PIN IT, SHARE IT, LIKE IT, RETWEET IT: CALIFORNIA AGRICULTURE

TEACHERS PERCEIVED USEFULNESS OF SOCIAL MEDIA IN THEIR

PROFESSIONAL LEARNING

A Dissertation

by

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ABSTRACT

Limited research exists on practicing secondary teachers use of professional learning

networks (PLN) and their role in teachers professional learning continuum. The purpose

of this research was to identify California agriculture teachers perceived usefulness of

social media in their professional learning. Adult learners are unique in several ways:

need to know, the learner's self-concept, unique life experiences, willingness to learn,

desired teaching method and motivating factors. Because social media provides a

platform that allows educators to network with other professionals in a way that

facilitates the exploration of their personal learning objectives and other characteristics of

adult learners, it should be considered professional learning. A digital survey utilizing a

Likert scale was distributed to a sample of 464 California agriculture teachers, 164

teachers completed the instrument. Constructs of perceived usefulness of professional

social media use, as well as their perceived usefulness of school sponsored professional

learning were compared to social media engagement and several other demographic

characteristics relating to the teacher and their teaching assignment. Although there was

variation in perceived usefulness of social media in relation to gender, age group, career

phase, and teaching assignment, there was no difference between groups by credential

type, highest degree, and teacher isolation. There was also a significant difference

between teachers perceived usefulness of professional social media use when compared

to their school sponsored professional learning. Predictors for perceived social media use

were perceived usefulness of school sponsored professional learning, social media use,

participation in content specific professional learning, career stage, and teaching

assignment. The findings of this study quantitatively support literature relating to

teachers' positive behaviors and attitudes toward social media use in their professional

learning.

DEDICATION

To Gavin, Dylan, and John:

May you never stop asking questions, learning, and dreaming.

ACKNOWLEDGEMENTS

Finally, and most importantly, thanks to my husband Bryan, our children Gavin, Dylan and John, as well as our family and friends for their innumerable sacrifices, unwavering support, and continued encouragement throughout my journey.

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NOMENCLATURE

CATA	California Agriculture Teachers Association
CoP	Community of practice
EOTE	Elements of online teacher engagement instrument
LEA	Local educational agency
PLC	Professional learning community
PLN	Professional learning network
PUSM	Perceived usefulness of social media instrument
PUSSPL	Perceived usefulness of school sponsored professional learning
RO	Research objective

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<center>**CHAPTER ONE**</center>

<center>**INTRODUCTION**</center>

Background and Setting

For a connected educator, professional learning is not restricted to opportunities in the formal context of programs and curricula. Instead, educators leverage a complex professional learning network (PLN) involving a myriad of informal personal interactions and online communities including social media (Trust, Krutka, & Carpenter, 2016). Literature shows professional learning is necessary for teachers to positively influence student learning in educational settings (Guskey, 2000; Harris, Mishra, & Koehler, 2009; Penuel, Sun, Frank, & Gallagher, 2012), as teachers must continue to build and refine their skills based on emerging research (Guskey, 2000). According to Nussbaum-Beach and Ritter Hall (2012), technology has made extended professional learning networks widely available to educators, in a space where individuals can harness the collective wisdom of other professionals around the world. These complex PLNs allow connected educators to engage others, investigate, and create knowledge without regard for proximity and time. Although each individual may benefit from their PLN in different ways, teachers have reported feeling connection to others as well as profess an increased exposure to new perspectives, concepts, and resources (King, 2011; Krutka, Carpenter, & Trust, 2016). Due to the individual and personal nature of these networks, they could be considered in alignment with core principles of adult learning as outlined by Knowles, Holton, and Swanson (2015).

Even with the widespread availability of the internet, and the length of time social media have been in existence, there is surprisingly minute empirical research surrounding

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teachers' informal learning through their online PLNs (Trust et al., 2016; Xing & Gao, 2018). Trust et al. (2016) define PLNs as "uniquely personalized, complex systems of interactions consisting of people, resources and digital tools that support ongoing learning and professional growth" (p. 28). Although this study focuses on teachers online PLNs, it should be noted that the Trust et al. (2016) study intended to focus on PLNs as they related to online interaction, but found that 71% of the respondents discussed the inclusion of individuals such as co-workers, administrators, and other personal relationships as valuable components of their PLNs. The sparse research that does exist on online PLNs is focused on the specific platforms of Facebook (Ranieri, Manca, & Fini, 2012; Rutherford, 2013) and Twitter (Carpenter & Krutka, 2015; Davis, 2015; Gallop, 2014; Lantz-Andersson, Lundin, & Selwyn, 2018). Trust et al. (2016) cautioned researchers from continuing to pursue research on specific social media platforms, as recent findings have well documented the complex nature of PLNs. Further, the internet is everchanging; therefore, it is inevitable specific online social platforms will fall from favor, as the Pew Research Center (2018b) noted. The danger of focusing research on the micro level of individual social media platforms, can distract from a greater usefulness of understanding PLNs as a whole (Trust et al., 2016).

In recent years, the U.S. has allocated school financial resources through Title I and Title II funding to address the issue of high quality teacher professional development (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Even with an increased focus on professional learning for teachers, in many cases, teachers' needs are not being met at the local level; therefore, these teachers are choosing to pursue their needs through their PLN (Rentner, Kober, Frizzell, & Ferguson, 2016). Rentner et al.

(2016) recommends school administrators examine policies relating to professional use of social media, and how it could support teacher learning.

A small body of research supports the implied perceived usefulness of social media in teachers professional learning (Trust, 2012). However, there is little empirical research which attempts to identify relationships and describe the effects of teachers perceived usefulness of social media as it relates to their school sponsored professional learning, social media use and other demographic attributes in a random sample. The Lantz-Andersson et al. (2018) review of literature identified only 28 studies in the area of informal professional learning online. None of the studies discussed utilized adult learning as a conceptual framework. With limited literature on the topic of educators PLNs, it is difficult to support preservice and in-service educators in building and maintaining their PLNs as part of their professional learning continuum.

The purpose of this research was to explore California Agriculture Teachers perceived usefulness of professional social media use. This study addressed AAAE Research Priority 3, question 2, "what methods, models, and practices are effective in recruiting agricultural leadership, education and communication practitioners (teachers, extension agents, etc.) and supporting their success at all stages of their careers?" (Stripling & Ricketts, 2016, p. 31). Educators at all levels, and in all subject areas, including those in positions of preservice and in-service teachers, administrators and teacher educators should consider social media as a component of their PLNs, and how they might ultimately improve student learning as a result of an educators ongoing and self-directed informal professional learning online (Krutka et al., 2016).

An online survey was used to identify teachers' attitudes and behaviors relating to social media as well demographics. The population of California agriculture teachers allowed for adequate sample size for statistical analysis. California (951 teachers), is second only to Texas (2600 teachers) in their number of agriculture teachers (Lawver, Foster, & Smith, 2018). Missouri (533 teachers), North Carolina (520 teachers), and Ohio (520 teachers) round out the top five states in the number of teachers, with substantially fewer teachers than Texas and California (Lawver et al., 2018). Further, the population was considered accessible, as the California Agriculture Teachers Association (CATA) maintains a list of all secondary agriculture teachers in the state. A sample of this nature could allow for generalizability to secondary agriculture teachers in other states as well as teachers of other content areas at the secondary level.

The conceptual framework of this study is andragogy. Teachers have a high perceived usefulness of social media for their professional learning because it aligns with the assumptions of the adult learner. Assumptions of the adult learner are (a) need to know, (b) learner's self-concept, (c) role of experience, (d) readiness to learn, (e) orientation to learning, and (f) motivation (Knowles et al., 2015). As teachers engage, discover, share, reflect and experiment as a result of their online interaction in their PLN (Krutka et al., 2016), they are allowed to do so with autonomy to meet their own personal learning objectives in the way they choose; whereby allowing themselves to meet the assumptions of their adult learning.

Statement of the Problem

Teachers often find their school sponsored professional learning to have low perceived usefulness (Guskey, 2000), and therefore are going online to meet their

professional learning objectives (Nussbaum-Beach & Ritter Hall, 2012). Although a body of research exists for teachers use of social media as an instructional strategy at the secondary and post-secondary level (Dabbagh & Kitsantas, 2012), there is limited research on teachers use of social media as a means by which to engage in professional learning (Lantz-Andersson et al., 2018; Trust et al., 2016). Without a thorough understanding of how teachers are engaging in professional social media use, teacher educators and adult learning program planners are unable to adequately design opportunities for adult learners to build and expand their PLNs to include social media to best meet the needs of each teacher.

Purpose and Objectives

The purpose of this research was to determine California agriculture teachers perceived usefulness of professional social media use and school sponsored professional learning, compared to their self-reported professional social media engagement. This research was guided by the following research objectives (RO):

RO1 Examine teachers' self-reported engagement in professional social media use.

RO2 Explain the variance of perceived usefulness of professional social media use and perceived usefulness of school sponsored professional learning.

RO3 Identify relationships relating to teachers perceived usefulness of social media use and other variables of interest.

RO4 Describe the effects of teacher career phase on PUSM compare to reported professional social media use.

RO5 Describe the effects of teaching assignment on teachers' perceived

usefulness of social media.

RO6 Describe the effects of age and gender on teachers' perceived usefulness of

social media.

RO7 Describe the effects of teacher credentialing and degrees on teachers'

perceived usefulness of social media.

RO8 Examine the effects of geography and teaching assignment isolation on

teachers' perceived usefulness of social media.

RO9 Predict perceived usefulness of social media use in teachers based on

demographic and teaching assignment characteristics.

Limitations

Caution may be warranted in generalizing these results to larger populations of

agriculture teachers outside of California as well as populations of teachers in other

secondary subject areas. It should be noted the CATA has a strong focus on professional

learning and has made it a recent initiative to encourage networking of its members, with

a special focus on mentoring early career teachers. This encouragement and professional

support infrastructure may not exist in other contexts. It should also be noted I have

facilitated several workshops for agriculture teacher professional learning at the regional

and state level, and am also the sole administrator of the California Agriculture Teachers

Facebook group. To combat possible error, surveys were anonymous. Also, follow up

reminders were through email and over the phone not in face to face workshops or

through the Facebook group where the primary researcher serves as the administrator.

The EOTE instrument showed high reliability with each of its subscales of Active Engagement, Passive Engagement, Sharing, Discovering, Reflecting, and Experimenting, all above the minimum Chronbach's $\alpha = .8$ as recommended by Field (2013). However, caution should be used in generalizing the scores of the EOTE to the population, as comparison of early and late responders in this study showed a significant difference between groups. Early responders' scores were lower, indicating a stronger agreeance with social media use behaviors, compared to higher mean scores in subsequent contacts with respondents. Early and late responders were compared on other variables of interest, and no significant difference occurred between the groups.

Assumptions

The whole population of secondary California agriculture teachers was considered to be accessible, as all teachers had a school sponsored or personal email address, which had been provided to the California Agriculture Teachers Association (CATA). It is assumed that email addresses were accurate, and that because teachers provided an email address to the CATA, that they had adequate access to the internet to complete the online survey for this research. It is also assumed that the teachers in the population hold at least a bachelor's degree, as this is a requirement for teaching in California schools (California Commission on Teacher Credentialing, n.d.).

CHAPTER TWO

REVIEW OF LITERATURE

Overview

This chapter outlines the literature pertaining to teachers' professional learning, professional social media use and the relationship to andragogy. Literature has documented teachers' explicit and implicit perceived usefulness of professional social media use (Alderton, Brunsell, & Bariexca, 2015; Dabbagh & Kitsantas, 2012; Davis, 2015; King, 2011; Ranieri et al., 2012; Xing & Gao, 2018). Teachers have reported social media to be useful for exposure to resources and ideas, overcoming feelings of isolation and ability to engage anytime from anywhere (Davis, 2015; Nussbaum-Beach & Ritter Hall, 2012). Teachers autonomy in all aspects of their engagement (Davis, 2015) aligns with the assumptions of the adult learner (Knowles et al., 2015), and therefore results in teachers perceived usefulness of their PLN.

For the purpose of this study, perceived usefulness is defined as the extent to which teachers believe professional learning "will help them perform their job better" (Davis, 1989, p. 320). Davis (1989) found that although ease of use influences perceived usefulness, the biggest predictor of use in relation to technology is perceived usefulness of the innovation. Twitter, Edmodo, blogs, Google+, Facebook, Discovery Education, and Pinterest are the most popular sites teachers are using for their online professional learning, however, of those sites and more, many teachers report utilizing more than a single platform for the purposes of engaging with their PLN (Trust et al., 2016).

Failure to address teachers' professional learning in the context of their subject area, for the purpose of building teachers' knowledge, skill and ability to be more effective for students, often results in failure of school sponsored professional learning programs (Guskey, 2002). Without professional learning that aligns to their adult learning needs, teachers may turn to engagement in informal learning opportunities online (Greenhow & Lewin, 2016; Nussbaum-Beach & Ritter Hall, 2012; Visser, Evering, & Barrett, 2014). Online, complex individually designed networks create an atmosphere in which educators can concurrently learn and share in a reciprocal style (Nussbaum-Beach & Ritter Hall, 2012; Trust et al., 2016). For the purpose of this study, PLN is defined as a "system of interpersonal connections and resources" where the primary area of engagement is online (Trust, 2012, p. 133).

Teacher Engagement in Online PLNs

Krutka et al. (2016) developed the *elements of teacher's professional learning network activities* model (Figure 2.1) to illustrate the elements of teacher's PLN interactions. This model depicts the complex relationships of elements (behaviors) based on the Trust et al. (2016) findings.

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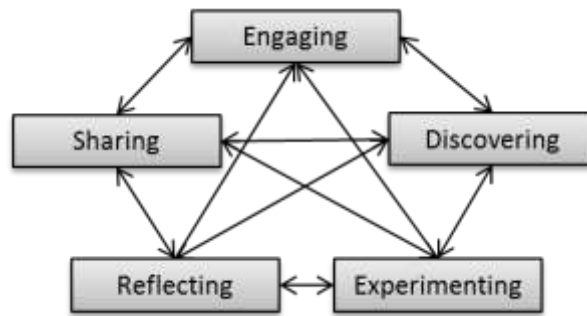
Figure 2.1. Modified elements of teacher's professional learning network activities (Krutka et al., 2016). Recreated with permission.

Each of the five elements of Figure 2.1 are connected with a series of interconnected and double-sided arrows, connecting each element to all others. This complex network of elements is a representation of the various ways teachers are utilizing their PLNs, which include professional social media use (Krutka et al., 2016). Each element in the model can be supported with a variety of findings from literature.

Engaging refers to the ways educators participate in their PLN, which is dependent on their individual motivations and self-identified needs (Krutka et al., 2016). Participants in their study identified the pursuit of specific goals in their engagement with their PLN. Adult learners felt need, orientation to learning, and readiness to learn play an important role in adult learning (Knowles et al., 2015). When adults pursue their personal learning objectives for professional purposes, they are acting upon their feelings of need as described by Knowles et al. (2015). Meaningful professional development was identified as a major theme of teachers' professional Twitter use, as their participation afforded them access to people and topics which they believed to be beneficial (Davis, 2015; Visser et al., 2014). Educators who use Twitter feel their autonomy in determining

when and to what extent they would participate in online discussion to be a major benefit (Davis, 2015). Other themes have been identified in literature relating to teachers content area included solicitation of ideas and resources in the areas of pedagogical content knowledge, general pedagogical knowledge and curriculum knowledge (Rutherford, 2013). When teachers actively seek these resources, they are seeking to address a personal need.

