CONTRASTS IN OPENNESS TOWARD MOBILE LEARNING IN THE CLASSROOM: A STUDY OF ELEMENTARY, MIDDLE AND HIGH SCHOOL TEACHERS

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ABSTRACT

In a study involving 1414 elementary, middle school, and high school teachers from a large school district in the southwestern USA, the authors examine the similarities and differences among teachers at the three levels of K-12 education common in US school systems: elementary, middle school and high school. Major findings are that elementary school teachers are typically more open to mobile learning based on analysis of scores for three of the four factors (Possibilities, Benefits, and Preferences) assessed by the Mobile Learning Readiness Survey. For the fourth factor on the MLRS (External Influences), elementary teachers less strongly agree than either their middle school or high school counterparts that external influences determine whether it is practical to use mobile learning for teaching and learning in a classroom-centered context.

KEYWORDS

Mobile learning readiness, professional development, grade level teacher differences, technology integration

1. INTRODUCTION

Mobile learning in the classroom is become increasingly common in schools. The unique affordances of mobile learning are creating interest in different learning and teaching approaches. These devices offer the ability to collaborate (Corbeil & Valdes-Corbeil, 2007), to personalize instruction (Steel, 2012) and allow self-regulated learning (Sha, Looi et al, 2012). Other features useful for learning include audio and video recording, instant access to the Internet, texting, uploading and sharing files in addition to a growing number of learning apps. The portability of these mobile devices allows students to connect to content within and beyond the classroom walls.

A recent research report indicates that mobile devices are virtually ubiquitous for U.S. middle and high school students while one third of them are using mobile devices provided by their schools (Nagel, 2014). In order to address students who may not have a device, many districts are providing devices to students for learning initiatives. Parents also see the value of mobile learning in the classroom. In a 2010 survey conducted by Project Tomorrow, 62% of the responding parents would purchase a mobile device for their child if the school allowed the device to be used for educational purposes (Project Tomorrow, 2010). Yet teachers often remain reluctant to accept mobile devices as learning tools because they feel the need for additional support and training before they are comfortable using the devices with students (Messinger, 2011). Determining the best strategies for successful implementation of mobile devices to improve the learning environment is an important topic for research.

1.1 Impact of Mobile Learning

A meta-analysis of mobile learning in K-12 education reported overall positive gains in learning for students (Liu et al, 2014). A more recent meta-analysis of 110 studies related to mobile learning and student achievement (Sung, Chang, & Liu, 2016) reported an overall mean effect size of 0.523 (Cohen's *d*), indicating that learning with mobile devices can be more effective than traditional teaching methods that use

pen and paper or desktop computers, to a moderate degree of magnitude (Cohen, 1988) that substantially exceeds the effect size = .3 standard beyond which an intervention is typically considered educationally meaningful (Bialo & Sivin-Kachala, 1996). Of the 110 articles in the meta-analysis, 38 were conducted at the elementary level, 10 at the middle school level and 10 at the high school level. The effect size differences for the elementary level were 0.654 while the effect sizes for the middle school level were 0.512 and high school 0.390. Additional reported findings indicated that implementation of handheld devices showed higher learning outcomes than the implementation of laptop computers. The authors conjectured that teaching with handheld devices uses more innovative teaching methods, including inquiry-based instruction (Sung, et al., 2016), while frequently laptops were replacements for desktop computers and used as such for note-taking and searching for information.

In a study of 224 teachers from 16 schools in Pennsylvania, Roche (2013) found that school level (elementary, middle or high school) and self-reported technology skill level are related to teachers' mobile learning attitudes. Teachers' perceptions regarding a change in their practices as well as their personal attitudes toward the change can significantly influence the successful implementation of mobile learning (Chao, 2005; Montrieux et al, 2014; Uzunboylu & Ozdamli, 2011). Roche (2013) also found significant differences by school level in how technology is used, specific technologies used and whether teachers created their own curriculum or used district curriculum.

1.2 Teacher Willingness to Accept Mobile Learning

Several factors are known to influence a teachers' willingness to use mobile technology in the classroom. These factors include student access, cost, class disruption, lack of teachers' technical and pedagogical skills, compelling evidence of effectiveness, and a lack of guidelines (Kim, 2013). In a study involving 1430 elementary, middle school, and high school teachers from a large school district in the southwestern USA, Christensen and Knezek (2017a) demonstrated that when aggregated across all school levels, teachers at different stages of technology integration proficiency also exhibit step-wise increments in their willingness to adopt mobile learning in their daily teaching and learning practices. In the current study, the authors examine the similarities and differences among teachers at the three levels of K-12 education common in US school systems: elementary (kindergarten – grade 5), middle school (grades 6-8) and high school (grades 9-12).

