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TEACHER DISPOSITIONS AS PREDICTORS OF TECHNOLOGY INTEGRATION: A CHANGING TIDE

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ABSTRACT

Technology initiatives are becoming commonplace in the U.S. Although technology is widespread, its use by teachers is not always clear. This study addressed teacher dispositions to predict classroom technology integration for a public district in the Southwest United States. A modification of the Teacher Attribute Survey was given to 250 pre-k through 12th-grade teachers, examining teacher self-efficacy, teacher philosophy, openness to change, and classroom technology use. Results showed technology use was significantly related to hours of professional development and willingness to continue graduate courses with no incentive. Implications suggest a shift from teachers learning the technology toward needing resources for implementation.

INTRODUCTION

A myriad of studies has emphasized technology's impact on student learning. Scholars have revealed that technological initiatives within the K-12 setting can improve student language acquisition (Hwang, Shi, & Chu, 2011), foster collaborative relationships (Botha, Vosloo, Juner, & Vanden Berg, 2009), enhance and encourage course-related interaction (Sung, Chang, & Chen, 2010; Thomas & Orthober, 2011), increase positive communication between students and teachers (Dawson, 2006; Hwang; Shi, & Chu, 2011), and elevate academic performance (Chang, 2001; Middleton & Murray, 1999; Schacter, 1999; Warschauser, 2006).

According to Dockstader (1999), technology integration is the act of a teacher using computers effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in meaningful ways. Over the past decade, there have been numerous researchers conduct studies to better understand classroom technology integration (Bebell, O'Dwyer, Russell, & Hoffman, 2010; Luo & Murray, 2018; Sauers & McLeod, 2017). This is the case regarding external factors that affect teachers' technology classroom integration. Considered first-order barriers (Ertmer, Ottenbreit-Leftwich, Sadik,

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Sendurur, & Sendurur, 2012), external factors include resource availability (e.g., physical access to technology, time allotted to learn technology, and technology support system provided to instructors) and institutional backing (e.g., district plan and approach to technology initiatives) (Hew & Brush, 2007; Kenton & Bauer, 2005; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018; Wachira & Keengwe, 2010).

School administration is also considered an external factor, as district and campus leaders shape the climate and culture of their campuses (Gruenert & Whitaker, 2015). Administrators have the influence and ability to make a positive or negative impact on teacher pedagogical practices and technology integration. Effective 1:1 initiatives occur after district leadership and campus administration take part in pre-planning, long-term planning, and strategic planning (Simmons & Martin, 2016). Also, Simmons and Martin (2016) argued that administrators are tasked with providing teachers' appropriate professional development opportunities and are responsible for funding resources (e.g., allocation of funds, grants, public-private partnerships, and parent fundraising initiatives). Moreover, the concern for teachers' technological relevance has been an issue for over 20 years as Ertmer (1999) stated that teachers need pedagogical skills that incorporate technology.

Second-order barriers associated with technology integration also exist. Second-order barriers include internal factors, such as teacher dispositions and teaching philosophies (Ertmer et al., 2012). Teacher dispositions are the values, commitments, and professional ethics that influence behaviors toward students, families, colleagues, and communities, affecting student learning, motivation, and development, as well as an educator's professional growth, including teaching philosophies (NCATE, 2001). Teaching philosophies guide teachers' pedagogical approaches and methods. Furthermore, a teaching philosophy acts as the cornerstone of reflective and scholarly practice in teaching and teaches (Coppola, 2002). Also, a teaching philosophy represents an individual's perceptions, values, and beliefs about the concepts of learning and teaching, roles of teachers and students, and goals of education (Goodyear & Allchin, 1998).

There are numerous types of teaching philosophies in the field of education (Beatty, Leigh, & Dean, 2008). It is generally thought that teaching philosophies exist on a continuum (Sawers, Wicks, Mvududu, Seeley, & Copeland, 2016) with two contrasting philosophical lenses at either end traditional or constructivism. On one end, following the traditional framework in a teacher-centered learning environment, students acquire content knowledge and learning through teacher instruction and lectures (Sawers et al., 2016). On the other end, teachers who incorporate a constructivist teaching philosophy believe that students acquire knowledge through active participation (Niederhauser, Salem, & Fields, 1999; Piaget, 1970). Therefore, constructivist creates a student-centered learning space where the teacher becomes a facilitator of learning (Sawers et al., 2016; Wang, 2002).