Discovery encompasses an unintentional exposure to ideas, resources, and methods as a result of PLN engagement (Krutka et al., 2016). While teachers had not specifically set out to find resources like lesson plans, teaching strategies, and other teaching tools, they were exposed to them through their presence in online platforms (Krutka et al., 2016). Twitter users who participate in #edchat reported the flow of information to be an asset, as the chat exposed individuals to ideas and resources (Davis, 2015). As discussed by Rogers (2003), unintentional exposure to innovations can assist in diffusion of innovations. The intentional and unintentional diffusion of educational innovations relating to educational practices and resources has been shown to occur through professional social media use where teachers both share, and are exposed to innovations (Davis, 2015; Krutka et al., 2016). Further, Aldunate and Nussbaum (2013) found a lack of exposure to innovators and early adopters of technology increases the incidence of innovation abandonment.

Experimentation refers to testing findings (including curriculum or instructional strategies) from PLN interaction, whether the discovery was purposeful or unintentional (Krutka et al., 2016). Ranieri et al. (2012) found members who participated in Facebook groups where members didn't have personal ties to other members in a face to face

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manner, were more likely to pursue new projects as a result of their interaction within the Facebook group. Inversely, those in thematic groups did not experience as many new ideas as a result of their Facebook membership because new ideas were less likely to surface in a homogeneous group.

Reflection addresses the teacher's consideration of outputs and changed behavior based on their exposure and implementation to new ideas, curriculum and instructional strategies (Krutka et al., 2016). York-Barr, Sommers, Ghere, and Montie (2005) asserted "learning is a function of reflection" (p. 19). York-Barr et al. (2005) recognized several benefits of personal reflection for educators, including a self-realization of personal gains, consideration of dilemmas, personal data analysis, and even a renewed clarity of professional purpose as it aligns to professional goals. Further, reflection with partners can also offer the same benefits of personal reflection, in addition to opportunities for coaching and support, reduced feelings of isolation, and increased self-efficacy. Benefits continue to grow with the inclusion of larger teams. In an online setting, individuals can engage in reflection and interact with others, and reap many of these same benefits recognized for professional learning communities (PLC). The access to a large numbers of possible collaborators online could offer educational practice improvements, as York-Barr et al. (2005) noted larger groups offer even greater growth potential when teachers move "from a culture of doing to a culture of learning," and as groups continue to reflect collaboratively, they can grow collectively (York-Barr et al., 2005, p. 19). Davis (2015) found examples of Twitter chat participants reflecting online, and being challenged to examine their thinking by other chat participants. Some educators report using Twitter for taking notes and reflections in real time while they are in attendance at conferences, and

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those who are not in attendance report following conferences through the Tweets of others (Visser et al., 2014).

Sharing denotes the teacher's individual contributions that add to the body of knowledge. Each of the five areas can be connected to several other elements of the model to best clarify the complex nature of PLNs and their role in educator's growth as a whole person (Krutka et al., 2016). Davis (2015) noted teachers brought resources to conversations including hyperlinks and information from other external sources. Although not a social media group, Hew and Hara (2007) found announcements for professional events to be a major theme in an online discussion group for teachers.

Adult learners are unique in many ways and therefore, should have their learning preferences considered in their professional learning continuum. Those who engage online in PLNs are considered connected educators (Nussbaum-Beach & Ritter Hall, 2012). PLNs meet several tenants of adult learning, as they can provide platforms for teachers to engage in their personal learning objectives though a teaching method of their choosing, on their own timeline, in a context which is relevant to their needs.

Adult Education

Notable teachers of history including Confucius, Aristotle, Socrates, Plato, and more recently Malcom Knowles have regarded the adult learner as separate of the child learner (Knowles et al., 2015). Knowles et al. (2015) described an approach to teaching and learning which adult learners are actively engaged, and the teachers take the role of facilitators. Early examples of a learner centered approach can be identified with the Chinese and Hebrews who utilized case studies, the Greeks popularized Socratic dialogue, and the Romans engaged in debate (Knowles et al., 2015).

Even with a rich history of differentiated adult learning instructional approaches, the United States school system was founded largely on the European school systems, which were grounded in methods associated with teaching children church beliefs and customs (Knowles et al., 2015). The assumptions these teachers relied upon became referred to as pedagogy, which literally translates to "the art and science of teaching children" (Knowles et al., 2015, p. 19). It wasn't until the mid-20th century that a distinction of adult and child learner arose in the U.S. (Knowles et al., 2015). Malcom Knowles is widely regarded as the father of andragogy, the model for adult learning (Knowles et al., 2015). The adult learning model is based on six principles which are discussed at length later in this chapter.

Purpose of Professional Learning

It is widely believed teachers require professional learning in order to improve student learning outcomes (Darling-Hammond et al., 2009; Guskey, 2002; Wilson & Berne, 1999). Darling-Hammond et al. (2009) express a national need to "bolster teacher skills and knowledge to ensure every teacher is able to teach increasingly diverse learners, knowledgeable about student learning, competent in complex core academic content, and skillful at the craft of teaching" (p. 3). However, the current approach of sporadic and isolated professional learning workshops may be sending teachers a message that reflection on their teaching practices is not necessary as part of their daily routine (Guskey, 2000).

Professional learning can take many forms including workshops, curriculum design, evaluation of data, and conferences (Avalos, 2011). Regardless of the format, researchers agree it should be high quality, coherent, specific to academic content, and

ongoing (Darling-Hammond et al., 2009; Guskey, 2000); however "most teachers in the

United States do not have access to professional development that uniformly meets all

these criteria" (Darling-Hammond et al., 2009, p. 5). Research shows teachers need close

to 50 hours of professional development to improve their skills to the point of increased

student learning, yet 90% of teachers report attending workshops and conferences that are

short term in nature, and nearly 60% reported participating in only two days (16 hours) of

professional learning related to their specific content area each year (Darling-Hammond

et al., 2009).

School officials have the difficult task of balancing teachers' unique learning

goals with the local educational agency's (LEA) vision and goals (Terehoff, 2002). There

are varying teacher attitudes about LEA sponsored professional learning initiatives. Many

teachers agree they participate in LEA sponsored professional learning not because they

are contractually obligated, but because they seek to become more knowledgeable, build

their skills, and enhance student learning (Guskey, 2002). While this may be true for

some, others comply with initiatives because they are contractually obligated, but see

little value in the application of the content being presented (Guskey, 2000). A variety of

factors may be responsible for the poor perceived usefulness of school sponsored

professional learning, including the presentation of innovations that are not supported by

research or cannot be implemented as a result of existing systems with in the LEA

(Guskey, 2000).

Regardless of teacher attitudes toward the implementation of PL, "notable

improvements in education almost never take place in the absence of professional

development" (Guskey, 2000, p. 4). In order to make improvements in student learning, it

is necessary to consider a multitude of variables in relation to content of professional

learning experiences, teacher beliefs and philosophies, as well as social systems that can

impact teachers' ability to implement change (Guskey, 1986). With professional learning

set as a lynchpin in student learning outcomes, it is important to consider the instructional

methods employed in their professional learning. Dewey (1916) wrote that formal

instruction "easily becomes remote and dead – abstract and bookish, to use ordinary

words of depreciation" (p. 8). In this context, professional learning for teachers must to

be personalized and aligned to the Knowles et al. (2015) principles of adult learning.

Formal professional development with fixed and rigid content and approaches to

instruction, although sometimes necessary, does not account for the adult learner's need

to know and past experiences, which often results in poor teacher perceptions of

professional learning events (Guskey, 2000).

> Professional development is about teachers learning, learning how to learn, and
>
> transforming their knowledge into practice for the benefits of their students'
>
> growth. Teacher professional learning is a complex process, which requires
>
> cognitive and emotional involvement of teacher individually and collectively, the
>
> capacity and willingness to examine where each one stands in terms of
>
> convictions and beliefs and the perusal and enactment of appropriate alternatives
>
> for improvement or change. (Avalos, 2011, p. 10)

Literature has shown professional learning for educators plays an important role

in student learning. Rentner et al. (2016) reported that nationally 15% of teachers believe

their day-to-day teaching could be improved if they were provided with more high-

quality professional development. Further, 6% cited a need for access to mentors to

address self-identified areas of improvement, and 6% also cited a need for greater access to curriculum and resources in a digital format. According to Darling-Hammond et al. (2009)

> The United States is squandering a significant opportunity to leverage improvements in teachers' knowledge to improve school and student performance. Other nations, our competitors, have made support for teacher and teacher learning a top priority with significant results. In these countries, students learn and achieve more. Teachers stay in the field longer and are more satisfied with their work. Educators take on even more responsibility for improving what happens in their building. (p. 2)

Diffusion of Innovations

To reach the goal of improved student learning, it is often necessary for teachers to adopt innovations. This process can be difficult for teachers (Guskey, 1986), considering the notion of change process is often overlooked by teacher professional learning facilitators (Guskey, 2002). Beyond this, recent educational reform has shifted toward greater stakeholder engagement, with a focus on parent and community involvement. As a result, professional learning is required not only for teachers, but for administrators to make the shift (Guskey, 2000). Considering the need for new knowledge and skills as well as a shift in attitudes, professional learning facilitators should contemplate the implication of the Rogers' (2003) diffusion of innovations in combination with the body of literature relating to implementation of educational practices and innovations (Guskey, 1986).

Diffusion is a required process in communication of knowledge of *innovations* or new ideas, by which stakeholders determine if they will accept or reject the innovation (Rogers, 2003). This process has several steps, "(1) an *innovation* (2) is *communicated* through certain channels (3) over *time* (4) among the members of a *social system*," this process can include the deliberate or unexpected spread of ideas (Rogers, 2003, p. 11). Because the diffusion of innovations is in part a social process, it is important to consider its implications in relation to this study. The diffusion of innovations relates to innovations presented in formal and informal professional learning. Teachers can get exposure to innovations through the use of social media, and more generally through PLNs (Krutka et al., 2016; Nussbaum-Beach & Ritter Hall, 2012). This process occurs when teachers share ideas and resources in online platforms. Exposure to new ideas, however doesn't constitute testing or adoption of these ideas (Rogers, 2003).

Teachers could have a variety of reasons why they do not implement changes (adopt innovations) in their classroom as a result of formal or informal learning. One reason relates to teachers reluctance to change for fear the innovation may result in poorer student learning outcomes (Guskey, 1986). The change process model states individuals are more likely to adopt change if the benefits of the innovation outweigh those of the current method. For the professional learning programmer, this translates to a need to allow opportunity for teachers to explore the benefits, and the programmer ready to explicitly communicate them for participants (Guskey, 2000).

The Krutka et al. (2016) model for the Elements of teachers' professional learning network activities relies heavily on communication. Rogers (2003) defined *communication* as methods and means by which information is shared. Communication

in this context can be considered from two aspects, teachers' adoption of social media for professional purposes, as well as adoption of innovations teachers are exposed to once professional social media use is adopted by the teacher. In order for educators to widely adopt social media Tucker (2018) recommended mentors to assist late adopters with incorporating Twitter into their PLN. When teachers engage in professional social media use, they can not only seek innovations relating to their expressed needs, but are also exposed to a wealth of innovations unintentionally (Krutka et al., 2016; Trust et al., 2016).

According to Rogers (2003), innovations that are visibly adopted by other members of the social construct are more likely to be widely adopted, as it stimulates discussion, and thereby facilitates diffusion. This can occur in forums where teachers share their experiences or resources, and others engage in discussion. As these resources and ideas are discussed on social media, the dialog provides channels for innovations to diffuse, or spread. According to Rogers (2003), the majority of individuals rely on personal appraisals of innovations as opposed to scientific findings. Because the diffusion process weighs heavily on peer communication, social media could be a catalyst for the spread of educational ideas. Although, the spread of ideas may not be as prominent in groups where the membership is similar. Krutka, Carpenter, and Trust (2017) identified the danger and limitations of learning when networks are restricted to individuals with similar cultural backgrounds, ideology and philosophy.

Those with similar "beliefs, education, and socioeconomic status" are as said to be *homophilous* (Rogers, 2003, p. 19), and considering teachers' PLNs it is safe to assume most have at least a bachelor's degree as a result of state licensure requirements

(California Commission on Teacher Credentialing, n.d.). The opposite of homophilous

groupings occur when individuals have differences in their social characteristics, referred

to as *heterophilous* (Rogers, 2003). Those with extensive PLNs are likely to have more

heterophilous groups, because their network likely consists of a variety of individuals

with various perspectives. Although the most effective communication happens within

the homophilous groups, in order for diffusion of a new idea to occur, and for growth of

teachers to occur, there must be heterophily to some extent to introduce the new idea and

challenge existing thinking to bring about change (Krutka et al., 2017; Rogers, 2003).

Further, without the cognitive dissonance in heterophilous groups, there may be a

tendency to forego fact checking of resources and opinions if they are in alignment with

existing beliefs (Festinger, 1962; Krutka et al., 2017).

Traditional Approaches to Professional Development

Although the terms education and learning are often used interchangeably, one

should not assume that because a teacher has participated in a professional learning

activity, they have learned (Guskey, 2000). Teachers have varied experiences and

backgrounds relating to teacher preparation programs, internships, early teaching

experience, and course work. Further, the systems in which teachers work can impact a

teachers' ability to implement change, regardless of the research that supports the need

for change (Guskey, 2000). Finally, although characteristics of effective professional

learning are widely agreed upon, there is conflicting literature related to professional

learning approaches to delivery which make it is difficult to create a unifying

professional development theory for educators (Boylan, Coldwell, Maxwell, & Jordan,

2018; Guskey, 2000). Traditional approaches to professional learning can take several

formats, and can be implemented in various timeframes, with varying levels of continued

support (Boylan et al., 2018).

Nationally, most teachers (90.52%) reported attending workshops, conferences, or

training sessions in the last 12 months, with an average of 5.38 days in the last year

(*Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015).

Outside of opportunities on their own campus, just over one quarter (26.12%) of teachers

reported some professional development through a university, and 22% reported making

observations at other schools (*Schools and Staffing Survey, Public and Private School*

Teachers: 2011-12, 2015). Table 2.1 shows a combination of data relating to teachers and

their professional learning. Between the 2007-2008 and 2010-2011 survey years

(*National Teacher and Principal Survey, 2015-2016 Public School Teachers*, 2018), and

the 2010-2011 survey year (*National Teacher and Principal Survey, 2015-2016 Public*

School Teachers, 2018), the instrument utilized to collect the data underwent major

revision, so data are not available for all years on all topics. Career technical education

teachers may have professional learning requirements relating to their funding, this is true

for California Agriculture programs, where teachers are required to attend at least 4 days

of professional learning per year (Agriculture Career Technical Education Incentive

Grant, n.d.).