Little information was found in the literature regarding whether there are differences by school level in teachers' willingness to adopt mobile learning or regarding the underlying constructs that adequately describe teachers who are willing to accept and implement mobile learning. In addition, systematic study of the relationship of willingness to adopt mobile learning to classroom level of technology integration within a level of schooling is not fully developed. This led to the following research questions in the current study.

RQ1: To what extent do elementary school, middle school, and high school teachers differ in their willingness to adopt mobile learning in the classroom?

RQ2: To what extent are levels of technology integration proficiency related to willingness to adopt mobile learning among elementary, middle, and high school teachers?

2. THE STUDY

2.1 Methods

2.1.1 Participants

Educators from grades K-12 in a large school district in the southwestern US were invited to submit data related to mobile learning readiness in the fall of 2015. Of the 1,430 respondents, slightly fewer than half (n = 640, 44.8%) reported teaching at the elementary level with the remainder representing middle school (n = 370, 25.9%), high school (n = 404, 28.3%), or undesignated (n = 16, 1.1%). The undesignated participants were left out of the analysis for grade level taught due to the small number and undefined level.

2.1.2 Instrumentation

Participants were administered a battery of instruments including the Mobile Learning Readiness Survey (MLRS) and Stages of Adoption of Technology. The MLRS was designed to assess areas of needs for preparing teachers to teach with mobile devices in their classrooms (Christensen & Knezek, 2017b). The MLRS contains four constructs that measure different dimensions of teacher willingness to integrate mobile learning that can impact the preparation of classroom teachers. Twenty-eight (28) Likert-type items representing four factors were responded to by participants on a scale of 1 = Strongly Disagree to 5 = Strongly Agree. The reliabilities for four scales produced from this instrument, for this set of data are listed in Table 1.

Table 1. Internal Consistency Reliabilities for Four Scales of the MLRS

	Cronbach's Alpha	No. of Items
Factor 1 (Possibilities)	.92	8
Factor 2 (Benefits)	.91	10
Factor 3 (Preferences)	.79	5
Factor 4 (External Influences)	.61	4

Stages of Adoption of Technology (Christensen, 1997) is an instrument also administered to the teachers. Stages is a self-assessment of a teacher's level of adoption of technology, There are six possible stages in which educators rate themselves: Stage 1 - Awareness, Stage 2 - Learning the process, Stage 3 - Understanding and application of the process, Stage 4 - Familiarity and confidence, Stage 5 - Adaptation to other contexts, and Stage 6 - Creative application to new contexts. Demographic items such as years of teaching and grade level taught (elementary, middle and high school) were also completed by the teachers.

2.2 Results

2.2.1 Association of Mobile Learning Readiness and Grade Level Taught

As shown in Table 2, there were significant ($p < .05$) differences on all four of the MLRS factors by grade level taught. For Factor 1 *Possibilities*, Factor 2 *Benefits* and Factor 3 *Preferences*, elementary teachers were significantly higher ($p < .05$) than both middle school teachers and high school teachers in their dispositions. However, for Factor 4 (External Influences) the elementary teachers were significantly lower in their dispositions from both middle and high school teachers. As shown in Figure 1, the middle school and high school teachers were very similar in their dispositions for each of the four factors and overlay each other on the graph. In response to research Q1, a Tukey post hoc analysis revealed the significant differences for all four factors were elementary versus middle and high school teachers.

Table 2. Comparison of Four Mobile Learning Readiness Factors and Grade Level Taught

		N	Mean	SD	Sig.
Factor 1	Elementary School	640	4.38	.54	
Possibilities	Middle School	370	4.17	.62	
	High School	404	4.16	.62	
	Total	1414	4.26	.60	.0005
Factor 2	Elementary School	640	3.66	.62	
Benefits	Middle School	370	3.51	.65	
	High School	404	3.50	.66	
	Total	1414	3.58	.64	.0005
Factor 3	Elementary School	640	3.19	.80	
Preferences	Middle School	370	3.00	.79	
	High School	404	3.01	.82	
	Total	1414	3.09	.81	.0005
Factor 4	Elementary School	640	3.25	.68	
External Influences	Middle School	370	3.45	.70	
	High School	404	3.45	.67	
	Total	1414	3.36	.69	.0005

