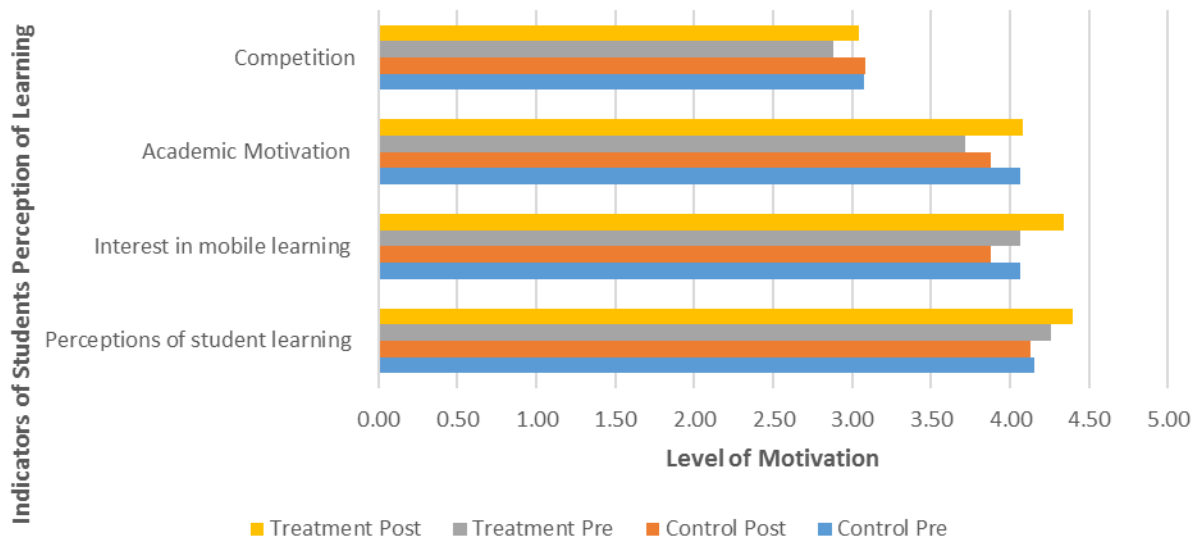


Figure 2 Average effect on student perception of learning

**Discussion**

The findings in regard to changes in academic achievement when using mobile devices were not promising and like a number of previous studies showed no significant differences between groups ((Froese et al., 2012; Lu, 2008; Sung & Mayer, 2010). The analysis showed both the control and treatment groups had similar growth from the pre-achievement measure to the post-achievement measure. Further, there was no significant difference in the retention of knowledge when comparing the control and treatment groups.

This finding is interesting given the prior findings on the subject. Huang, Lin and Cheng (2010) found that the incorporation of mobile devices rendered slightly higher post-test scores than those students who completed the same activity with a book. The current study found no effect of mobile learning on higher academic achievement. The paper learners had similar achievement and retention to those learners who received the mobile instruction. These results mirror those of Lu (2008), who found similar growth in both the mobile device learners to paper learners from the pre-test to post-

test. However, when tested weeks later, Lu (2008) also found any advancements in learning due to mobile devices were lost and both groups' gains were not significantly different.

In regard to student motivation when using mobile devices, the results offered several promising conclusions. The analysis showed a significant change in students' perception of learning when using mobile devices as compared to paper learners. Further, the analysis showed a significant change in students' interest to learn using mobile devices among the treatment group. Finally, there was a significant change in students' academic motivation when incorporating mobile devices among the mobile groups. Those findings are described in detail below. Overall, there was a significant change in students' motivation and interest when incorporating mobile devices into the classroom environment.

An important outcome emerged from this study. The students who used mobile devices showed a significant increase in their perception of learning. This finding suggests that the students who received the treatment felt a positive change in their learning. These students felt more successful in their learning throughout the unit. This is consistent with other findings on the topic. Huang, Lin and Cheng (2010) found that incorporating mobile devices into the classroom significantly impacted students' dispositions, including more positive perceptions towards the activity when using mobile devices. In addition, other studies have shown teachers to have higher perceptions of students' academic achievement when mobile devices were incorporated into the classroom (Navaridas, Santiago & Touron, 2013). Although the treatment groups did not have significant growth in their academic achievement as compared to the control groups, their perception of learning was much higher.