Table 2.1

Percentage of U.S. teachers' participation and attitudes toward professional development

	2007-2008[a]	2010-2011[a]	2015-2016[b]
Content specific PL			
No	14.88		
Yes	85.12		
Hours of subject area PL			
8 Hours or less	19.02	17.95	
9-16 hours	23.69	23.03	
17-32 hours	19.89	20.39	
33 hours or more	22.52	21.31	
Skipped or invalid	14.88	17.32	
Usefulness of content area PL			
Not useful	1.54	1.44	
Somewhat useful	23.61	22.66	
Useful	37.70	35.93	
Very useful	22.26	22.66	
Skipped or invalid	14.88	17.32	
Teacher influence on PL content			
No influence		18.81	18.49
Minor influence		35.90	37.64
Moderate influence		33.49	32.64
A great deal of influence		11.81	11.24

Note. Source data from *National Teacher and Principal Survey, 2015-2016 Public School Teachers* 2018); *Schools and Staffing Survey, Public and Private School Teachers: 2011-12* 2015). Data not available for survey years through the National Center for Educational Statistics. PL = Professional learning.
[a] Schools and Staffing Survey, Public and Private School Teachers; [b] National Teacher and Principal Survey, Public School Teachers

In considering professional development specific to the subjects teachers teach, the number of hours of professional learning teachers received in their content area

remained fairly constant between survey cycles, with between 22-21% of teachers getting four days or more of content area professional learning in a 12 month timeframe (*Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015). This group is significant, as literature shows roughly 50 hours of professional learning is required to generate a significant change in teacher practice, which represents roughly six days of professional learning (Darling-Hammond et al., 2009). Teachers' perceptions of their professional learning was mostly positive, with 58.95% reporting useful or very useful, and 24.1% reporting not useful or somewhat useful (*Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015). Only 25% of teachers reported being compensated for professional development that occurred outside of scheduled work times (*Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015). Over half (54.71%) of teachers report having no to minor influence on professional learning programs in their schools, while 45.3% report having moderate to great influence (*Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015). Considering the assumptions of the adult learner, the lack of perceived input on their professional learning may be in violation of the assumption of need. Though no metrics exist for perceived usefulness of non-subject area professional learning, the literature for usefulness of content area professional learning is quite high, with less than 2% of teachers reporting not useful in two survey cycles (*National Teacher and Principal Survey, 2015-2016 Public School Teachers*, 2018; *Schools and Staffing Survey, Public and Private School Teachers: 2011-12*, 2015).

Although most teachers see the need for professional learning, the common systems and structures are often considered by teachers to be irrelevant (Avalos, 2011).

Professional learning opportunities are often considered ineffective at engaging teachers for a myriad of reasons (National Research Council, 2000). In a 1994 study of U.S. teachers, 67% reported not having any choice relating to the professional development they were asked to participate in (National Research Council, 2000). Even though Knowles et al. (2015) identifies timeliness as a need for adult learning, many adult learning events focus on generic topics, which are disconnected from the context of the teachers classroom (National Research Council, 2000). Beyond content being perceived as not connected, the professional learning events are often infrequent and disconnected (Guskey, 2000). Guskey (2000) said this proliferates a message of professional learning not a part of teachers' daily practice. Given these challenges, teachers are working to meet their needs outside of what their school sites are providing them (Trust et al., 2016).

Collaborative and Social Professional Learning

Collaboration amongst teachers can help to bolster teacher learning beyond traditional workshop and formal education type opportunities (National Research Council, 2000). According to Darling-Hammond et al. (2009), teachers should meet regularly with their peers to engage in conversations centered on data to explore strategies, write curriculum and assessments, reflect upon teaching as well as other considerations. This research seeks to focus on informal learning typically associated with a PLN, but it is also important to identify the role of professional learning communities (PLC) and communities of practice (COP) in relation to the PLN.

Table 2.2 compares PLCs and PLNs. PLC's, sometimes referred to as a COP, are a common approach to professional learning. As stated by Stewart (2014), "the mission of a PLC is to gain a deeper understanding of how students learn content and then apply

that understanding to how content is taught" (p. 29). These teams are often organized

according to grade level and/or subject area depending on the teaching assignment at a

specific site. Group membership is dictated by the administration at a site or district level.

The purpose of these groups is to increase student learning through discussion and

reflective practice surrounding student work (Stewart, 2014). The frequency at which

these groups convene is dictated at a site or district level but are often weekly or monthly.

Stewart (2014) noted these groups are most effective when teachers have the autonomy to

examine their own professional goals, which can be aligned with the findings of Knowles

et al. (2015), as adult learners must feel a need to engage in learning. Although in the

PLC and COP, individuals interact with other professionals on an ongoing basis, in a

PLC this interaction is limited to a specific group of professionals in a specific location,

whereas a PLN may include individuals from online and face to face. PLNs are discussed

at a greater depth later in this chapter.

Table 2.2

Professional Learning Communities Compared to Professional Learning Networks

	PLC	PLN
Origin	Organized for teachers by administrators	Determined by the individual
Membership	Grade level or subject area teams	Determined by the personal needs of the individual
Location	At a school site	Mostly online through SM, blogs, discussion forums, etc.
Purpose	Increase student learning	Determined by the individual
Frequency of Interaction	Determined by administration.	Ongoing

Note. Table based on Stewart (2014), National Research Council (2000), and Nussbaum-Beach and Ritter Hall (2012). SM = Social media.

Social Media Use

　　How adults learn and interact socially has continued to evolve and change, especially over the last 20 years. In 2000, 52% of U.S. adults used the internet, and in 2018 that number has reached 89% (Pew Research Center, 2018a). According to the Pew Research Center (2018b), in the last 10 years, U.S. adult use of social media has increased from 10% to 69%. Internet use has increased across all age groups, as has home broadband internet until recently, which the Pew Research Center (2018a) attributes to a growing number of individuals utilizing smart phones as their primary internet source in their homes. This is especially true for the non-white demographics of black (24%) and Hispanic (35%), as well as those reporting $30,000 or less income per year.

　　Table 2.3 shows the upward trend of social media use in the U.S. by various demographic characteristics. In general, those living in urban areas, with the greatest income, and education lead social media use.

Table 2.3

Percentage of Adult Social Media Use in the United States

Demographic	Social Media			Broadband Internet Use[a]		
	2018	2012	2005	2018	2012	2005
Age						
18-29	88	82	7	98	96	83
30-49	78	64	6	97	91	79
50-64	64	39	4	87	79	66
65+	37	16	3	66	54	28
Gender						
Women	73	56	6			
Men	65	50	4			
Race						
Hispanic	72	51				
Black	69	48	4			
White	68	53	5			
Community type						
urban	75	75	56			
suburban	69	54	5			
rural	59	45	3			
Education						
college graduates		79	64			
some college	72	65	5			
High School or less	60	41	3			
Income						
$75,000+	77	68	7			
$50,000-$74,999	74	57	8			
$30,000 - $49,999	74	58	6			
Less than $30,000	63	46	3			

Note. Data from Pew Research Center (2018b).
a Only age data collected for internet use.

Over the years social media platforms have fallen from favor (Trust, 2012).

According to Skeels and Grudin (2009), most active sites in 2009 were MySpace,

Facebook, Classmates, LinkedIn, Live Spaces and Reunion.com. Figure 2.2 shows the

Pew Research Center's (2018b) findings for the years of 2012 and 2018. Individuals have

increased their use of Facebook, Pinterest, Instagram, LinkedIn, and Twitter. Although

YouTube was created in 2005, it was not monitored by the Pew Research Center (2018b)

in their 2012 survey. In 2018, the platform has become prominent, with 73% of American

adults utilizing it. This shift in platform use is why Trust et al. (2016) cautioned

researchers from focusing research efforts relating to educational social media use to

specific platforms, as research findings focused on specific platforms can quickly become

irrelevant to current use.
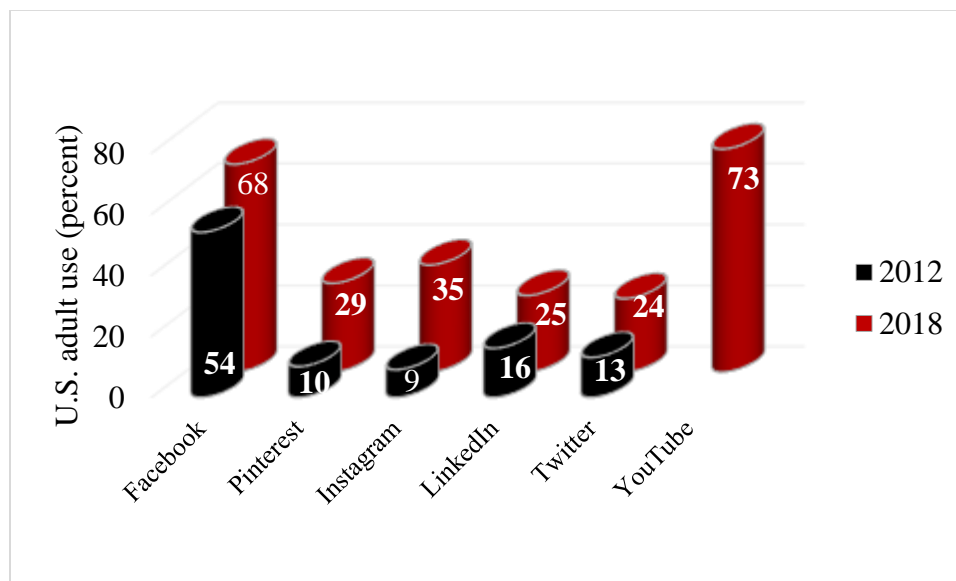
Figure 2.2 Social Media Use by Platform in the U.S. Generated with data from Pew
Research Center (2018b)

Figure 2.3 shows the frequency of use by social media platform for those that utilized each social media site. Facebook has the highest daily use, followed by Instagram, Twitter, then YouTube (Pew Research Center, 2018b).
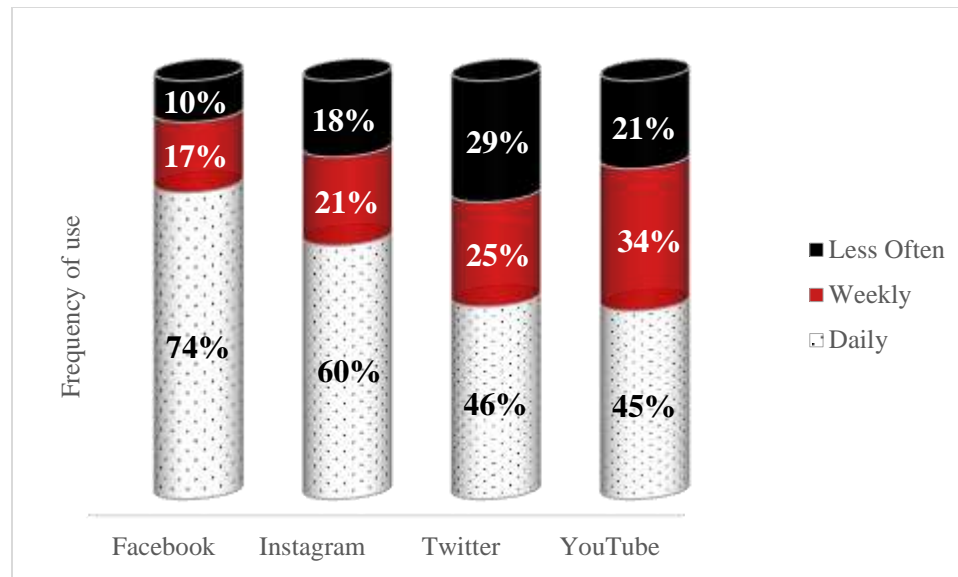
Figure 2.3 Frequency of use for those that use each platform in the U.S. Pew Research Center (2018b)

Social media platforms can provide users regular opportunity to engage in social exchange. Rutherford (2013) examined an Ontario-based teacher group of 384 members on Facebook. Each discussion averaged 10 response posts, which exemplifies the collaborative nature of the Facebook platform (Rutherford, 2013). Because education Facebook groups' posts are participant generated, they meet tenants of adult education and the keys to successful professional development outlined by Rutherford (2013). Further, 70% of the posts reviewed by Rutherford (2013) pertained to categorization of

teacher knowledge, an indication that the discussions taking place on the site could have potential impact on teachers.

Professional Social Media Use

As technology use has become more common on school sites, most schools have a technology use policy. Rodesiler (2017) found 63% of schools in his study had social media policies as a standalone policy or as part of a larger technology use policy. Although many districts had variations in their definition of social media, the common theme related to the interactive nature of social media platforms. Because of the interactive nature of social media, some districts took a stance against social media use on LEA devices and or during scheduled work time.

PLNs are considered an informal professional learning opportunity for teachers (Lantz-Andersson et al., 2018; Trust et al., 2016). Lantz-Andersson et al. (2018) conducted a review of 52 formal and informal professional learning groups. They termed formally organized learning groups as those hosted on learning management systems, including the examples of Blackboard and WebCT. They noted an expansion of research starting in 2010, where informal professional learning groups started to rise. They attributed this increase to the popularity of social media. Of the 52 studies in their review, 28 were identified as informal. Of the informal studies, only four studies were published between 2000 and 2010, and from 2011 to the time of their publication, there were 24 studies.

According to Trust et al. (2016), informal learning through "PLNs not only seemed to help participants meet specific pedagogic or emotional needs, but their networks also allowed many educators to forge, and more towards, new conceptions of

their professional identities" (p. 31). While Visser et al. (2014) found a low percentage a teachers to be Twitter users, Davis (2015) found teachers who used Twitter questioned why informal professional learning through Twitter was not considered a tool for their professional learning, as a result of this research finding, he recommended training for administrators on how Twitter could be leveraged for professional purposes. Benefits cited in social media include social and emotional support, changed behavior, overcoming isolation, exposure to different perspectives, the ability engage at a time that is convenient for the teacher, and the ability to ask questions and getting feedback.

Social and emotional. A variety of social and emotional benefits have been identified. Davis (2015) identified a sense of belonging and emotional support as themes of educators who participated in Edchat (#edchat) weekly Twitter chats. PLNs were able to create a positive feeling about teaching and learning. Further, in the area of effectiveness, they found PLNs helped teachers stay retained in the teaching profession and feel invigorated (Trust et al., 2016).

Changed behavior. In the area of cognitive needs, 96% of teachers reported modifying their teaching based on exposure to resources, methods, or ideas through their PLN. While 96% of respondents reported modifying their teaching based on their interaction in their PLN, 25% reported significant changes to their reflective practices and teaching philosophy (Trust et al., 2016). One fifth of respondents reported a shift in their perceived role in the classroom from content experts to coaches and facilitators in their classrooms as a result of their engagement with their PLN (Trust et al., 2016).

Overcoming isolation. Several studies have found teachers are using social media to overcome a sense of isolation. Feelings of isolation can relate to geography or

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isolation from individuals which share a common content area to collaborate with (Trust et al., 2016; Wesely, 2013). Feelings of isolation were also identified when collaborative partners were present at a school site but were not willing to collaborate (Wesely, 2013). also resulted when the Teachers report a feeling of belonging, as well as a sense of community in which they can receive encouragement in times of personal or professional despair. This is especially true when teachers do not have access to this support during their school day (Davis, 2015). Guskey (1986) identified continued support as an essential element of professional learning programs. Because teachers may feel limited support on their school site in their implementation of innovations relating to education, as Trust et al. (2016) found, social media may allow teachers to overcome those feelings.

Exposure to differing perspectives. Many educators noted building diverse networks that reached beyond those in their profession and of differing philosophies (Trust et al., 2016). Complex networks of this nature allow for teachers to be exposed and to engage in discourse surrounding ideas and resources they may not have been exposed to had they not purposefully reached beyond those that share their same ideals. "Twitter may provide practitioners with on-demand resources and opportunities to engage in reflective thinking and be a part of an online community of practice that spans a global network of professionals" (Davis, 2015, p. 1557).

Time. Online PLNs offer educators the convenience of asynchronous engagement in topics of their interest at their own convenience (Krutka et al., 2017). However, not all online PLN interaction is asynchronous, Twitter chats offer educators the opportunity to engage with colleagues through discussion using hashtags. Some individuals find the scheduled and fast paced nature of the Twitter chat format to be restrictive and confusing,

especially for teachers in situations where their school site didn't support the use of social media Davis (2015).