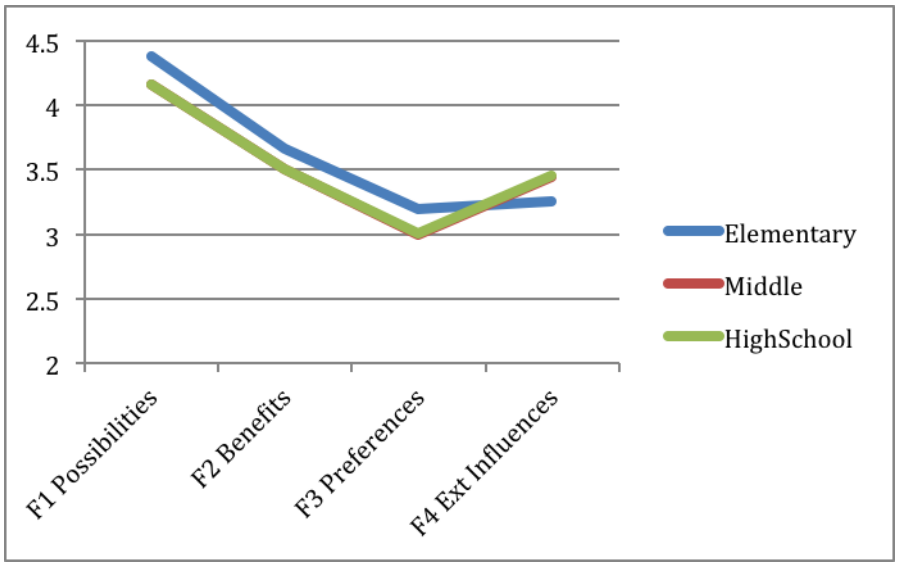

Figure 1. Four Factors of the MLRS by Grade Level Taught

2.2.2 Association of Technology Integration Measures and Grade Level Taught

An analysis of variance of Stages of Adoption of Technology by grade level taught showed significant (p <.05) differences among the three groups of teachers (Table 3). As revealed by a Tukey post hoc analysis, high school teachers were significantly (p <.05) higher in stages of technology integration than both elementary and middle school teachers.

Table 3. Analysis of Variance for Stages of Adoption of Technology by Grade Level Taught.

	N	Mean	SD	Sig.
Elementary School Teachers	640	4.45	1.062	
Middle School Teachers	370	4.41	1.121	
High School Teachers	404	4.68	1.134	
Total	1414	4.50	1.103	.001

2.2.3 Mobile Learning Measures by Stages of Adoption of Technology at Elementary, Middle and High School Levels

Analysis of variance for the four factors of the Mobile Learning Readiness Scale by Stages of Adoption of Technology were completed for each of the subpopulation samples of elementary, middle, and high school teachers listed in Table 3. The procedures followed were identical to those described in detail, for the combined group of 1400+ teachers in Christensen and Knezek (2017a). Results are illustrated in Figures 2-4. As shown in Figure 2, elementary teachers generally exhibit a smooth progression on all four factors of *Possibilities*, *Benefits*, *Preferences* and *External Influences* as proficiency in technology integration as indicated by Stages of Adoption of Technology, increases. For middle school teachers (Figure 3), the progression has a lesser slope (less rapid increase) but is still generally smoothly increasing as Stages of Adoption of Technology increase. For high school teachers (Figure 4), the transition changes appear to be more erratic possibly due to small numbers of teachers in Stage 1.