In a like manner, the current study found there was a highly significant difference when comparing the change in students' interest in mobile learning. Since the treatment group's mean ( $M = 4.34$ ) was higher than the control group's mean ( $M = 3.88$ ), it is clear that the treatment group showed a greater change in interest in mobile learning. The mobile group's interest in mobile learning increased significantly. This is consistent with findings such as those that have shown teachers to perceive an increase of student interest and activity when incorporating mobile devices (Navaridas et al., 2013). Likewise, Sung and Mayer (2013) found that participants using mobile devices were more satisfied by their learning activities than participants using desktop computers.

The last significant finding was the change in students' academic motivation. Students in the treatment groups felt like they had an increased academic motivation in learning when using mobile devices. Because the treatment groups' mean was higher, it appears the treatment group ( $M = 4.08$ ) showed greater change in academic motivation in mobile learning than the control group ( $M = 3.89$ ). This, too, is consistent with other findings comparing mobile learning systems to a textbook, in which teacher and researcher observations found higher engagement, enthusiasm and motivation among mobile users (Huang et al., 2010).

### **Limitations**

There were several limitations to this study. First, on some occasions, students within the mobile group did not have access to a mobile device, either because the battery was dead, it was forgotten at home or they did not own a mobile device. In those instances, students would work from desktop computers. In a very rare occasion, they would work from paper materials. This may have limited some students' opportunity to fully participate in the study.

Further, the school district closed school on six days due to inclement weather during the course of the current study. While the study still included fifteen days of intervention, the study was interrupted by that inclement weather and possibly affected the academic performance of all students within the study. However, if any momentum was lost, both the control and treatment groups were affected by the inclement weather to the same degree.

In addition, on three of those inclement weather days, students were required by the school district to participate in online learning activities for each of their classes. Essentially, all students were exposed to a different technological intervention. While the online learning system is used in and out of the classroom daily, the control groups were exposed to an intervention that they would not normally be using in place of paper learning in the classroom. There were both positive and negative reactions throughout the school district in regards to the online learning during those three days. However, those three days of online learning may have impacted the post-survey responses.

Finally, ideally, to supplement the surveys focused on mobile devices, an additional pre/post survey would have measured motivation to learn social studies. This would have applied equally to both groups and may have helped to determine whether the use of mobile devices impacted interest in the content area. This may serve as a suggestion for future researchers.

### **Conclusion**

This study sheds light on the importance of mobile devices in the classroom. While the study did not reveal a statistically significant effect from mobile learning on academic achievement, it did offer valuable insight on students' motivation to learn by mobile devices. There was a statistically significant change in students' motivation for learning due to their use of mobile devices. Students showed a greater change in their perception of learning when using mobile devices. Students believed they had a greater change in their learning using mobile devices as compared to paper-learners. Those students were more confident in their learning. In addition, students using mobile devices showed a greater change in their interest and motivation to learn as compared to paper learners. Overall, the students felt more excited and driven to learn when using mobile devices.

While mobile devices offered no significant impact on academic achievement, the findings do encourage the use of mobile devices to engage students in the classroom. Mobile devices should no longer be hidden in classroom but should be incorporated into the classroom to design engaging, empowering and effective instruction. This finding is important because it is an easy way for teachers to refresh and renew their classroom instruction to engage their potentially disinterested students.

Incorporating mobile devices into the classroom may not significantly affect academic achievement in the classroom. The limited incorporation of mobile devices may not render higher achievement measures as compared to paper resources. Instead, the incorporation of mobile devices may offer an interactive classroom environment where students feel enthusiastic and eager to learn. Students may have a higher interest when allowed to use their mobile devices for learning purposes.

Future research may reveal more on student motivation and academic achievement. That research may better explain why students are so motivated to learn using mobile devices when this study found that mobile devices did not significantly affect academic achievement in this sample. Further, it would be of benefit to know if a longer intervention would have a significant effect on academic achievement.