Asking questions and getting feedback. Most informal professional learning groups for teachers have few individuals which drive the discourse and interactions (Lantz-Andersson et al., 2018). Those who observe without making identifiable contributions are referred to as lurkers (Lantz-Andersson et al., 2018; Xing & Gao, 2018). Xing and Gao (2018) conducted a longitudinal analysis of over 600,000 tweets from 2009 to 2015 with the hashtag #edchat. Their algorithm was used to classify tweets into their dimensions of online discourse, they noted their inability to quantify the engagement on lurkers as a limitation. They noted that the types of discourse which occur in groups can dictate whether a teacher persists in continuing their online PLN engagement. Meaning, those which are not exposed to discourse perceived as valuable, are likely to abandon the innovation of social media use for professional purposes.

Discourse plays a crucial role in our social interactions as well as with meaning making that is required for learning. Xing and Gao (2018) identify three dimensions of online discourse, *cognitive, interactive, and social*. The cognitive dimension relates to individuals active engagement in cognition, examples may include "self-reflection, brainstorming, generating information," as well as asking questions and starting conversations (Xing & Gao, 2018, p. 389). The second dimension, interactive relates to the collaborative aspects of online discourse (Xing & Gao, 2018). Actions that exemplify the interactive dimension among individuals include agreeing or disagreeing, adding to others ideas, and making connections to ideas (Xing & Gao, 2018). The third dimension,

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social, addresses the behaviors which build community within the group (Xing & Gao, 2018).

Some individuals who build a PLN and engage in professional social medial use later abandon the practice. They found the type of discourse teachers were exposed to and engage in impacts their long-term engagement in the #edchat community. Those individuals with the greatest exposure to cognitive and interactive tweets were more likely to persist over time, whereas those exposed to more social tweets had a higher risk of dropping out of the community.

Barriers. Barriers relate to the systems teachers work in as well as other factors outside of schools. These factors can relate to teachers' skills and personal preferences, as well as factors relating to their LEA. One major barrier to engaging in professional social media use can relates to restrictions imposed by school districts and sites on access to these platforms. In the Visser et al. (2014) study of teacher Twitter users, over 30% of teachers said their schools have firewalls restrict their access to Twitter. Of those, 60% admit working around this barrier by utilizing their personal devices and avoiding school networks (Visser et al., 2014).

Teachers engagement on specific social media platforms can result from a combination of skill and attitude. Visser et al. (2014) found individuals with greater self-reported technology proficiency were more likely to engage in professional Twitter use. Wesely (2013) found that while Twitter users were engaged in content specific needs, there was a theme of the members of the #langchat seeking technological innovations. Twitter users also sometimes find the flow of information to be difficult to follow (Davis, 2015).

Teachers sometimes cite the time as a barrier of use. Some social media interaction can occur asynchronously, meaning teachers engage at their leisure, which is often cited as a benefit (Nussbaum-Beach & Ritter Hall, 2012). However, in the case of synchronous activities time can be a barrier. For example, Twitter chats occur in real time, and may pose a barrier to use if the time the activity is not convenient for the teacher (Davis, 2015). This may be especially true when these chats are facilitated by individuals from other time zones. Even still, if teachers do not have the opportunity to engage in these chats in real time, the chat contents can be reviewed at a later time through searching the appropriate hashtag.

As literature continues to grow in the area of PLNs, Krutka et al. (2017) offer the PLN Engagement Framework as a way for educators to reflect on their PLN, as "without encouragement to reflect, it can be easy to remain unaware of what we do not know, or need to better understand" (Krutka et al., 2017, p. 251). The framework was designed for ongoing use, and allows for specific focus on the three key areas of people, spaces and tools. Within each area, teachers are encouraged to answer the questions (a) "What is my PLN?" (b) "How does my PLN shape my professional growth?" (c) "What are my PLN goals?" (Krutka et al., 2017, p. 249). Deliberating on questions of this nature can assist teachers in making decisions about their PLN, for example who to follow or unfollow based on their personal goals (Krutka et al., 2017). Educators are encouraged to engage in open discussion with their colleagues as "discussions about these activities, can result in sharing and cross-pollination of new, innovative and critical ideas across school, district, state and even national lines" (Krutka et al., 2017, p. 250).

Conceptual Framework

The conceptual framework of this study is centered on andragogy and associated principles of adult learning as identified by Knowles et al. (2015). Although Malcom Knowles was not the first to coin the term andragogy, he is widely regarded as the father of andragogy (Knowles et al., 2015). Adults are widely considered intrinsically-motivated, self-directed learners (Knowles et al., 2015). The term andragogy, has Greek roots which loosely translate to teaching adults (Terehoff, 2002). The assumptions of a child learner, referred to as pedagogy, are different than that of the adult in several ways (Knowles et al., 2015; Terehoff, 2002). Table 2.4 compares the assumptions to learning. In the pedagogical model, the teacher has the knowledge, and their role is to disseminate knowledge, compared to andragogy, where the learner has autonomy and the teacher has taken more of a facilitator role (Knowles et al., 2015). Typical instructional methods of a pedagogy include lecture and teacher assigned readings (Knowles et al., 2015). A learner focusing on what is required to pass a course or meet a teacher expectation is indicative of the pedagogical model (Knowles et al., 2015). In andragogy, adults must see a personal relevance to their learning. According to Knowles et al. (2015), while making adults aware of specific ways the learning might increase their performance or life, a more impactful approach would be to allow learners to identify their current position in relation to the learning, and where they would like to be.

Table 2.4

Comparison of learner assumptions

	Pedagogy	Andragogy
Teacher Role	Makes all decisions about -content to be learned. -pace and sequence of learning. -determination of content mastery.	Individualizes teaching methods to meet learners needs.
Learner Role	Submits to teacher roles.	Determines learning objectives.

Note. Based on Knowles et al. (2015)

It is believed that andragogy aligns most closely to the needs of the adult learner. Knowles et al. (2015) discussed several definitions of adult, which are necessary to define in reference to this research. First, from the biological standpoint, a person is considered an adult when they reach the age at which they can reproduce. The second, a legal threshold of adulthood is reached when individuals are permitted to vote, marry or attain a driver's license. The third, a social consideration relates to when individuals perform roles of typical adults, including careers, marriage, and parenting. The fourth, and the definition this research focuses on, is the psychological consideration of adulthood. Knowles et al. (2015) stated, "we become adults when we arrive at the self-concept of being responsible for our own lives, of being self-directing" (p. 43).

The principles of adult learning are (a) *need to know,* (b) *self-concept,* (c) *role of experience,* (d) *readiness to learn,* (e) *orientation to learning,* (f) *motivation to learn* (Knowles et al., 2015). Table 2.5 compares these assumptions for the theories of pedagogy and andragogy. In considering the role of maturation and the learner's self-

concept, as age increases the role of dependence on the teacher should shift to greater self-direction on the part of the learner (Knowles et al., 2015). This inverse relationship is not based so much on age, as much as it is on the learner's self-directedness. In the U.S. educational system pedagogy is often practiced inappropriately, especially in the early adult years (Knowles et al., 2015). This issue may be perpetuated when learners are not provided adequate opportunity to engage in behaviors that will reduce their dependency on the teacher. For practicing teachers who have a disposition to self-directedness, being subjected to professional learning with a pedagogical approach can be antagonistic (Terehoff, 2002).

Table 2.5

Andragogical versus pedagogical assumptions

Assumption of Learner	Pedagogy	Andragogy
Need to know	Expectation to be regarded as standard met or threshold for being promoted.	Personal relevance must be established.
Learner's self-concept	Dependent on teacher. Little self-direction.	Responsible for own learning. Fully self-directed.
Role of experience	Not considered.	Individuals have adequate life experience to draw from.
Readiness to learn	Linked only to desire to promote or pass.	When need arises, they are ready to learn.
Orientation to learning	Acquiring content knowledge related to subject area.	Centered on usefulness to task, life or problem.
Motivation	External factors.	Intrinsic factors.

Note. Based on Knowles et al. (2015)

Andragogy Principles

Anyone with an internet connection has the ability to pursue personal learning objectives at their convenience. Birkenholz (1999) and Knowles et al. (2015) discussed the learning needs of the adult as they relate to timeliness, usable format, and conciseness of their personal deficiency or need. Further, this trait allows them to generate their own learning objectives and produce a plan of action to meet their needs (Birkenholz, 1999). Knowles et al. (2015) outline an adult learning cycle in which learners determine a need, then create a course of action, implement the action plan, and finally evaluate their learning according to their learning goal. Although this may be considered a best practice in adult learning, it is not how typical teacher professional learning is implemented (Guskey, 2000).

Need to know. The first principle of andragogy is the need to know. To tend to this principle, adult learners should be included in the planning process of adult learning programs (Knowles et al., 2015). According to Knowles et al. (2015), at the heart of this principle is the why, and in reference to adult education programs it is extended to include how and what will be learned. Traditional approaches to educator professional learning often violate this principle, as professional learning is mandated and administered with a top down approach, with little to no regard for teacher autonomy (Guskey, 2000). Teachers comply with participation in these initiatives because they are contractually obligated, but often see little value in relation to their classroom instruction and subsequent student learning (Guskey, 2000). Because online interactions can allow learners to pursue their personal learning objectives, they may be considered a valuable asset for professional learning networks. Further, workshop type professional learning

may often also violate this principle, as concepts are deconceptualized by facilitators, and therefore teachers do not make the connection to their felt need to know (National Research Council, 2000).

Learner's self-concept. As children we rely heavily on the direction of others. As we mature, and physiological age increases, so does our self-concept (Knowles et al., 2015). Consequently, we become more self-directed and take an increasing role in making decisions that impact life and learning. As individuals make this shift, they typically resent situations where they feel they are not allowed autonomy (Knowles et al., 2015). Adult education programs with pedagogical approaches, may be met with bitterness, as the adult learner desires independence. Adults resent circumstances in which they feel as though they are denied autonomy. Even well-intentioned administrators and professional learning coordinators who wish to honor the principles of adult learning are subject to the reality that systems within LEAs may prohibit teacher input regarding their professional learning (Guskey, 2000; Knowles et al., 2015). When teachers are denied choice, psychological conflict arises with violation of their self-directed preference, the typical adult reaction is to escape the situation (Knowles et al., 2015). Subsequently, for professional learning which is choice based, when faced with a conflict, this can result in high dropout rates because adults can choose to not return (Knowles et al., 2015).

Outside of the educational realm many adult education programs are designed based on expressed needs of the learner. This practice has several assumptions: (a) the learner is self-aware enough to accurately appraise their needs, (b) based on the need, the learner can determine what learning is required to meet the need, (c) when learning is

required, will maintain motivation, and (d) motivated to learn when need exists (Knowles et al., 2015).

The theory of andragogy is not without several concerns. There are situations where andragogy may not be an appropriate approach. Without clear definition of when to practice andragogy some have found it is possible to practice pedagogy and increase student learning when educators create a learning experience in which students feel a need to learn, have autonomy in the form of student voice and choice, and have an attitude of mutual respect (Knowles et al., 2015).

PLNs that include social media offer teachers' autonomy in every aspect of their engagement, from which platforms to utilize, to who to follow, and the extent to which they wish to share openly. Teachers who engage in PLNs have high perceived usefulness of their networks (Trust, 2012), this could be in part due to the self-directed nature of the PLN approach (Nussbaum-Beach & Ritter Hall, 2012) and its alignment to the self-concept principle of andragogy.

Role of the learners' experiences. Because adults have a greater breadth of experience to draw from than children, approaches to teaching adults that are centered on transmission of knowledge are not typically well received because, as they do not honor adult learners unique and broad experiences (Knowles et al., 2015). The child learner has limited life experience from which to draw upon. In contrast, and adult learner has a rich array of life experiences from to build upon. The child learner has built their identity primarily around their family, whereas an adult has an identity shaped by their experiences (Knowles et al., 2015). Adult learners experience the most growth when they are engaged in learning experiences where they leverage their life experience through

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student centered teaching methods. Effective professional learning should include

"experiential techniques—techniques that tap into the experience of the learners, such as

group discussions, simulations, exercises, problem-solving activities, case methods, and

laboratory methods" (Knowles et al., 2015, p. 45). These approaches to professional

learning offer teachers the opportunity to connect prior experience to their current

learning (Terehoff, 2002). Online PLNs allow teachers to reflect on their personal

experiences, and utilized their knowledge to assist others in making meaning of their

problems and needs though online chats and discussion groups like Twitter and Facebook

(Nussbaum-Beach & Ritter Hall, 2012). The ability to bring forward and apply personal

experiences through online PLNs honors the role of the adult learners' personal

experiences and therefore reaffirms the third principle of andragogy.

   Readiness to learn. Readiness to learn is related to appropriateness of life stage

for the desired learning (Knowles et al., 2015). PLNs are designed by the individual to

meet their individual needs (Nussbaum-Beach & Ritter Hall, 2012). Based on educators

current teaching assignment, years of teaching, and a plethora of other factors, teachers

can individually tailor their network to their readiness to learn specific topics.

   Orientation to learning. For adults, motivation to learn occurs when they are

faced with life experiences that necessitate their learning to navigate the issue (Knowles

et al., 2015). Online social media interaction can afford the opportunity for teachers to

ask for advice or resources relating to their current need (Alderton et al., 2015; Trust et

al., 2016).

   Motivation. Adults' motivation to learn often relates to solving a problem of

personal relevance, which is often referred to as a "need." From this, they could attain

personal gratification, one of the biggest motivators in adult learning (Birkenholz, 1999; Knowles et al., 2015). Most literature supports the idea of adult learners as self-directed (Knowles et al., 2015). For the purpose of this study, adult is defined as an individual with a "self-concept of being responsible for our own lives, of being self-directing" (Knowles et al., 2015, p. 43). Wesely (2013) found teachers who engaged on Twitter to identify themselves as individuals that "liked to learn" (p. 312).

Connections Between Andragogy and the Model for Teacher PLN engagement

When the Krutka et al. (2016) model (Figure 2.1) is considered in reference to Knowles et al. (2015) principles of andragogy, there are several connections.

Engagement. The first principle of the andragogical model, need to know, focuses on adult learners' desire to see personal relevance in order to engage in the learning process (Knowles et al., 2015). The element of PLN engagement relates to teachers participating in their PLN according to their unique and individual professional objectives (Krutka et al., 2016). Visser et al. (2014) found 40% of teachers were accessing Twitter from a mobile phone, versus 36% from computers and 24% from other devices. Assuming teachers are accessing the platform from their personal mobile phone, this supports the Knowles et al. (2015) findings that adults will exert considerable personal assets (including time as well as financial resources) to pursue their personal learning goals. Participants in the Edcat (#edchat) on Twitter cited their ability to filter information by following hashtags as a benefit of their Twitter use, because it allowed them to pursue their personal learning objectives (Davis, 2015).

Discovery. The element of PLN discovery refers to teachers unintentional exposure to ideas and resources (Krutka et al., 2016). Because PLNs are voluntary, and a

facilitator or educator is not imposing their will upon the adult learner, the learner's self-concept is respected (Krutka et al., 2016). The voluntary nature of social media PLNs allows learners the autonomy of making their own decisions. Without a formal education figure facilitating the professional learning, the adult learner is free to engage in self-directed learning at a level of openness, rigor, and frequency of their choosing.

Reflection. Reflection is largely thought of as a trait for those with advanced knowledge or skill. The element of PLN reflection embodies individuals reflection on their professional practice (Krutka et al., 2016). The readiness to learn characteristic of the adult learner denotes a level of maturity required for reflection (Knowles et al., 2015). Twitter Edchat (#edchat) participants reported reflecting on their personal practice, as well as the thoughts of others as a benefit of their participation (Davis, 2015).