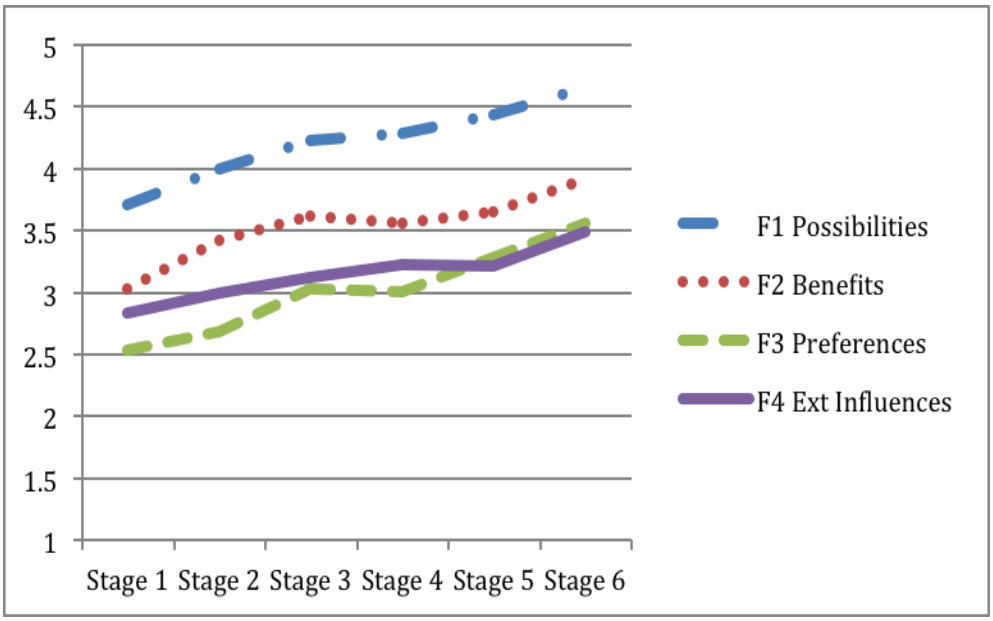

Figure 2. Elementary school teachers' MLRS factors by stage of adoption of technology

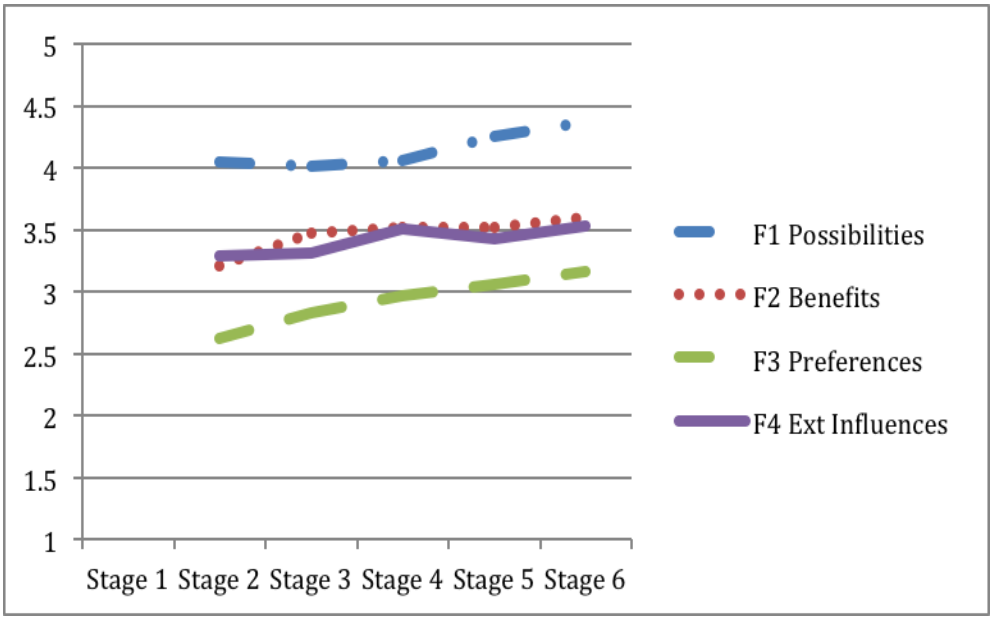

Figure 3. Middle school teachers' MLRS factors by stage of adoption of technology

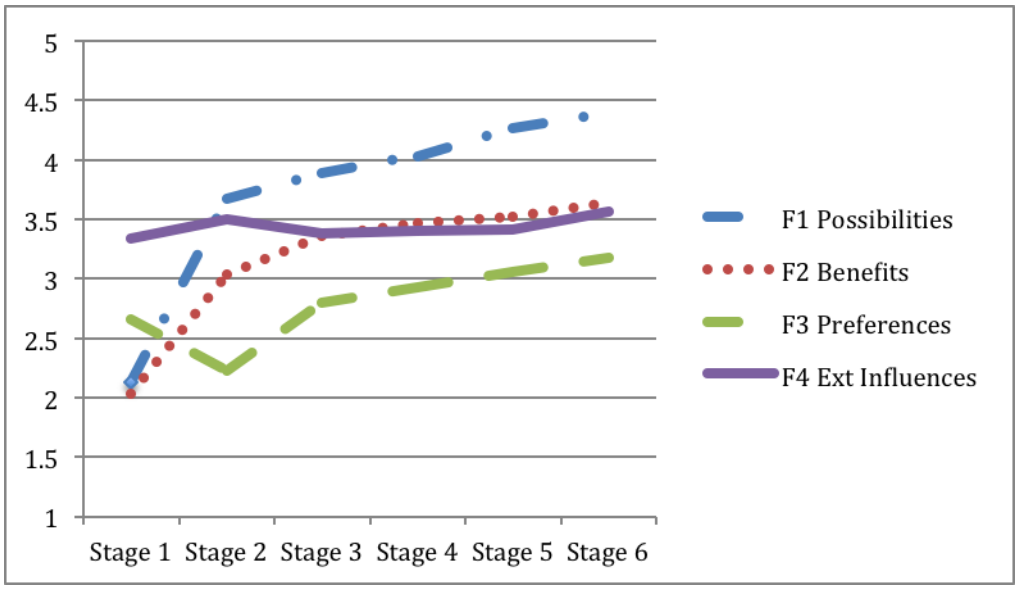

Figure 4. High school teachers' MLRS factors by stage of adoption of technology

With respect to research Q2, trends in the relationship of levels of technology integration to willingness to adopt mobile learning are similar for elementary, middle school and high school teachers. The positive linear association appears to be strongest for elementary school teachers.