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**Appendix A*****Motivation Survey***

I am trying to learn more about your interest for social studies. The sentences below describe how some students feel about learning in this class. Read each sentence and circle one answer that is most like how you feel. There is no correct answer. This survey simply describes your feelings about this class.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
1.	The readings in class prepared me for the last unit test.				1 2 3 4 5
2.	I do not learn when using mobile devices in class.				1 2 3 4 5
3.	I felt motivated to learn during the last unit.				1 2 3 4 5
4.	I do not understand the information from the last unit.				1 2 3 4 5
5.	I like using a mobile device for learning.				1 2 3 4 5
6.	I do not like to use mobile devices in the classroom.				1 2 3 4 5
7.	I try to get more answers right than my friends.				1 2 3 4 5
8.	I found it difficult to get myself to study the content of the last unit.				1 2 3 4 5
9.	I like being the best in social studies.				1 2 3 4 5
10.	I learn best from paper materials.				1 2 3 4 5
11.	The readings in class have helped my learning.				1 2 3 4 5
12.	I did not feel enthusiastic about what we learned in the last unit.				1 2 3 4 5
13.	I was excited to learn during the last unit.				1 2 3 4 5
14.	I don't mind if I'm the last person to finish the reading assignment.				1 2 3 4 5
15.	I learn best from mobile materials.				1 2 3 4 5
16.	I do not think I passed my last unit test.				1 2 3 4 5
17.	I like being the only one who knows an answer.				1 2 3 4 5
18.	I do not like to be compared academically to my classmates.				1 2 3 4 5
19.	I think using a mobile device helps my learning.				1 2 3 4 5
20.	I don't mind if my friends get higher grades than me.				1 2 3 4 5

***Disposition Survey***

20 items

4 constructs

**Perceptions of student learning (4 items):**

The readings in class prepared me for the last test.

I do not understand the information from the last unit.

The readings in class have helped my learning.

I do not think I passed my last unit test.

**Interest in mobile learning (6 items):**

I like using a mobile device for learning.

I do not like to use mobile devices in the classroom.

I learn best from paper materials.

I learn best from mobile materials.

I think using a mobile device helps my learning.

I do not learn when using mobile devices in class.

**Academic Motivation (4 items):**

I felt motivated to learn during the last unit.

I found it difficult to get myself to study the content of the last unit.

I did not feel enthusiastic about what we learned in the last unit.

I was excited to learn during the last unit.

**Competition (6 items):**

I try to get more answers right than my friends.

I like being the best in social studies.

I don't mind if I'm the last person to finish the reading assignment.

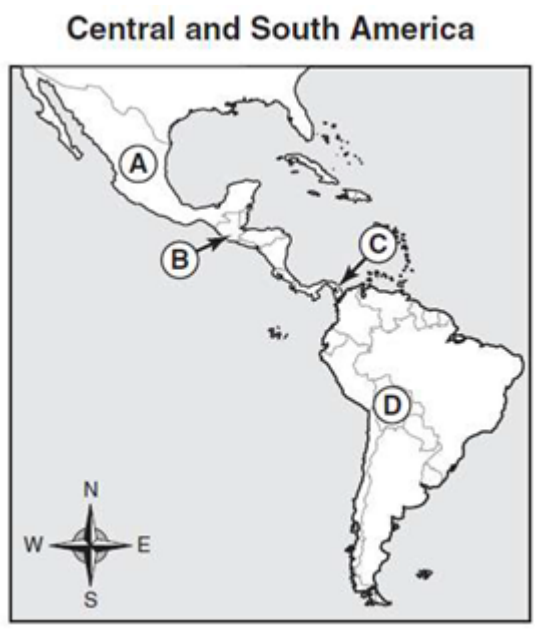
I like being the only one who knows an answer.

I do not like to be compared academically to my classmates.

I don't mind if my friends get higher grades than me.