Sharing. The element of PLN sharing refers to teachers sharing their experience, technical skills, or resources (Krutka et al., 2016). In the andragogical model, the role of an adult learner's prior experience is honored (Knowles et al., 2015). Several studies have identified teachers sharing resources and teaching strategies (Trust, 2012; Wesely, 2013). Visser et al. (2014) found 55% of teacher Twitter users frequently generated their own content in the form of tweets, as opposed to more passive forms of interaction like sharing and retweeting without comments. Tucker (2018) noted that Twitter posts can serve as an online portfolio of professional learning.

Experimenting. Teachers report positive outcomes when they experiment in their classroom as a result of their learning via their PLN, some teachers even report their online professional learning to be transformative (Visser et al., 2014). Trust et al. (2016) found 96% of teachers reported changing their teaching practices as a result of their PLN

engagement. Orientation to learning is tied to motivation to engage in learning activities which help teachers to address current issues or improve their ability to perform (Knowles et al., 2015). The element of PLN experimenting (Krutka et al., 2016) encompasses teachers learning process of implementing their learning from social media in their classrooms. Teachers testing these resources, strategies and ideas in their classroom could be an indication of their orientation to learning.

Summary

High quality, sustained professional learning for teachers is crucial to improve student learning outcomes (Guskey, 2000). Educators must take a life-long learning approach to ensure their technical skills remain relevant, and "they must constantly analyze the effectiveness of what they do, reflect on their current practices, make adaptations when things are not going well, and continually explore new alternatives and opportunities for improvement" (Guskey, 2000, p. 19). Formal professional learning initiatives on high school campuses are varied in their approaches and effectiveness. Most high school teachers report limited training in their content each year, even when research has shown 50 hours of professional learning are required to make changes that impact student learning (Darling-Hammond et al., 2009). A shift toward PLC's has been a step in the right direction of building collegial conversations which encourage reflective practices and help to diffuse innovations relating to best practices. With limited perceived usefulness of school sponsored professional learning (Guskey, 2000), as well as limited availability of content specific professional learning (Darling-Hammond et al., 2009), many teachers are finding an array of benefits from engaging in PLNs online (Nussbaum-Beach & Ritter Hall, 2012; Trust, 2012; Trust et al., 2016). Teachers engagement in their

PLN can allow for extension and enhancement of traditional professional learning experiences (Krutka et al., 2017). These PLNs often include social media like Twitter and Facebook (Nussbaum-Beach & Ritter Hall, 2012). Teachers report the on-demand availability of resources and collaboration has resulted in changes to their teaching practices, and in some cases significant changes to teaching philosophy (Trust, 2012).

The assumptions of the adult learner are different of the child learner in reference to the roles of the teacher and learner. Adult learning facilitators should individualize their programs and teaching methods to account for adult learners needs, and individuals should determine their own learning objectives. These assumptions of andragogy rely on individuals' readiness and willingness to pursue their own personal learning objectives. Social media engagement allows adults autonomy to engage in professional learning which is relevant to their lives. Teachers report a variety of benefits of their online interactions including access to content and non-content specific resources and opportunity to engage with individuals which expand their professional network.

CHAPTER THREE

METHODS

This chapter outlines the population, sample, instrument and data analysis for this study. An online survey was used to collect data on secondary agriculture teachers' perceived usefulness of professional use of social media and their school sponsored professional learning, as well as their professional social media use behaviors. Various statistical tools were employed to identify relationships, explain variance and predict use of teachers perceived usefulness of social media in relation to variables of interest.

Research Design

A self-administered Qualtrics survey (see Appendix A) was distributed to a random sample of 464 California agriculture teachers in a single administration. This study's design was identified as a result of a review of literature relating to teachers' professional social media use for their self-directed learning within their PLN. A survey research design offered the ability to examine relationships between variables from a descriptive standpoint, as well as utilize inferential statistics, which may be generalized to similar populations (Creswell & Creswell, 2017; Dillman, Smyth, & Christian, 2014; Fraenkel, Wallen, & Hyun, 2012).

Instrument Design

This study utilized a web based 58 item survey instrument that measured several constructs. Qualitative (Alderton et al., 2015; Davis, 2015; Trust, 2012), mixed methods (Rutherford, 2013; Visser et al., 2014), and quantitative studies (Greenhow & Lewin, 2016; Ranieri et al., 2012; Xing & Gao, 2018) were considered in the design of the instrument used in this study. Demographic questions collected data relating to the

number of years of teaching, highest degree earned, age, geographical region of teaching assignment, credential path, teaching assignment, gender, and identification of isolation from others teaching the same course on the same site. Constructs of perceived usefulness of professional use of social media (PUSM) and perceived usefulness of school sponsored professional learning (PUSSPL) examined teachers' attitudes toward professional learning. The elements of online teacher engagement (EOTE) was created to quantify teacher' behaviors relating to their PLN engagement. The PUSM, PUSSPL and EOTE were compared to explore and explain relationship to demographics for each participant.

Perceived usefulness. The items within the PUSM and PUSSPL constructs were generated based on the Davis (1989) perceived usefulness scale with his permission. Adjustments to the scale items related to aligning with the context of teacher professional learning by replacing the term "job" with statements related to teaching or students. Participants responded to the prompts of "*using social media professionally*" (for PUSM) and *"mandatory school sponsored professional learning"* (for PUSSPL) on a 7 point Likert-scale in relation to the same six items of (a) improves my effectiveness as a teacher, (b) improves my ability to prepare and deliver high quality instruction for my students, (c) results in significant changes to my teaching, (d) results in improved learning outcomes for my students, (e) enhances my effectiveness as a teacher and (f) makes it easier to perform my duties as a teacher.

Elements of online teacher engagement. The third construct, EOTE was designed by the author of this paper based on the Krutka et al. (2016) model of Elements of teacher's professional learning network activities (see Figure 2.1). The Krutka et al.

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(2016) model was informed by qualitative research themes from the Trust et al. (2016) study, where a voluntary non-random sample was generated through a snowball approach within existing social media teacher groups. Because teachers in the sample learned about the opportunity to participate in the study through a social media channel, there may be concerns of bias relating to a possibility of views skewed positively when compared to a general population of teachers (Krutka et al., 2016). Krutka et al. (2016) confirmed that at the time of this study, to their knowledge, there were no quantitative instruments published or in the data collection phase to test their model, and suggested a quantitative analysis would be a next step in building on their findings (D. Krutka, personal communication, September 28, 2018).

Several demographic questions were asked to explore possible relationships. Demographic areas selected were based on previous studies discussed throughout Chapter Two. *Number of years teaching* could provide insight beyond the demographic of age, as individuals can enter the teaching profession at any age. *Age and Education* are shown to differ in respect to social media use in the U.S. population as a whole (Pew Research Center, 2018b). Further, in relation to Age and Education, and years teaching, Birkenholz (1999) said "persons with more extensive knowledge bases tend to have more unanswered question to motivate them to seek answers (ie., participate in educational processes)," (p. 17) this motivation to seek answers could be taking the form of engaging in professional online networks. The demographic of *region* may provide insight into rural versus urban geographic location, which may be impacted by access to broadband internet access availability. Further, the number of teachers per program varies greatly, with some regions having a greater prevalence of small programs, and consequently a

higher possibility of geographic isolation. *Primary teaching assignment* may provide clarity to possible patterns relating to professional needs of pedagogical content knowledge or content knowledge. Identifying *professional learning activities* may help to identify if there is a relationship between a teacher's willingness to pursue professional learning based on their felt needs as opposed to mandated by their LEA. Exploring patterns in teachers required and self-selected professional learning may provide insight into relationships regarding trends in professional social media use and PLNs. Although Trust et al. (2016) cautioned researchers from focusing their research on specific social media platforms, there could be value in identifying possible trends in *Social media platform* use when compared to other demographic and perceived usefulness data. Specific platforms included in the instrument are based on those identified by the Pew Research Center (2018b) as the most popular, however, respondents had the option to add other platforms. Teachers can arrive in the classroom through traditional teacher preparation programs or alternative certification processes. Identifying the *teacher certification* path a teacher has taken may assist in identifying specific needs or trends for the two groups. *Teacher isolation*, including geographic and content/grade level, has been cited as a motivator in teachers' professional social media and PLN development and use (Trust et al., 2016).

Sample

   Population. The population for this research was 942 high school agriculture teachers from California (California Agricultural Teachers Association, 2018). The CATA keeps a current roster of agriculture teachers at the secondary and post-secondary level, regardless of their paid or non-paid status in the CATA (California Agricultural

Teachers Association, 2018). California is second only to Texas in the number of

agriculture teachers at the secondary level (Lawver et al., 2018); therefore, offered a

desirable population for the statistical analysis as well as broad generalizability for this

study. Further, the entire population was reasonably accessible through permission from

the CATA. Beyond generalizability, a large sample was necessary, as this research

represented an exploration in quantitative analysis of behaviors relating to professional

social media use for teachers. It was unknown what effect size could be expected in the

use of a multiple linear regression. Assuming the effects could be medium, Field (2013)

recommends at least a sample of 160 for the purpose of employing a regression in data

analysis. Likewise, he also recommends 10-15 cases per predictor, with 11 predictors a

sample of at least 110 was necessary.

California is divided into six FFA regions (Figure 3.1). The geographic size of the

region is not indicative of the number of teachers within each of those regions.

Figure 3.1 California FFA regions map. Counties included in each FFA region are coded with color according to the key. Map adapted from Babbage (2009) with data from California Agricultural Education (n.d.)

Population data was provided by the CATA (California Agricultural Teachers Association, 2018). Table 3.1 shows population of agriculture teachers is not evenly distributed between regions, and there are more female than male teachers in each region in the population as well as the sample. The population has more female (58%), than male teachers (39%), with only 2.4% declining to state. The sample of this study had 65% females, 34% males and less than 1% declining to state. New teachers made up 25% of the population, and 26% of the sample. The population of early teachers was 33%,

while the sample was 30%. Mid-career teachers comprised 33% of the population and 13% of the sample. The population of late-career teachers was 27%, and the sample was 30%. The majority of respondents were from the San Joaquin Region (40.5%), followed by Central (21.5%), then South Coast (12.3%), Superior (11%), Southern (8%), and North Coast (6.7%).

Table 3.1

Gender Frequency and Independent Variables of Interest

Variable	Population								Sample							
			Female		Male		Withheld				Female		Male		Withheld	
	n	%	f	%	f	%	f	%	n	%	f	%	f	%	f	%
Region																
Central	264	28	150	57	114	43	1	<1	35	21	20	57	15	42		
San Joaquin	225	24	128	57	93	41	4	2	66	40	44	67	21	32	1	1
Southern	125	13	76	61	46	37	3	2	13	8	8	62	5	38		
South Coast	122	13	71	58	46	38	5	4	21	13	16	76	5	24		
Superior	136	14	70	51	57	42	9	7	18	11	11	61	7	39		
North Coast	70	7	54	77	15	21	1	1	11	7	8	73	3	27		
Career Stage																
New	235	25	142	60	88	37	5	2	42	26	31	74	11	26		
Early	311	33	218	70	88	28	5	2	50	30	42	84	8	16		
Mid	137	15	78	56	56	41	3	2	22	13	10	45	11	50	1	5
Late	259	27	111	43	138	53	10	4	50	30	23	46	27	54		
Teaching Assignment[a]																
Agriscience																
Agriculture Biology									76		60	79	16	21		
Agriculture Chemistry									49		41	84	7	14	1	2
Agriscience									43		30	70	12	28	1	2
Plant Science									38		28	74	10	26		
Animal Science									37		32	86	5	14		
Agriculture Earth Science									5		3	60	2	40		
Mechanics[b]									51		12	24	39	76		
Other																
Agriculture Leadership									33		26	79	6	18		
Agriculture Business									18		15	83	3	17		
Floral									16		16	100				
Natural Resources									4		4	100				

Note. Population *N* = 942. Sample *N* = 164. Population females *f* = 549, 58.3%; males *f* = 370, 39.3%; withheld *f* = 23, 2.4%. Sample females *f* = 107, 65.2%; males *f* = 56, 34.1%, withheld *f* = 1, >1%.
[a] Population data not available, frequency represents duplicated number of teachers in the sample, therefore percent was not calculated. [b] Includes all agriculture mechanics courses, welding, power mechanics, small engines.

Table 3.2 shows nearly 86% of individuals attained their teaching credential through a traditional path, with only 8% having attained a designated subject credential, followed by 4.3% with a teacher intern credential path and 1.8% through alternative means. Only one respondent (.6%) held a doctoral degree, with the remainder split nearly equal in their percentage of Bachelor's (49.1%) and Master's Degrees (50.3%). Age, highest degree and credential path data for the population were not available to the researcher at the time of the study.

Table 3.2

Descriptive Statistics for Sample Credential Path, Highest Degree, and Age (N = 164)

	f	%
Credential Path		
Traditional	140	85.9
Alternative – Designated Subject	13	8.0
Alternative – Teacher Intern	7	4.3
Other[a]	3	1.8
Highest Degree		
Doctoral	1	.6
Master's	82	50.3
Bachelor's	80	49.1
Age		
Under 29	56	34.1
30-39	49	29.9
40-49	30	18.3
50-59	22	13.4
60+	7	4.3

Notes.
[a] Credential attained by credit by exam, as an add on to a Science Single Subject Credential.

Respondents' completed years of teaching had a wide range (36 years), with the mean of 10.48 years (*Mdn* = 8.0, *Mode* = 2, *SD* = 9.1). Respondents age range spanned 44 years, with a mean of 37.13 years of age (*Mode* = 27, *SD* = 11.5). Figure 3.3 shows average minutes of professional social media use and years teaching compared by age brackets. Teachers in the under 29 had the highest use of social media, followed by a decreasing trend for the 30-39, 40-49, and 50-59 age groups. The 60 + group has similar use patterns to those in the 30-39 age group. In general, as years of teaching increases, the mean use of social media decreases until the age bracket of 60+, when a shape spike in use occurs.
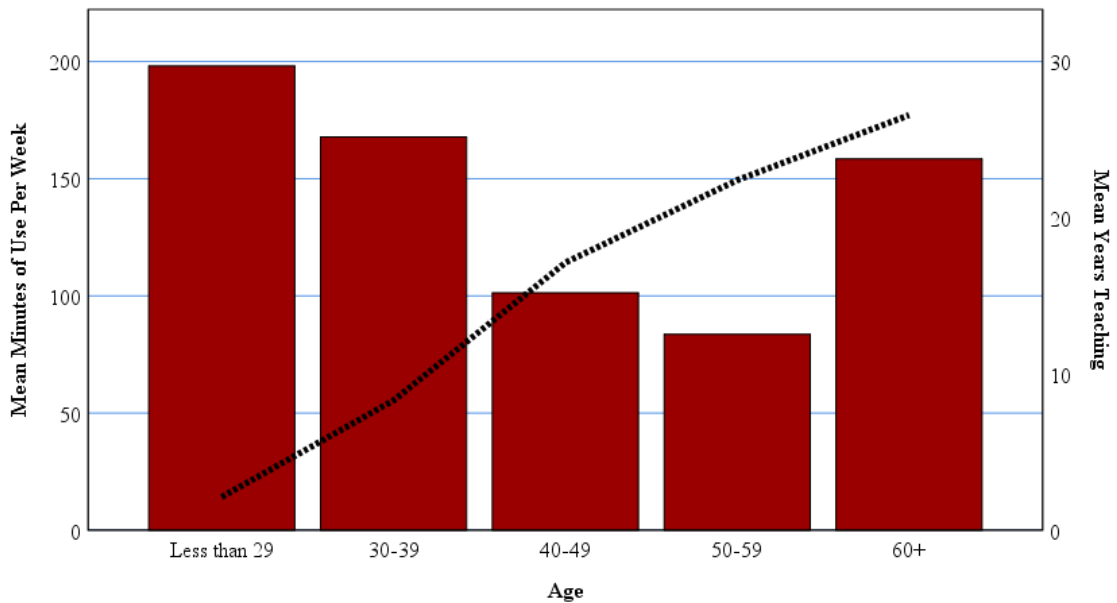
Figure 3.3: Mean years teaching and minutes of professional social media use per week by age.