2.2.4 Item Level Analysis

The 28 items were analyzed to compare teachers by grade level. Twenty-three (23) of the 28 items were significantly (p <.05) different by grade level taught. For 20 of the items with significant differences, elementary teachers reported higher means. Examples of these items are:

Item 2. Mobile learning will bring new opportunities for learning.
Item 17. The use of mobile technology in the classroom increases student engagement.
Item20. The use of mobile technology in the classroom allows students to develop creativity.

For 3 of the items elementary teachers reported lower means. These items were:

Item 24. Students are more knowledgeable than I am when it comes to using mobile technologies.
Item 27. My curriculum is conducive to students having their own technology.
Item 28. My administration is supportive of students having their own device.

Teachers at all grade levels seem to agree on five items related to mobile learning in the classroom in which there were no significant differences. Areas where teachers regardless of level of teaching tend to agree are:

Item 13. Teachers at all levels slightly prefer to use a traditional textbook rather than an electronic textbook.
Item 21. Teachers at all levels generally agree that mobile learning will improve communication between students and teachers.
Item 22. Teachers at all levels generally agree that mobile learning will improve communications among students.
Item 23. Teachers at all levels slightly agree that having a mobile device would improve student organization.
Item 25. Teachers at all levels generally agree that their school is doing a good job of using technology to enhance learning.

It appears that elementary teachers in this study are more open to embracing mobile learning in their classrooms but are not certain how it might fit into their current curriculum or whether the required support will be available. Teachers at all grade levels prefer the traditional teacher textbook to an electronic one, agree that mobile learning can support communication of different types and feel their schools are supportive of technology to enhance student learning.

3. DISCUSSION

The most surprising finding of this study is that elementary school teachers express the highest willingness to adopt mobile learning. This, combined with the conjectured and reconfirmed finding that the profiles of elementary, middle school, and high school teachers across the four scales of the Mobile Learning Readiness Survey differ greatly, implies that professional development activities for teachers, as well as learning activities for students, may differ greatly across these three levels. Perhaps the findings are related to the type of learning environment differences between primary (elementary) and secondary (middle and high) schools. Perhaps the differences are due to the ubiquitous access of mobile devices by middle and high school students (Nagel, 2014). These middle and high school teachers have experienced the difficulties involved in student devices brought to school, yet did not have the preparation to deal with the management and are reticent to embrace these devices for learning. Most elementary teachers may not have yet had to deal with these negative issues and are preparing to embrace mobile learning in a more systematic way as indicated in the more controlled studies found in the meta-analysis (Sung et al, 2016) that mobile learning device implementation had a more effective impact for elementary than middle and high school students.

4. CONCLUSIONS

In this study involving 1414 teachers from a large public school district in the southwestern USA, major findings are that elementary school teachers are more open to using smartphones, tablets and other hand-held information technology devices for mobile learning in their classrooms, when compared to middle school or high school teachers. For three of the four factors assessed by the Mobile Learning Readiness Survey (*Possibilities*, *Benefits*, and *Preferences*), elementary teachers as a group were found to be significantly ($p < .05$) more positive. For the fourth factor on the MLRS (*External Influences*), elementary teachers less strongly agree than either their middle school or high school counterparts that external influences determine whether it is practical to use mobile learning for teaching and learning in a classroom-centered context. These findings imply that there are likely different approaches and different types of professional development appropriate for elementary teachers versus middle and high school teachers. It appears that the elementary school level may be the most conducive for beginning a large-scale project such as a district-wide initiative if there is a need for a systematic implementation with the ability to measure impact. Middle school and high school teachers may need more focus on specific issues such as classroom management and implementation of an intervention that is based on having multiple classrooms of students for a limited period of time each day. Middle school and high school teachers may also need to be more versed in the integration of multiple types of personal devices brought to school by students. As shown in this study, teachers at different grade level bands have differing perceptions and needs when it comes to professional development for integrating mobile learning in the classroom. Additional research is needed to confirm whether the trends found in this study are applicable on a broad scale, across the US and in other portions of the world.

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