**Appendix B*****Achievement Measure***

1. Look at the map.



- Which letter on the map shows the location of the Panama Canal? (SS6G1a)
- a. A
  - b. B
  - c. C
  - d. D
2. Two important island-nations are: (SS6G1b)
    - a. Bolivia and Brazil
    - b. Panama and Cuba
    - c. Haiti and Venezuela
    - d. Cuba and Haiti
  3. Which of the following make it difficult to transport goods in Central America? (SS6G3)
    - a. Active Volcanoes
    - b. Thick forests and rugged mountains
    - c. Frequent flooding and overflowing rivers
    - d. Lack of roads
  4. Which is often an effect of a high literacy rate? (SS6g4c)
    - a. A higher illiteracy rate
    - b. Lower educational levels
    - c. A lower standard of living
    - d. A higher standard of living
  5. Which country had the MOST influence on the primary language spoken in Latin America today? (SS6G4b)

- a. Italy
  - b. Spain
  - c. France
  - d. Germany
6. Which of the following statements is true about Cuba's land size (SS6G3b)
- a. It's the same size as Mexico.
  - b. It is about the same size as Jamaica and Puerto Rico combined.
  - c. It is about half of the Caribbean's total land area.
  - d. It is one of the smallest Caribbean islands.
7. Some Latin American countries have grown rich from natural resources. Why have other countries with similar resources remained poor? (SS6G3b)
- a. They have a less educated population, and most people herd animals.
  - b. The people who live there are not interested in mining natural resources.
  - c. Those countries used government funds to pay for wars instead.
  - d. The resources are in isolated locations, and there is a lack of money for development.
8. Most of the Caribbean islands have fewer mineral resources than do Middle and South America. Which of the following does Cuba mine? (SS6G3b)
- a. Bauxite
  - b. Nickel
  - c. Gold
  - d. Silver
9. Why do most people live in the tierra templada climate zone of Latin America? (SS6G3b)
- a. It is the best zone in which to grow tropical crops.
  - b. It is the zone that includes the ocean.
  - c. It has mild temperatures throughout the year.
  - d. It receives very little rainfall.
10. Which form of government did Cuba establish after the 1959 revolution led by Fidel Castro? (SS6CG2)
- a. Republic
  - b. Communist
  - c. Parliamentary
  - d. Monarchy
11. Why do some countries have higher literacy rates for boys than for girls? (SS6G4c)
- a. Boys enjoy learning to read and write more than girls do.
  - b. Girls enjoy learning to read and write more than boys do.
  - c. Some cultures believe that it is not as important for girls to learn to read and write as it is for boys.
  - d. Some cultures believe that it is not as important for boys to learn to read and write as it is for girls.



12. How was Haiti freed from French rule in 1804? (SSH2c)
- Simon Bolivar and his army led the fight for independence.
  - Toussaint-Louverture led enslaved Africans in a revolt.
  - Miguel Hidalgo encouraged the Haitians to fight for freedom.
  - Haitians recruited Spanish soldiers to fight with them.
13. How does investment in capital by companies help a country increase its GDP? (SS6E3b)
- The GDP of a country goes down when companies make more money.
  - Companies that invest in capital are able to provide a better place for their workers to work.
  - Highly trained workers help the company be more profitable by finding ways to help the company work better.
  - When a company invests in capital, it can produce more goods at a better price and increase the profit that it makes.

14. Look at the chart.

Country	Population	GDP per Capita*	Literacy Rate	Area (in square kilometers)
Haiti	8,924,553	\$1,300	53%	27,750
Jamaica	2,804,332	\$7,400	88%	10,991
Puerto Rico	3,958,128	\$18,400	94%	13,790

\*GDP per Capita is GDP per person

Based on the information in the chart, what is the BEST way for a country to grow its economy? (SS6E3a)

- An increase its population
  - Protect its environment
  - Invest in human capital
  - Colonize neighboring countries
15. Which term describes how political power is distributed in Cuba? (SS6CG2a)
- Federal government
  - Unitary government
  - Aristocratic government
  - Confederation government
16. In some Latin American countries, people of mixed Native American and European descent make up most of the population. What are these people called? (SS6G4a)
- Creoles
  - Pidgin
  - Mestizos
  - Immigrants

17. What is the name of the large festival held in many Latin American countries on the last day before the Christian holy period called Lent? (SS6H2b)
  - a. Carnival
  - b. The Day of the Dead
  - c. Independence Day
  - d. Simon Bolivar Day
  
18. Cuba's economy is much like which of the below economies? (SS6E1c)
  - a. People decide how resources are used and what goods and services are produced.
  - b. The government decides how resources are used and what goods and services are produced.
  - c. People and the government decide how resources are used and what goods and services are produced.
  - d. Trading partners decide how resources are used and what goods and services are produced.
  