Several studies have examined how internal factors impact classroom technology integration. Tondeur, van Braak, Ertmer, and Ottenbreit-Leftwich (2017) found that the level of integration involves teachers' beliefs about how technology is related to student learning. Additionally, Li, Garza, Keicher, and Popov (2019) related that teachers' openness toward using technology was significant in their use of technology, as well as technological self-efficacy, for teaching at the high school level regardless of their skill. However, there continues to be a lack of literature on teacher dispositions and the use of technology.

Literature Review

Teacher Dispositions

Teachers play a key role in influencing technology use in the classroom. Teacher attitudes and beliefs (dispositions) about technology's role in classroom curriculum can influence how and when they integrate technology for instructional purposes (Becker & Anderson, 2000; MacArthur & Malouf, 1991; Tondeur, et al., 2017; Vannatta & Fordham, 2004). Teacher dispositions also acknowledged as second-order barriers to technology integration (Vongkulluksn et al.,2018), include technology self-efficacy (Hardy, 1998; Dawson & Rakes, 2003; Li et al., 2019), teaching philosophy (Dawson & Rakes, 2003), and technological content knowledge (Wachira & Keengwe, 2010).

Internal dispositions are commonly impacted by external barriers and campus environments. For example, lack of technology leadership can influence teachers to feel as though there is little or no support for integrating technology into pedagogy. The process of classroom technology integration includes writing grants to purchase new technology, as well as

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finding and attending conferences in order to learn how to use the new technology (Wachira & Keengwe, 2010).

In all, the dispositions of classroom teachers can be used to help predict the utilization of technology in the classroom (Honey & Moeller, 1990). This study examined those dispositions and combinations of dispositions to attempt to predict successful technology integration in the classroom.

Academic Success

Technology integration toward academic success has varied. Problems linked to 1:1 computing included technical and logistical issues. Even when resolved there is limited evidence that 1:1 computing raises academic performance when GPA is used as a measurement for success (Islam & Gronlund, 2016). However, with the rise of mobile devices research has shown an increase in student achievement (Harper & Milman, 2016), peer interaction (Sung, Hou, Liu, & Chang,2010), language acquisition (Hwang, Shi, & Chu, 2011), creativity and classroom engagement (Downes & Bishop, 2015), and student/teacher communication (Hwang, Shi & Chu, 2011). Though technology may be tied to student success, teachers must still be willing to integrate it as part of their teaching practices.

1:1 Technology Initiatives

Due to academic and student learning benefits mentioned above, one-to-one (1:1) technology initiatives are becoming more prevalent in K-12 classrooms in the U.S (Lamb & Weiner, 2018; Sauers & McLeod, 2017). Abud (2014) defined *one-to-one technology* as a school district providing students with their own computing devices. Within a 1:1 environment, students use computing devices to acquire knowledge anytime and anywhere with a focus on independent student learning (Ditzler, Hong, & Strudler, 2016; Solomon, 2005). Research has shown that 1:1 initiatives improve student academic performance (Bebell & Kay, 2010; Spektor-Levy & Gronot-Gilat, 2012) attendance and behavior (Rockman,1995; Yang, Yu, Gong, & Chen, 2017), and critical thinking skills (Chang, 2016). However, the educational research community has yet to provide a comprehensive understanding of 1:1 initiatives (Lindqvist, 2016; Penuel, 2006).

Research Purpose and Questions

With the increase in technology integration at a nationwide level, especially regarding 1:1 initiatives, the need to understand successful technology implementation better is a growing concern. The rationale of this study, therefore, stemmed from the need for further examination on how specific teacher attributes and second-order barriers predict successful classroom technology integration. With this purpose in mind, the following questions guided the research study: (a) How do pre-K through 12th-grade teachers' personal beliefs, philosophies, and attributes relate to technology integration?; (b) What teacher characteristics or attributes work together to inform technology use in the classroom?; and (c) How does the commitment to teaching improvement play a role in predicting technology use among teachers?

Methodology

Setting

This study focused on six campuses in a rural public school district in the southern United States. The investigators selected this particular school district for two main reasons. First, a district-wide 1:1 technology initiative was launched in 2016. In efforts to accomplish this particular initiative, the district made a significant investment in technology resources to support innovative teaching and learning strategies. For example, the technology budget for the district's 3rd and the 4th-grade campus in 2015 was $2,000; however, the district allotted $400,000 for the campus following the launching of the 1:1 initiative. This shift in spending represented a significant investment in technology resources to support innovative teaching and learning strategies.