Table 3.3 shows agriculture educators collectively teach a variety of 44 different courses, of which offerings vary greatly by school district and site (California Agricultural Education, 2018). The table shows 2,679 teachers, which indicates most teachers are likely teaching several courses, as there were only 942 high school agriculture teachers in the state at the time of this study. In large programs, teaching assignments may be limited to a single course, or a few courses, compared to smaller programs where fewer teachers will teach several courses as a result of master schedule constraints.

Table 3.3

Duplicated[a] California Agriculture Teacher Course Assignments and Student Enrollment

Course	Teachers	%	Student Enrollment	%
Agricultural Biology	275	10.3	15,417	15.1
Introduction to Agricultural Mechanics	228	8.5	10,855	10.6
Floriculture & Floral Design	211	7.9	11,130	10.9
Agriculture and Soil Chemistry	170	6.3	8,452	8.3
Agricultural Welding	150	5.6	5,118	5.0
Ag Communications & Leadership	126	4.7	2,484	2.4
Veterinary Science	124	4.6	3,331	3.3
Other Agriculture Mechanics	109	4.1	3,514	3.4
Introduction to Agriculture	107	4.0	4,620	4.5
Fabrication & Construction	106	4.0	2,680	2.6
Advanced Agriscience	97	3.6	2,318	2.3
Introduction to Agriscience	89	3.3	3,747	3.7
Sustainable Agriculture	84	3.1	4,711	4.6
Agricultural Environmental & Earth Science	82	3.1	4,310	4.2
Ag Economics	74	2.8	2,413	2.4
Other Agriscience	72	2.7	2,031	2.0
Introduction to Animal Science	64	2.4	1,744	1.7
Introduction to Ornamental Horticulture	59	2.2	1,763	1.7
Other Animal Science	52	1.9	1,190	1.2
Other Ornamental Horticulture	50	1.9	1,067	1.0
Other Agriculture Business Course	37	1.4	669	0.7
Agriscience Systems Management	35	1.3	755	0.7
Plant Science	29	1.1	626	0.6
Agriculture Business Management	27	1.0	478	0.5
Food Science	25	0.9	1,018	1.0
Large Animal Science	25	0.9	718	.7
Engine & Power Mechanics	24	0.9	681	.7

Table 3.3

Course	Teachers	%	Student Enrollment	%
Greenhouse & Nursery Management	17	0.6	355	.3
Soil Science	15	0.6	804	.8
Ag Sales & Marketing	13	0.5	230	.2
Small Animal Care & Management	12	0.4	358	.4
Ag Computers & Technology	11	0.4	160	.2
Other Plant and Soil Science	10	0.4	415	.4
Equipment Operation & Repair	9	0.3	216	.2
Landscape Design	7	0.3	152	.1
Crop Production	6	0.2	144	.1
Natural Resource Management	6	0.2	154	.2
Other Forestry and Natural Resources	6	0.2	210	.2
Viticulture	6	0.2	136	.1
Forestry	3	0.1	97	.1
Landscape & Turf Management	3	0.1	32	.0
Aquaculture	1	0.0	34	.0
Wildlife Management	1	0.0	40	.0

Note. Total teachers 2,679. Total students 102,226. Based on data from California Agricultural Education (2018).

[a] Teachers and students may be counted multiple times if assigned to more than one course or enrolled in more than one course.

Table 3.4 shows the teaching assignments of respondents. The corresponding percentage represents the number of respondents who also teach one or more sections of the course. The table also shows the number of course taught in isolation, meaning teachers are the sole teacher of the course on their campus. Agriculture Biology ($n = 76$) was the most widely taught course, with 46% of teachers teaching one or more section, followed by agriculture mechanics ($n = 51$, 30%), agriculture chemistry ($n = 49$, 30%), agriscience ($n = 43$, 26%), plant science ($n = 38$, 23%), animal science ($n = 37$, 23%), and agriculture leadership ($n = 33$, 20%). A total of 84% of the sample teaches one or more courses in isolation. One quarter ($n = 41$, 25%) of agriculture biology teachers were teaching the course in isolation. Just under one fifth of the respondents were teaching Agriculture mechanics ($n = 30$, 18%), Agriculture chemistry ($n = 31$, 19%), Agriscience ($n = 27$, 17%), Plant science ($n = 28$, 17%), Animal Science ($n = 31$, 19%), and agriculture leadership ($n = 27$, 17%) in isolation.

Table 3.4

Frequency of Teaching Assignment Compared to Those Taught in Isolation of Other Teachers (N = 164)

	Teaching assignment		Course taught in isolation	
Course	f	%	f	%
Agriculture biology	76	46	41	25
Agriculture mechanics	51	30	30	18
Agriculture chemistry	49	30	31	19
Agriscience: non-biology or chemistry	43	26	27	17
Plant science	38	23	28	17
Animal science	37	23	31	19
Agriculture leadership	33	20	27	17
Floral Design/Floriculture	16	10	15	9
Agriculture business	18	11	16	10
Agriculture Earth Science	5	3	2	1
Natural resources	4	2	4	2
Other	19	12	19	12

Notes. Floral design, Agriculture Earth Science responses added as category based on their frequency in the "other" response box. Percentages represent the percent of the frequency in the sample population.

Table 3.5 shows teachers reported number of professional learning days in the last 12 months. Teachers had a greater mean number of non-mandatory content specific ($M = 8.23$, $SD = 6.61$), than mandatory content specific ($M = 4.19$, $SD = 5.33$) professional learning days, with a mean of 12.43 ($SD = 5.94$) total days of content specific professional learning in the last 12 months. Teachers were also required to participate in 11.88 ($SD = 5.41$) days of non-content related professional learning through their LEA. On average, teachers completed nearly 30 days ($M = 29.76$, $SD = 14.68$) of professional learning over the last 12 months.

Table 3.5

Days of Professional Learning (PL) Participation in Last 12 Months (N = 164)

Type	M	SD
Non-Content	11.88	5.41
Specific Content Area		
Teacher Choice	8.23	6.61
Mandatory	4.19	5.33
Total	12.43	5.94

Note. Total PL for content and non-content specific $M = 29.76$, $SD = 14.68$

Figure 3.4 shows the mean number of professional learning days in the last 12 months by career stage and type. On average, new teachers show a slightly higher number of days of content and non-content specific professional learning than the other groups.
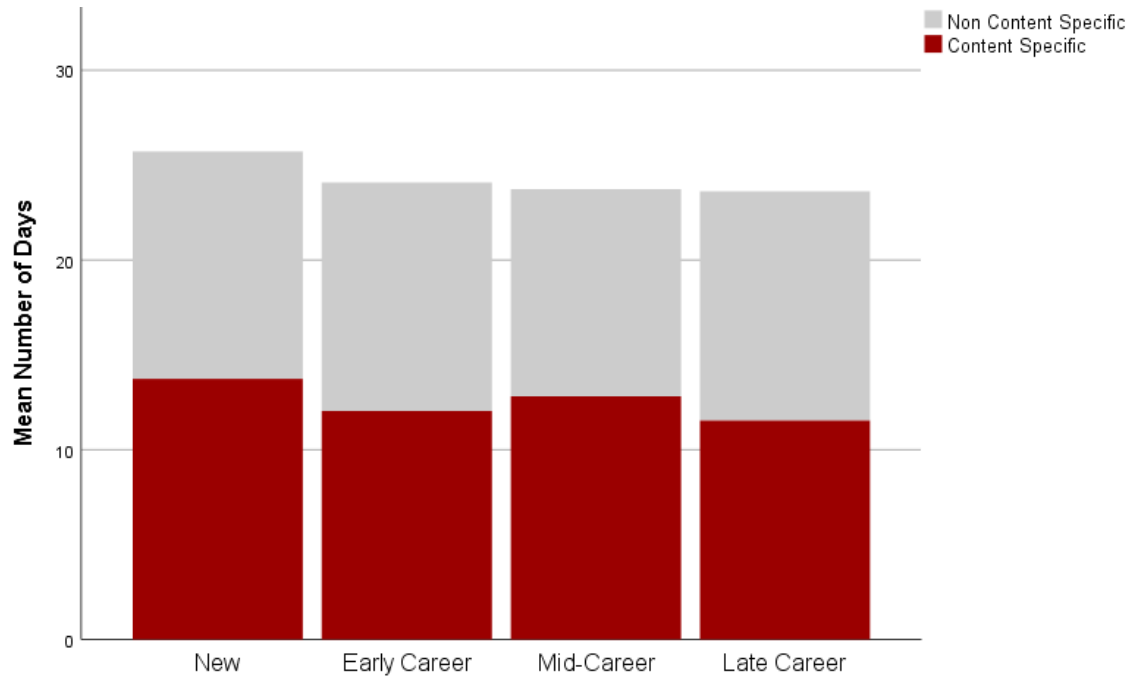
Figure 3.4 Mean days of content specific and non-content specific professional learning by years of teaching.

Data was collected via a list of provided social media platforms identified by the

researcher as likely utilized by teachers (Pew Research Center, 2018b). Platforms

included on the survey were Google+, Facebook, LinkedIn, Pinterest, Instagram,

YouTube, Snapchat, and space for alternative responses. Respondents indicated their

number of minutes of use per week by moving a slider bar. Respondents were offered

space to include additional social media platforms where they identified Kahoot,

Edpuzzle, CTEonline, Goformative, Remind, GroupMe, Tumblr, and Teachers Pay

Teachers. The minutes reported by respondents for these platforms are not reflected in

this paper, as they are were not the focus of this study. Additionally, the survey included

Google+ as an option, in reviewing the data, the researcher determined the abnormally

high frequency of use reported may be due to error. Google + may have been confused with the Google platform as a whole, meaning a teacher may have been documenting general Google searches, as opposed to interaction on the Google+ social media platform. This is supported by the recent cancelation of the platform due to lack of use by its members. For this reason, the data for this variable has not been included in this study.

Table 3.6 shows a total of 98.8% of respondents ($n = 164$) reported using social media for professional purposes for more than one minute per week. YouTube (f = 138, 84.1%), Facebook (f = 119, 72.5%), Pinterest (f = 107, 65.2%), and Instagram (f = 70, 42.7%) were the most popular platforms, with over 50% of the sample using them. Those with the highest reported usage included YouTube ($M = 55.94$, $SD = 62.90$), Facebook ($M = 57.79$, $SD = 54.12$), Pinterest ($M = 54.03$, $SD = 63.92$), and Instagram ($M = 56.19$, $SD = 63.86$), all with nearly an hour of use per week for those that use those platforms.

Table 3.6

Professional Social Media Use by Platform in Minutes Per Week (N = 164)

	F	%	*M*	*Mdn*	*Range*	*SD*
YouTube	138	84.1	55.94	30.00	314	62.90
Facebook	119	72.5	57.79	40.00	314	54.12
Pinterest	107	65.2	54.03	30.00	314	63.92
Instagram	70	42.7	56.19	30.00	314	63.86
LinkedIn	26	15.9	5.77	4.00	19	6.24
Snapchat	31	18.9	20.71	4.00	146	37.05
Twitter	7	4.3	28.57	30.00	78	26.63

Note. Total use *M* = 156.19, *SD* = 167.86. *M*, *Mdn*, *Range* and *SD* are calculated for those who reported using the platform only.

Sample recruitment. Although a census approach would have been possible given access to email addresses, this research has utilized a random sample approach as it aligned to the research objectives of this study. This method allows for the inferential statistical analysis of the effect of the independent variables on the dependent variable, which would in turn allow for generalization to the broader population (Fraenkel, Wallen, & Hyun, 2019). A sample's normal distribution and adequate size are imperative for generalizability (Creswell & Creswell, 2017; Field, 2013; Fraenkel et al., 2012). The method of random sampling is most representative of a population, and allows for the greatest generalizability (Dillman et al., 2014; Fraenkel et al., 2012). Field (2013) recommended a minimum sample of at least 77 if a large effect size is anticipated and 166 for an anticipated medium effect. If a small effect size is anticipated he gives no specific guideline. With limited empirical research relating to this study, it is difficult to anticipate an effect size. For this reason, a sample of half the population was selected.

The sample frame for this study was a random sample of 472 high school California agriculture teachers of the population of 942 secondary agriculture teachers in

the state. As recommended by Dillman et al. (2014), the first step in recruitment began with securing an accurate list of email contacts. This was accomplished through permission from the CATA, which granted access to their high school agriculture teacher roster. The sample was then systematically identified by sorting alphabetically by last name, and identifying every odd numbered individual for participation in the study.

Survey Instrument Mechanics

The perceived usefulness constructs of PUSM and PUSSPL in this study were designed based on the Davis (1989) perceived usefulness scale (see Appendix A), where each item was edited to fit the context of this study. Teachers were asked to identify their attitudes toward professional social media use. This included the use of any social media platform including but not limited to Facebook, Twitter, Pinterest, Google+, LinkedIn, YouTube, Snapchat, etc for the purpose of their professional learning and collaboration. Participants responded to six items. Responses were collected on a seven-point Likert-type scale following the Davis (1989) anchors of 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely nor unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely,* 7 = *extremely unlikely*. The instruments were determined to be reliable through post hoc analysis, with a the PUSM Cronbach's α = .96, and the PUSSPL Chronbach's α = .97.

Items on the EOTE scale were designed based on current qualitative and limited quantitative literature (Carpenter & Krutka, 2015; Davis, 2015; Ranieri et al., 2012; Trust et al., 2016; Veletsianos & Kimmons, 2016; Visser et al., 2014). Teachers responded to items created to align with the five elements of the Krutka et al. (2016) model. Data was coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor*

disagree, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.* The subscales of the EOTE had high reliably as determined by post hoc analysis, Sharing had Chronbach's α = .94, Experimenting had Chronbach's α = .98, Active Engagement had Chronbach's α = .92, Passive Engagement had Chronbach's α = .88, Discovery had Chronbach's α = .94, and Reflecting had Chronbach's α = .85, all above the acceptable range of Chronbach's α = .8 (Field, 2013).

Likert scale design. Closed-ended survey research inherently limits individual's opportunity for response. When forced with choices that do not align to the respondents' feelings, the respondents typically react by not responding or by selecting a response that does not fully align to their wishes (Dillman et al., 2014). For this reason, a 7-point Likert scale was determined to be the best fit for this research. An odd number of responses choices allows for respondents to choose a neutral response, which works to counteract the possible error of forced choices.

Instrument visual design. As recommended by Dillman et al. (2014) and Fraenkel et al. (2012) the instrument was reviewed and adjusted according to feedback from content experts. Experts were emailed the questionnaire, and minor revisions were made, and are reflected in the final version of the instrument in Appendix A. Once approved by the expert panel and the University Internal Review Board, the link to the instrument was sent via email.

Digital surveys offer various advantages including speed, economy, and ease of returning surveys when compared to other non-digital options (Sue & Ritter, 2007). Although Dillman et al. (2014) recommended post mailed letters with a good faith offer of a small sum of cash, a method of this type was not feasible in relation to labor, time,

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and funding constraints associated with this research. Instead, an offer of entry in a random drawing was utilized in an effort to reduce nonresponse error.