19. Which country does Cuba NOT trade with (SS6E2b)?
  - a. Venezuela
  - b. United States
  - c. China
  - d. Both a and c
  
20. What are children of black slaves and Europeans called (SS6G4a)?
  - a. Mulattoes
  - b. Indigenous people
  - c. Black Europeans
  - d. Mestizos
  
21. What is the major religion in Latin America (SS6H2b)?
  - a. Buddhism
  - b. Judaism
  - c. Islam
  - d. Catholicism
  
22. What was a major effect of the Columbian Exchange? (SS6H1b)
  - a. Decline of indigenous population
  - b. Agriculture change
  - c. Introduction of the horse
  - d. All of the above
  
23. Who defeated Batista and established a communist government in Cuba? (SS6H3a)
  - a. Fidel Castro
  - b. Toussaint L'Ouverture
  - c. Simon Bolivar
  - d. Miguel Hidalgo

24. Which country supported communist Cuba? (SS6H3a)
  - a. United States
  - b. India
  - c. Soviet Union
  - d. Brazil
  
25. Which country has the least freedom to do business? (SS6E1c)
  - a. Cuba
  - b. Brazil
  - c. Canada
  - d. About the same in each
  
26. What currency is used by both Mexico and Cuba? (SS6E2d)
  - a. Peso
  - b. Dollar
  - c. Real
  - d. Euro
  
27. How does having natural resources help the economy of a country? (SS6E3c)
  - a. The country is able to produce all the goods and services that it needs.
  - b. Companies can export natural resources without having to create goods to sell.
  - c. The country saves money because it does not have to import natural resources needed by the people.
  - d. Companies spend more money because they must buy the natural resources needed to create more goods.
  
28. What animal helped native people hunt and trade over a larger area? (SS6H1)
  - a. Pig
  - b. Goat
  - c. Horse
  - d. Sheep
  
29. When did slavery end for most parts of Latin America (SS6H2a)
  - a. After the slaves revolted
  - b. As countries gained independence from Europe
  - c. After the kings of Spain and Portugal outlawed slavery
  - d. When the people of the country voted to free the slaves
  
30. Slavery helped to build the countries of Latin America, but much of the wealth was shipped to Europe. Today, one effect of that situation is: (SS6H2a)
  - a. Many Latin American countries are very poor.
  - b. Latin American countries do not have good workers.
  - c. People in Latin American are trying to move to Europe.
  - d. There are few people in Latin America with African ancestors.

31. What almost caused a nuclear war between the United States and the Soviet Union? (SS6H3a)
  - a. Kennedy did not like the leader of the Soviet Union.
  - b. The Soviet Union wanted to show the Cubans that they were strong friends.
  - c. Castro allowed the Soviet Union to build a nuclear missile launch complex in Cuba.
  - d. The United States wanted the sugar cane crop that the Soviet Union was buying from Cuba.
  
32. What term describes how political power is distributed in Cuba? (SS6CG1a)
  - a. Unitary government
  - b. Aristocratic government
  - c. Confederation government
  - d. Federal government
  
33. What statement is true about political parties in Cuba? (SS6CG2a)
  - a. There are many political parties.
  - b. There is only one legal political party.
  - c. The leader of a political party cannot be president.
  - d. Those running for office may not be in the Communist Party.
  
34. Which childhood event allowed Toussaint L'Ouverture to learn ideas about freedom and equality? (SS6H2c)
  - a. He made a trip to France.
  - b. The French Revolution occurred.
  - c. He worked on the plantation with his family.
  - d. His owner allowed him to learn to read and write.
  
35. What was one reaction the United States had to Cuba taking over property owned by Americans? (SS6H3a)
  - a. The United States threatened a nuclear attack.
  - b. The United States put an embargo on Cuban goods.
  - c. The United States wanted Cuba to trade with other countries.
  - d. An agreement was reached to limit the number of Cubans entering the United States.