Also in 2016, the district's administration accepted an invitation to join the League of Innovative Schools. The League of Innovative Schools energizes and encourages the most innovative leaders of the nation's school districts. By working as a team on shared priorities and utilizing leading educational leaders, entrepreneurs and researchers league districts advocate for innovative learning and leadership practices that lead to improved outcomes for students and that help prepare them for learning for life (Vo, 2017).

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Regarding sampling, a survey link was sent via email to 250 teachers in the participating school district. The survey return rate was 33% (n = 83). See Table 1 for the demographic breakdown of teachers in the district. Approximately one-fourth, or 25%, of teachers, held advanced degrees (Texas Education Agency, 2016).

Table 1

Racial Composition of Selected School District (n=250)

District Racial Composition	Percentage
African American	0.00%
Hispanic	8.00%
White	90.40%
Other	1.60%

Instrumentation

For this study, a modified version of the Teacher Attribute Survey (TAS) was utilized. Developed by Vannatta and Fordham (2004), the TAS consists of 66 items that assesses variables such as teacher self-efficacy, teaching philosophy, openness to change, amount of professional development, amount of technology training, years of teaching, hours worked beyond the contractual work week and the amount of teacher and student use of technology in the classroom. Vannatta and Fordham (2004) found the TAS to have a high level of reliability with a Cronbach's alpha, α = .9083. See Table 2 for a distribution of TAS survey questions and examined variables.

Table 2

Teacher Attribute Survey

Variable	Definition	Items	Likert Scale	Cronbach's alpha
Self-Efficacy	Beliefs of ability to affect student performance	1-16	1-6	.73
Philosophy 1	Teacher-centered vs. Student-centered	17-25	1-6	.61
Philosophy 2	Constructivist vs. Traditionalist	32-36	1-5	.69
Open to Change	Willingness to take risks and learn from mistakes	26-30	1-6	.69
Teacher Use of Technology	Frequency of instructor use of a variety of technology tools and applications in the classroom	37-51	1-4	.85
Student Use of Technology	Frequency of student use of a variety of technology tools and applications in the classroom	49-60	1-4	.80
Overall Use of Technology	Frequency of instructor and student use of a variety of technology tools and applications in the classroom	37-60	1-4	.89
Continue Grad Course Work Without Salary Incentive	Willing to take graduate courses if no salary incentive w available	31	1-6	
Professional Development	# of actual hours in past two years	61	open	
Tech Training	# of actual hours in past two years	62	open	
# Hours Worked Beyond the Work Wee	# of hours one typically works beyond the contractual work week to prepare for teaching	63	1-6	
# of Years Teaching		64	open	

Note: Survey was adapted from Vannatta & Fordham (2004).

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Data Analysis

In addition to descriptive statistics, investigators ran a forward multiple regression analysis in SPSS to examine predictive variables regarding teachers' overall classroom technology use and integration.

Results

3.1 *Teachers' beliefs and dispositions*

Table 3 shows the results of the descriptive analysis of teachers' beliefs and dispositions regarding the following variables: teacher self-efficacy, teacher philosophy 1, teacher philosophy 2, and openness to change.

As indicated in Table 3, teachers scored in the moderately agree range for self-efficacy. This shows that the participating teachers believed they can affect student performance. Teacher philosophy 1 revealed that teachers leaned slightly toward a student-centered learning environment. The variable openness to change scored in the moderately agree range indicating that the participating teachers have a willingness to take risks and learn from their mistakes. Constructivist vs. traditionalists, or teacher philosophy 2, leaned slightly toward the constructivist viewpoint.

Table 3

Means and Standard Deviations of Teacher Attributes

Variable	*Recoded Items*	*M*	*SD*	*SE*
Teacher Self-Efficacy	3, 4, 8, 10, 11, 12	4.15	0.42	0.04
Teacher Philosophy 1	17, 18, 20, 21, 22, 23, 25	3.21	0.58	0.06
Teacher Philosophy 2	32, 34, 35, 36	2.86	0.43	0.05
Openness to Change	28	4.15	0.61	0.07

3.2 Technology use in the classroom

The results of the descriptive analysis of classroom technology use among teachers and students are shown in Tables 4 and 5. As evident within these tables, teacher use of technology (M = 2.63, SD = .64) was slightly higher than student use of technology (M = 2.33, SD = .64).

The most frequently used type of technology by teachers and students were iPads and Chromebooks. Moderate frequency use was also found for SMART boards, presentation software, and content-specific software.