According to McPeake, Bateson, and O'Neill (2014) email addresses should be less than one year old to minimize returned surveys. For this reason, the instrument was sent to respondents in January 2019. October 15 is the deadline for the submission of state reporting in California agriculture programs therefore, data gathered after that point, but before the end of the regular school year would yield the most current email addresses.

Several recommendations of Dillman et al. (2014) were implemented in the survey design to reduce non-response as well as increase validity. First, an overall consideration was given to clarity and conciseness. To encourage response, and reduce the burden of time, respondents were able to gauge the time remaining on the questionnaire based on a progress bar. For the purpose of clarity, section headings were utilized to create organization and avoid visual clutter. Dillman et al. (2014) noted a professional and organized appearance creates an inherent value and perception of importance. Second, because question order plays a role in individuals' motivation to complete the survey and reduces possible measurement error due to questions influencing one another, care was taken to group similar topics. Third, within each section the question of most importance or interest is listed first, as respondents will make judgements about whether to continue based on the first question. Fourth, each statement was examined for readability, as instruments with a lower perceived burden as perceived by easier comprehension are more likely to be completed. Fifth, several considerations were made in the survey appearance including dark print was used to note question stems

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and responses were shown in smaller font below the stem. Also, consistent visual spacing was used to indicate question grouping. Navigation buttons were also included to assist in navigation in the event respondents need to return to a previous question.

The research design was approved by an internal review board (See Appendices C-F). Survey respondents remained anonymous.

Administration

The survey was self-administered by respondents through the online Qualtrics software hosted by Texas A&M University (TAMU). Demographic data was collected utilizing multiple choice items questions with a combination of single answer, multiple answer and drop-down list options. Matrix-item types were utilized for Likert-scale questions. A slider type item allowed for users to declare their usage of social media for professional purposes in minutes per week. All items were marked with the "mobile friendly" option, as many individuals own smartphones and tablets may be been accessing the instrument from their smart device. According to Dillman et al. (2014), a responsive survey platform that accommodates a smaller screen is necessary to engage a significant portion of possible respondents. Further, a welcome screen was designed to encourage participation. As recommended by Dillman et al. (2014), participants were incentivized to complete the study with entry into a drawing for a $50 gift card. A single participant was randomly selected after the conclusion of the study.

At the time of sample frame design, it was reasonably assumed the population was accessible due to recent annual update of the database. In the first contact of the sample frame of 471 teachers, seven were identified as incorrectly included in the sample, and were excluded from the study because they didn't meet the criteria for

participation, leaving 464 teachers in the sample frame. Table 3.7 shows the timeline for

recruitment and data collection. An initial email was sent to notify individuals of the

study, this was followed by an email with the link to the instrument three days later. A

total of three remainder emails were scheduled. The reminders were sent only to those

who had not yet completed the survey at the time of the scheduled reminder.

Table 3.7

Recruitment and reminder timeline

Date	Weekday	Contact
January 3	Thursday	Initial email notification with incentive information
January 6	Sunday	Instrument link and incentive information
January 9	Wednesday	Reminder email 1 including link and incentive information[a]
January 12	Saturday	Reminder email 2 including link and incentive information[a]
January 15	Tuesday	Reminder email 3 notification of upcoming survey close date[a]
January 25	Friday	Phone call to 20 random non-respondents[b]
February 4	Monday	Survey closed

Note. Based on Dillman et al. (2014).
[a] Reminder emails were sent to unfinished respondents as identified by Qualtrics.
[b] Non-respondents identified by Qualtrics then assigned a random number in Excel and sorted numerically.

Of 170 surveys submitted, six were eliminated as they were not complete and had

been auto submitted after two weeks of non-activity as a result of a Qualtrics setting,

leaving 164 respondents. This represents a 35% response rate, less than the Lindner,

Murphy, and Briers (2001) suggestion of 85% or greater to avoid additional procedures to

control for nonresponse error. Considerations for non-response error and generalizability

are discussed later in this chapter.

Appendix B contains the recruitment and reminder emails. Returned emails were checked for typographical errors, if none existed, names were researched online and emails were readdressed based on school website directories. Initial email notifications (see Appendix B) were sent January 3, 2019 in groups of approximately 20 recipients as blind carbon copies from the researcher's institution sponsored email address. Small groups were utilized in an effort to bypass SPAM filters. A total of 23 emails were returned after the initial contact, and an attempt was made to readdress them (McPeake et al., 2014). Of that group, two provided alternate emails, six responded but did not provide an alternate email to circumvent their SPAM filter, nine did not respond to email contact, four were no longer teaching high school agriculture (did not meet participation criteria), and two could not be reached.

After initial email notification from the author's institution sponsored email, contact with the sample was conducted through the Qualtrics platform email function. Reminder emails were sent to those who were identified by the software as unfinished at the scheduled reminder email times for January 9, 12 and 15. Thank you emails were sent through the Qualtrics platform just before the second Qualtrics reminder was scheduled to occur. Following that initial group, thank you responses were scheduled to be automatically sent after each respondent completed the survey.

After the final scheduled reminder, several days passed with no response. Without 30 respondents in the final group, an effort was made to collect additional responses (Lindner et al., 2001). A random sample of non-respondents was generated by assigning a random number to an Excel spreadsheet of non-respondents, and sorting the list

numerically in descending order. The first 20 individuals on the list were contacted via phone. When there was no answer, a voicemail was left. Of those individuals, three had left ag teaching and no longer met the criteria for the study, therefore, the next three non-respondents on the list were contacted. Each of these individuals received a new survey invitation via email, as well as still having access to their pervious email link. A total of eight surveys were returned as a result of the phone contact. After six days of no additional surveys after the last contact, it was assumed no further responses would be returned and the survey was closed.

Error

Sampling error is assumed to be included in any research involving a sample selected from a sample frame (Dillman et al., 2014). A census data collection approach in this research of secondary agriculture teachers in California was not feasible due to time constraints. To reduce this error and obtain data which yields only a negligible difference, Dillman et al. (2014) recommended careful consideration of sample design. Therefore, as recommended by Fraenkel et al. (2012) and Field (2013), large sample sizes were employed to increase the statistical validity of the data.

To address nonresponse error, several methods were employed. First, as recommended by Dillman et al. (2014), careful consideration was given to instrument design. Second, initial contact with individuals occurred via an email, with a follow up as suggested by Dillman et al. (2014). Third, early and late responders were compared to address external validity as it relates to nonresponse error (Lindner et al., 2001). As recommended by Lindner et al. (2001), late respondents are those individuals who

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completed the instrument after the final reminder. Table 3.8 shows the frequency and

percent of respondents in relation to contacts.

Table 3.8

Event and timeframe for completed survey instruments (n = 164)

Event	f	%
Initial notification up to reminder email 1	64	39.3
After reminder email 1 up to reminder email 2	33	20.2
After reminder email 2 up to reminder email 3	29	17.8
Late responder group		
After final email reminder (late responder group)	29	17.9
After phone call to random sample of 20 non-respondents	8	.1

Note. Sample frame included 464 individuals

     To address non-response error an independent *t*-test was used to compare the

early and late respondent groups on the variables of interest (Table 3.9). A Levene's Test

for equality of variances was significant on all variables, therefore, equal variances were

assumed. Early responders were similar to late responders on the variables of PUSM,

PUSSPL, age, completed years teaching, social media use (in minutes per week), and

days of professional learning. However, there was a significant difference for the

Elements of Online Teacher Engagement (EOTE), $t(162) = -3.26$, $p = <.01$, representing

a small effect (Field, 2013). For this reason, although the EOTE has high reliability, the

significant difference between early and late respondents warrants caution in

generalizing.

Table 3.9

Comparison of Early[a] Versus Late[a] Responders on Primary Variables of Interest (n =164)

	Early (n = 126)		Late (n = 38)				95% CI	
Variable	Mean	SE	Mean	SE	t[c]	p	Lower	Upper
PUSM	2.77	.11	3.12	.22	-1.54	.13	-.80	.10
PUSSPL	3.86	.12	3.73	.20	.57	.57	-.34	.61
Age	36.94	.99	37.79	2.08	-.39	.69	-5.08	3.37
Career phase	10.83	.84	9.31	1.25	.90	.37	-1.81	4.84
SM use	158.20	13.89	141.32	30.08	.54	.59	-44.54	78.31
Days of PL	29.29	1.22	31.34	2.88	-.76	.45	-7.43	3.32
EOTE	16.27	.57	20.79	1.52	-3.26	<.01*	-7.27	-1.18

Note. PUSM = Perceived Usefulness of Social Media. PUSSPL = Perceived Usefulness of School Sponsored Professional Learning. Perceived Usefulness scales adapted from Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340 with permission. EOTE = Elements of Online Teacher Engagement. PL = Professional learning.
[a] Those who completed the instrument prior to the last stimulus [b] Those who completed the instrument after the final email stimulus, including the phone contact. [c] df = 162
* $p < .05$

Data Analysis

Several statistical procedures were employed to analyze the results of the instrument in relation to the dependent variable as well as independent variables. Groups within independent variables with less than 30 were not considered for statistical analysis individually, and in some cases where noted were combined with other groups to ensure statistical validity (Field, 2013; Fraenkel et al., 2012). When *t*-tests were utilized, the Levene's Test was used to analyze the assumption of equal variance. When non-significant, equal variances were assumed, when significant, equal variances were not assumed (Field, 2013). Corresponding degrees of freedom (df), t values (*t*), significance (*p*), confidence intervals (CI), and effect sizes are reported where appropriate as suggested by Field (2013). Specific methodology is discussed for each research objective.

Additional considerations for data analysis methods are discussed as they relate to each research objective.

RO1. Research objective 1 sought to examine teachers' self-reported engagement in professional social media use. Engagement in PLNs was measured on the EOTE scale. Teachers responded to a Likert-scale in reference to their agreeance to 28 items. Data was coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.* Professional social media use was defined as interactions and resources you search and find in the form of groups, chats, and other that enhance your ability to positively impact student learning. Social media was defined as any major social media platform including but not limited to Pinterest, Facebook, YouTube, Google +, Snapchat, Twitter, etc. A principal factor analysis was conducted on the 28 items of the EOTE instrument (see Appendix A) utilizing Statistical Package for Social Science (SPSS) version 25 software.

An oblique promax rotation was selected, as literature supports the likelihood of variables being correlated. Figure 2.1 shows the interconnected elements of the Krutka et al. (2016) model demonstrated with double ended arrows, supporting the likely correlation. The Kaiser-Meyer-Olkin measure was utilized to evaluate sampling adequacy, KMO = .95, which is considered Marvelous (Hutcheson & Sofroniou, 1999). The pattern matrix was utilized to determine the unique contribution of each variable to the factor (Field, 2013). Eigenvalues more than 0.7 were retained as factors (Jolliffe & Jolliffe, 1986; Jolliffe, 1972). Because there is not current scale in existence for the purpose of quantifying teacher behaviors relating to their PLN engagement (D. Krutka, personal communication, September 28, 2018), the EOTE scale is considered

exploratory. Methods where eigenvalues of more than 1 are retained, may result in substantially different factor loadings than with a .7 threshold (Field, 2013). Jolliffe (1972, 1986) report eigenvalues of 1 to be too strict.

RO2. Research objective 2 sought to explain the variance of perceived usefulness of professional social media use and perceived usefulness of school sponsored professional learning. The independent variable of PUSSPL measured respondents perceived usefulness of their school sponsored professional learning in reference to the same items of the PUSM. Examples of these events or experiences required by teachers' district or site could include workshops, training, and mandated collaborations with grade level or content area, or other arrangement. Participants responded to six statements for each construct. Responses were collected on a seven-point Likert-type scale following the Davis (1989) anchors of 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely nor unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely,* 7 = *extremely unlikely*. It should be noted a low score on the PUSM and PUSSPL are considered to have the most perceived usefulness, and those with the highest score have the least perceived usefulness. The instrument was determined to be reliable, with a Cronbach's α = .97. Item scores were used to create a mean score which is reported as the PUSM and PUSSPL. This research objective sought to compare the PUSM and PUSSPL using a paired *t*-test. Effect size is reported as small as *r* = .10, medium as *r* = .30, and large as *r* = .50 or greater (Field, 2013).

RO3. Research objective 3 sought to Identify relationships relating to teachers' perceived usefulness of social media use and other variables of interest. Three bivariate correlations were conducted using SPSS version 25 software. Correlations are reported as

Pearson's *r*, and are interpreted as .10 = small, .30 = medium, and .50 = large (Field, 2013). All tables showed an absence of correlations in the .8-.9 range, which indicates the assumption of multicollinearity is met, with the exception of age and years teaching which showed a significant large correlation (Field, 2013).

The first correlation table sought to identify relationships between variables of interest as identified by literature discussed in Chapter 2, in reference to the dependent variable of PUSM. Coding for these variables is discussed throughout this chapter.

The second correlation, teaching assignments, examined possible relationships between the courses teachers teach. Teachers identified their teaching assignments selecting all that applied from a list of the most popular courses according to the California Agricultural Education (2018) data. Options were Agriscience – non-Agriculture Biology or Chemistry, Animal Science, Agriculture Biology, Agriculture Business, Agricultural Chemistry, Agriculture Leadership, Agriculture Mechanics, Natural Resources, Plant Science and Other. Respondents were asked to enter the names of the courses in the other category. Based on a large frequency of responses in two areas, the additional categories of Agriculture Earth Science and Floral Design/Floriculture were added after the conclusion of the survey. These responses were coded into their new respective categories. Each course of interest was created as a variable, and coded dichotomously in SPSS, as 0 = no, 1 = yes. A code of 1 indicating the teacher had at least one section of that course in their current teaching assignment.

Social media use was the last correlation. It sought to examine relationships between popular platforms. Minutes each platform was used (see earlier discussion of data collection procedure) were compared to the use of other platforms.

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RO4. Research objective 4 sought to describe the effects of teacher career phase on PUSM and social media use. A single factor one-way analysis of variance (ANOVA) was conducted using SPSS version 25 software to determine if there was a significant difference between teacher career phases for the dependent variable of PUSM. Alpha level was set at .05 *a priori*. Career phases were based on years completed teaching, and coded as New = 1-3 years, Early Career = 4-10, Mid-Career = 11-16, and Late Career = 17 and over, which are reflective of professional learning programs in the state. The F statistic was used to determine the fitness of the model (Field, 2013). Effect size for the ANOVA is reported as ω^2 as suggested by Field (2013). Due to non-orthogonal grouping for these contrasts, *p* values should be interpreted with caution. Effect sizes suggested values are represented as .01 = small, .06 = medium, .14 = large (Kirk, 1996).

The assumptions of the ANOVA test are discussed as they relate to its robustness. As suggested by Field (2013), homogeneity of variance was considered met with a Levene's test $(3, 160) = .25$, $p = .36$. The significance (*p*) was greater than the .05 level required to meet the assumption of equal variance for the ANOVA test. The assumption of independence of errors was considered met, as the correlation ($r = .22$), although significant ($p = <.01$), is below the level of concern for inflated Type 1 error (Field, 2013). The ANOVA test is said to be robust and to control for Type I error even in situations of skew, kurtosis and non-normal data when sample sizes are equal (Field, 2013). With unequal sample sizes between groups, New ($n = 42$), Early ($n = 50$), Mid ($n = 22$), and Late ($n = 50$), the Hockberg's GT2 procedure was used to control for Type 1 error in the post hoc tests (Field, 2013). This procedure can be sensitive to population variance; therefore, it was compared to the Games-Howell test to consider variance in the

population (Field, 2013). Values reported in Chapter 4 are a result of the Hocksberg GT2 procedure, but were cross referenced with Games-Howell procedure. Comparisons reported significant were significant with both procedures, supporting the assumption of equal variance in the population and use of Hocksberg GT2 for post hoc analysis.