Table 4

Teacher Use of Technology	***M***		***SE***
Computer with SMART Board		1.07	0.13
Digital Camera	2.14	1.13	0.13
iPad or Chromebook	3.59	0.79	0.09

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Content Specific Tools (e.g., digital microscope, graphing calculator)	2.12	1.12	0.13
Word Processing	2.60	1.21	0.14
Database	2.25	1.15	0.14
Spreadsheet	2.26	1.14	0.13
Drawing/Graphics Programs (e.g., photoshop, AutoCad)	1.92	1.04	0.12
Content Specific Software (e.g., iStation, Accelerated Reader)	2.92	1.14	0.13
Presentation Software (PowerPoint, Apple Works, Prezi)	3.14	1.03	0.12
Multimedia (e.g., iMovie, KidPix, Adobe Premiere)	2.38	1.06	0.13
Email, Discussion Groups/ Listserves	2.90	1.21	0.14

Table 5

Student Use of Technology	*M*	*SD*	*SE*
Computer with SMART Board		1.17	0.14
Digital Camera	1.82	0.99	0.12
iPad or Chromebook	3.63	0.81	0.10
Content Specific Tools (e.g., digital microscope, graphing calculator)	2.11	1.16	0.14
Word Processing	2.26	1.16	0.14
Database	1.76	0.94	0.11
Spreadsheet	1.65	0.88	0.10
Drawing/Graphics Programs (e.g., photoshop, AutoCad)	1.99	1.06	0.12
Content Specific Software (e.g., iStation, Accelerated Reader)	2.99	1.16	0.14
Presentation Software (PowerPoint, Apple Works, Prezi)	2.53	1.13	0.13
Multimedia (e.g., iMovie, KidPix, Adobe Premiere)	2.29	1.17	0.14
Email, Discussion Groups/ Listserves	2.22	1.19	0.14

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3.3 Commitment to teaching improvement

Commitment to teaching improvement was measured with two variables: Willingness to take graduate courses without a salary incentive (question 31) and the number of hours worked beyond the regular work week (question 63). Both variables were addressed using a six-point Likert scale ranging from strongly disagree (1) to strongly agree (6).

Overall, teachers slightly agreed that they would continue to complete graduate courses, even if they were not required for on-going licensure or rewarded with a salary increase (M =3.67, SD =1.78). During the last two years, teachers averaged 21 hours of professional development. Professional development completed that was specific to technology training averaged 17 hours over the last two years. Survey results indicated that teachers spent approximately 3.5 hours working beyond the contractual work week. Participants in the study had been teaching for an average of 15 years.

Table 6 shows the results of additional analyses. Multiple regression analysis results showed the relationship between teacher dispositions and overall technology use. The relationship of teacher disposition, hours of professional development with overall technology use was statistically significant: β =.364, t = 2.37, p < .05. The relationship of teacher disposition, willingness to continue graduate courses with overall technology use was statistically significant: β = .637, t = 4.78, p < .05. The remaining variables were not significantly related (see Table 6).

Table 6

Table of Regression Coefficients

Standardized Coefficients	**Beta**	**t**	**Sig**
Teacher Self-Efficacy	0.103	0.847	0.403
Philosophy 1	-0.053	-0.423	0.675
Openness to Change	-0.281	-1.998	0.053
Philosophy 2	-0.038	-0.274	0.785
Professional Development	0.364	2.371	0.023
Technology Training	-0.046	-0.346	0.732
Hours Worked Beyond the Contractual Work Week	-0.121	-1.021	0.314
Years Teaching	-0.017	-0.150	0.881
Continue Graduate Courses	0.637	4.784	0.000

Discussion

The major premise of this study questioned how teacher dispositions predicted technology use in a classroom. This study found statistical significance in two areas: the number of professional development hours in which teachers participated and willingness to take graduate courses without an incentive influenced technology integration by classroom teachers. This appears to be a departure from previous work in the area. Whereas previous studies showed self-efficacy and openness to technology (Li, Garza, Keicher, & Popov, 2019), attitudes and beliefs toward technology (Becker & Anderson, 2000; MacArthur & Malouf, 1991; Tondeur, et al., 2017; Vannatta & Fordham, 2004), teaching philosophy (Dawson & Rakes, 2003), and

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technological content knowledge (Wachira & Keengwe, 2010) as some of the most important factors, the current study appears to show a different trend. Attitudes, beliefs, and knowledge tend to be internal perspectives, professional development, and graduate courses are external factors.

These results suggest a major change in the tide. One-to-one technology initiatives are more and more prevalent (Spektor-Levy & Gronot-Gilat, 2012), technology is more and more accessible via classrooms (Doran & Herald, 2016), and mobile technology is accessible to almost everyone (Futuresource Consulting, 2016). Thus, the need to understand the technology is more inherent in modern culture. As newer generations enter education as teachers and administrators, they are more likely to be comfortable with technology. For example, Generation X roughly spans those people born between 1965 and 1979. They are technology savvy and are considered "gung-ho adopters" of the internet (Katz, 2017, p. 18). Generation Y children are born from 1980 to 1994. According to Maiers (2017) technology is an "intimate part of everyday life" (p. 214) and they are considered the highest educated generation. Moreover, they will comprise 75% of the workforce by 2025 (Maiers, 2017). From a generational viewpoint, the results of this study are showing a departure from previous studies, indicating the issue of implementing technology in the classroom may have less to do with internal factors and more to do with the external, that is, additional training (professional development & graduate courses) for implementing educational services with technology.

Prensky (2001) suggested that school administrators must start teaching teachers to use the technology their students are already using. However, it is not an easy task to encourage active full-time teachers to change their personal beliefs, values, and teaching methods (Fleischer, 2012). As a result, much attention has been given to the importance of emphasizing technological centered pedagogy methods in pre-service teacher education programs.

To prepare future teachers for successful technology integration in the classroom, Duran, Fossum, and Leura (2006) suggested alignment of technology use with coursework and faculty modeling as crucial elements of an effective teacher preparation program. In turn, Ertmer (1999) posited that "It is important that teachers gain technical skills as well as pedagogical knowledge of effective instructional practices that incorporate meaningful uses of technology" (p. 48). Within this framework, teacher preparation programs need to better prepare future educators for employment in technological rich schools (Donovan, Green, & Hansen, 2012; Friedman & Kajder, 2006). Teacher educators need to set up environments within teacher education programs where teacher candidates receive vicariously (observation of technology integration) and personal (practice using technology to facilitate learning) technology experiences (Ertmer, 2005). Exposure to technology will make for an easier transition for teacher candidates from teacher preparation programs to classrooms (Friedman & Kajder, 2006).

Teacher educators must identify obstacles that stand in the way of successful technology integration while keeping in mind the power of individual teachers in determining the success or failure of one-to-one computing (Bebell & Kay, 2010). While many new teacher graduates were either born or raised during the Age of Digital Technology (Donovan, Green, & Hansen, 2012), this does not guarantee successful technology integration in the classroom. Research has found that digital natives have demonstrated a low tolerance to traditional instructional methods (Safro & Ansong-Gyimah, 2010). Furthermore, Li, Worch, Zhou, and Aguiton (2015) explained that digital native student teachers are not necessarily adept at keeping up with changes in digital technology.

It is important to highlight several limitations to this study. As with all survey studies, the survey return rate is a subject of concern. While this study achieved a respectable survey return rate from teachers (83 of 250; 33%), the authors acknowledge that an increase in the number participating teachers would have improved the reliability of the data. Also, the study was confined to a single, rural school district. By expanding the research population to include multiple school districts, schools in suburban as well as urban areas rich in diversity could lessen the limitations of the research. Also, not all campuses have had equal time and training in participating in the 1:1 initiative. The kindergarten and 1st and 2nd-grade campus were engaged in the 1:1 initiative for one year, while the 3rd and 4th-grade campus had been engaged in the initiative for three years.

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Conclusion

As mentioned throughout this study, 1:1 technology initiatives are becoming more commonplace in U.S. K-12 education institutions (Zheng, Warschauer, Lin, & Chang, 2016). Recognizing this trend, Bebell and Kay (2010) stressed, "It is impossible to overstate the power of individual teachers in the success or failure of 1:1 computing" (p. 47). Echoing Dawson and Rakes (2003), teacher commitment to innovation and their confidence to incorporate that innovation may positively impact effective technology adoption. Therefore, teachers should strive to attend professional development that exemplifies technology-enhanced lessons.

More research is needed on how non-technology specific teacher attributes predict successful technology use in the classroom. Knowing teacher attributes that lead to successful technology integration in the classroom, will help school administrators specifically target these attributes when hiring new teachers. School administrators would also benefit from knowing how and what types of professional development influences technology classroom integration. School boards and policymakers could use research studies, such as the current paper, to make informed decisions considering funding technological resources. By analyzing the amount of overall technology use with the quality of that use, the influence over student outcomes could be more closely predicted.

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