RO5. Research objective 5 sought to describe the effects of teaching assignment on PUSM. An ANOVA was conducted using SPSS version 25 software to determine if there was a significant difference between teaching assignment for the dependent variable of PUSM. Teaching assignments were coded as 1 = agriscience (includes agriculture biology, chemistry, earth, general agriscience and pathway concentrators with science base including plant and animal science), 2 = agriculture mechanics (includes all agriculture mechanics courses, welding, power mechanics, small engines), 3 = agriscience and agriculture mechanics (includes teachers with one or more sections from the agriscience and agriculture mechanics category), and 4 = other (includes agriculture business, leadership, floral design and other non agriscience and mechanics courses). Effect size for the ANOVA is reported as ω^2 as suggested by Field (2013). Alpha level was set at .05 *a priori*.

The assumptions of the ANOVA test are discussed as they relate to the robustness. As suggested by Field (2013), a Levene's test (3, 160) = 2.34, p = .08 was used to test the assumption of homogeneity of variance. The significance was greater than the .05 level required to meet the assumption of equal variance for the ANOVA test. The ANOVA test is said to be robust, and to control for Type I error even in situations of skew, kurtosis and non-normal data when sample sizes are equal (Field, 2013). The Agriscience (n = 116), Agriculture Mechanics (n = 30), Agriscience and Agriculture

Mechanics ($n = 16$), and Other ($n = 2$) were unequal in size. For this reason the Hockberg's GT2 procedure was used to control for Type 1 error in the post hoc tests (Field, 2013). This procedure can be sensitive to population variance; therefore, it was compared to the Games-Howell test to consider variance in the population (Field, 2013). Both the Games-Howell and Hocksberg GT2 procedures were conducted and analyzed, there was no significant difference between the groups with regular to significant differences (p). With a significant ANOVA, the homogeneous subset is included in the results to explore the difference in groups.

An ANOVA was conducted using the Statistical SPSS version 25 software to determine if there was a significant difference between the number courses a teacher teaches on the dependent variable of PUSM. The number of course taught were coded as *1 = 1 course, 2 = 2 courses, 3 = 3 courses, and 4 = 4 or more courses.* Effect size for the ANOVA are reported as ω^2 as suggested by Field (2013). Alpha level was set at .05 *a priori*. The assumptions of the ANOVA test are discussed as they relate to the robustness. As suggested by Field (2013), a Levene's test $(3, 160) = 1.04$, $p = .38$ was used to test the assumption of homogeneity of variance. The significance was greater than the .05 level required to meet the assumption of equal variance for the ANOVA test.

RO6. Research objective 6 sought to describe the effects of age and gender on PUSM. An ANOVA was conducted using SPSS version 25 software to determine if there was a significant difference between age groups for the dependent variable of PUSM. Age in years was coded as $1 =$ less than 29, $2 = 30 - 39$, $3 = 40 - 49$, $4 = 50 - 59$, and $5 = 60$ and over. Effect size for the ANOVA was reported as ω^2 as suggested by Field (2013),

low = .01, medium = .06, large = .14 (Kirk, 1996). Alpha level was set at .05 *a priori*. All groups were compared to one another in post hoc testing.

The assumptions of the ANOVA test are discussed here as they relate to the robustness. The ANOVA test is said to be robust, and to control for Type I error even in situations of skew, kurtosis and non-normal data when sample sizes are equal (Field, 2013). As suggested by Field (2013), a Levene's test (3, 160) = .2.34, p = .08 was used to test the assumption of homogeneity of variance for the ANOVA test. The significance was greater than the .05 level required to meet the assumption of equal variance for the ANOVA test. With unequal group sizes between the groups of 29 and under (n = 56), 30 – 39 (n = 49), 40 – 49 (n = 30), 50 – 59 (n = 22), and 60 and over (n = 7), the Hockberg's GT2 procedure was used to control for Type 1 error in the post hoc tests (Field, 2013). A Hockberg's GT2 procedure was selected for post hoc analysis due to unequal group size. This procedure can be sensitive to population variance, therefore it was compared to the Games-Howell test to consider variance in the population (Field, 2013). Values reported in Chapter 4 are a result of the Hocksberg GT2 procedure, but were cross referenced with Games-Howell procedure. Comparisons reported significant were significant with both procedures, supporting the assumption of equal variance in the population and use of Hocksberg GT2 for post hoc analysis.

An independent *t*-test was conducted using the SPSS version 25 software to determine if there was a significant difference between gender groups for the dependent variable of PUSM. Gender was coded as 1 = males (n = 56) and 2 = females (n =107), and 3= undisclosed (n = 1). Due to the small group size of undisclosed gender, it was not included in statistical analysis. As suggested by Field (2013), a Levene's test $F(162)$ =

.1.48, $p = .23$ was used to test the assumption of homogeneity of variance. With a

nonsignificant value, equal variances were assumed (Field, 2013). The r values were

interpreted as: small $r = .10$, medium as $r = .30$, and large as $r = .50$ or greater (Field,

2013).

RO7. Research objective 7 sought to describe the effects of teacher credentialing

and degrees on PUSM. An independent t-test was conducted using the SPSS version 25

software to determine if there was a significant difference between age groups for the

dependent variable of PUSM. Credential path was coded as 1 = traditional ($n = 140$) and

2 = alternative - including intern, designated subject and other credit by exam ($n = 24$).

The r values were interpreted as small as $r = .10$, medium as $r = .30$, and large as $r = .50$

or greater (Field, 2013). As suggested by Field (2013), a Levene's test $F(162) = .89$, $p =$

.35 was used to test the assumption of homogeneity of variance. With a nonsignificant

value, equal variances were assumed (Field, 2013).

An independent t-test was conducted using the SPSS version 25 software to

determine if there was a significant difference between age groups for the dependent

variable of PUSM. Credential path was coded as *1 = traditional* and *2 = alternative*

(including intern, designated subject and other credit by exam). As suggested by Field

(2013), a Levene's test $F(162) = .70$, $p = .40$ was used to test the assumption of

homogeneity of variance. With a nonsignificant value, equal variances were assumed

(Field, 2013). The r values were interpreted as small as $r = .10$, medium as $r = .30$, and

large as $r = .50$ or greater (Field, 2013).

RO8. Research objective 8 sought to examine the effects of geographic isolation

and teaching assignment isolation on PUSM. An ANOVA was conducted using the SPSS

version 25 software to determine if there was a significant difference between region of teaching assignment groups for the dependent variable of PUSM. Region of teaching assignment was coded as *1 = Superior, 2 = North Coast, 3 = Central, 4 = San Joaquin, 5 = Southern, 6 = South Coast.* Effect size for the ANOVA is reported as ω^2 as suggested by Field (2013), low = .01, medium = .06, large = .14 (Kirk, 1996). Alpha level was set at .05 *a priori*. As suggested by Field (2013), a Levene's test (5, 158) = 3.59, $p = <.01$ was used to test the assumption of homogeneity of variance for the ANOVA test, with a significant test ($p <.01$), the assumption was not met. The Welch procedure was used to adjust the F value as suggested by Field (2013).

An independent *t*-test was conducted using the SPSS version 25 software to determine if there was a significant difference in groups relating to isolation of teaching assignment for the dependent variable of PUSM. Isolation of teaching assignment path was coded as 1 = none ($n = 26$) and 2 = One or more course (on a site without another teacher teaching the same course) ($n = 138$). As suggested by Field (2013), a Levene's test $F(162) = <.00$, $p = .96$ was used to test the assumption of homogeneity of variance. With a nonsignificant value, equal variances were assumed (Field, 2013). The *r* values were interpreted as small as $r = .10$, medium as $r = .30$, and large as $r = .50$ or greater (Field, 2013).

RO9. Research objective 9 sought to predict PUSM based on independent variables of interest. A multivariate data analysis was conducted using the SPSS version 25 software. Independent variables included PUSSPL, social media use (in minutes per week), days of content specific professional learning attended in the last 12 months, highest degree, credential type, gender, career stage, region, number of courses taught,

and teaching assignment. The dependent variable was PUSM. A hierarchal variable data entry approach was utilized. Alpha level of .05 was determined *a priori*. Assumptions for multivariate correlation were met. Multicollinearity was evaluated with collinearity diagnostics of Tolerance, with all values more than .2, which Menard (1995) considers to be met, and VIF of less than 10, which Myers (1990) considered to meet the assumption. Further evaluation of the multicollinearity assumption was conducted through evaluation of the matrix of Pearson Correlations, the variables of age and career stage were significantly correlated with $r = .85$, therefore age was removed from the model, as career stage offers future researchers' greater usefulness. After this change, the absence of correlations in the .8-.9 range indicated the assumption of multicollinearity was met Field (2013). Homoscedacity was verified through review of plots. The assumption of independent errors was tested using Durbin-Watson Statistic (1.59), which is within the acceptable range of 1 to 3. Effect sizes is reported in R_2, and interpreted according to Cohen (1988) as .02=small, .13=medium, and .26=large (Fields, p. 313).

Using SPSS, the blocks of data were entered utilizing a hierarchical (blockwise entry). As recommended by Field (2013), the predictors were entered according to importance based on the findings of literature discussed in this paper.

- Block One: PUSSPL, Social Media Use, and Content Specific professional learning
- Block Two: Career Stage, Gender, Degrees, Credential Type, Teaching Assignment, Region, Number of Courses Taught

CHAPTER FOUR

RESULTS

This chapter explores the results of the research objectives stated in Chapter 2. Research objectives of this study sought to explore teachers' engagement in social media, explain the variance between teachers PUSM and PUSSPL, identify relationships within variables of interest, describe the effects of independent variables on PUSM and to predict teachers PUSM based on variables of interest. Statistical procedures utilized to analyze data for the research objectives included exploratory factor analysis, ANOVA, *t*-tests, and a multiple linear regression.

RO1

Research objective 1 sought to examine teachers' self-reported engagement in professional social media use. Engagement in PLNs was measured on the EOTE scale. With no existing quantitative instrument for use in analyzing teachers online professional social media engagement, the EOTE instrument was drafted based on current research findings (Krutka et al., 2016; Trust et al., 2016). Table 4.1 shows the rotated factor loadings for the exploratory factor analysis of the EOTE instrument. Six factors loaded with eigenvalues over .7, and were reported to have high reliability using Cronbach's α. Five of the factors that were loaded were titled to match the existing elements of the Krutka et al. (2016) model with the exception of engagement. The element of engagement was divided into two separate elements of active engagement and passive engagement.

Table 4.1

Factor Loadings Exploratory Factor Analysis with Promax Rotation of Elements of Online Teacher Engagement Scales (N = 164)

Item	Experimenting	Sharing	Discovery	Passive Engagement	Active Engagement	Reflecting
I make changes to my teaching practices.	**.99**					
I experiment with new teaching strategies in my classroom.	**.93**					
I experiment with new approaches to teach my students.	**.92**					
I experiment with new curriculum resources.	**.82**					
I test ideas other teachers have suggested.	**.79**					
I make changes to how I teach my curriculum.	**.69**					
I share my opinion online.		**1.1**			**-.41**	
I share my feelings online.		**1.0**				
I share ideas online.		**.76**				
I share resources online		**.71**				
I post, tweet, share about my personal experiences relating to teaching.		**.64**				
I respond to others posts with text and/or links to discuss my past experiences.		**.57**				

Table 4.1

Continued

Item	Experimenting	Sharing	Discovery	Passive Engagement	Active Engagement	Reflecting
I discover new teaching resources I had not intentionally set out to find.			.87			
I make changes to my teaching practices.			.81			
I learn about new technologies and digital tools even though I wasn't searching for them.			.74			
I become more aware of opinions and perspectives which are different than my own.			.72			
I connect to individuals I might not have otherwise connected with.		.43	.45			
I get connected to new teaching strategies I had not intentionally set out to find.	.40		.41			
I search for resources I need by searching hashtags or key term searches within the social media platform.				.77		
I search for resources I need by looking in group shared folders and drives.				.71		

Table 4.1

Continued

Item	Experimenting	Sharing	Discovery	Passive Engagement	Active Engagement	Reflecting
I search for people and/or groups I would like to connect with.		**.41**		**.42**		
I ask for resources.					**.92**	
I ask questions and/or for advice.		.35			**.67**	
I reflecting on how I can become a more effective teacher.	.38					**.55**
I spend time thinking about the teaching resources I am currently using.	.33					**.53**
I reflect on my experiences relating to ideas I found on social media.						**.51**
Eigenvalues	16.51	2.98	1.149	.90	.80	.76
% of variance	58.96	10.65	4.11	3.22	2.85	2.72
α	.98	.94	.94	.88	.94	.85

Note. Only factor loadings over .30 are shown. Values over .40 are shown in bold. Coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree*

The EOTE scale scores were organized into six constructs based on the factor loadings, Reflecting ($M = 3.24$, $SD = 1.15$), Passive Engagement ($M = 3.18$, $SD = 1.54$), Active Engagement ($M = 3.34$, $SD = 1.70$), Discovery ($M = 2.65$, $SD = 1.23$), Experimenting ($M = 2.64$, $SD = 1.09$), Sharing ($M = 4.07$, $SD = 1.05$). The descriptive statistics for each construct and its items are discussed in this section.

Table 4.2 shows the descriptive statistics for the factor loading of reflecting on the EOTE scale. The constructs mean indicated teachers somewhat agreed with the series of statements relating to their personal reflection of their online interactions. Two statements had a mode of "agree" with the statements of "I spend time thinking about the teaching resources I am currently using," ($M = 2.59$, $SD = 1.24$) and "I reflect on how I can become a more effective teacher" ($M = 2.51$, $SD = 1.29$).

Table 4.2

Descriptive Statistics for the Reflecting Construct of the Elements of Online Teacher Engagement Scale (N = 164)

Item	M	Mode	Range	SD
I reflect on my experiences relating to ideas I found on social media.	3.10	3	6	1.40
I spend time thinking about the teaching resources I am currently using.	2.59	2	6	1.24
I reflecting on how I can become a more effective teacher.	2.51	2	6	1.29

Note. Total $M = 3.24$, *Mode* $= 2.80$, *Range* $= 6$, $SD = 1.15$. Coded as $1 =$ *strongly agree*, $2 =$ *agree*, $3 =$ *somewhat agree*, $4 =$ *neither agree nor disagree*, $5 =$ *somewhat disagree*, $6 =$ *disagree*, and $7 =$ *strongly disagree.* Reliability Cronbach's $\alpha = .85$

Table 4.3 shows the descriptive statistics for the factor loading of passive engagement on the EOTE scale. "I search for people and/or groups I would like to connect with," had the lowest level of agreeance ($M = 3.46$, $SD = 1.92$), followed closely by "I search for resources I need by searching hashtags or key term searches within the social media platform," ($M = 3.48$, $SD = 1.87$). The highest level of agreeance occurred with the item "I search for resources I need by looking in group shared folders and drives" ($M = 2.62$, $SD = 1.59$).

Table 4.3

Descriptive Statistics for Passive Engagement on the Elements of Online Teacher Engagement Scale (N = 164)

Items	M	Mode	Range	SD
I search for resources I need by searching hashtags or key term searches within the social media platform.	3.48	3	6	1.87
I search for people and/or groups I would like to connect with.	3.46	2	6	1.92
I interact with things others have posted by using features such as liking, pinning, sharing, retweeting.	3.15	2	6	1.82
I search for resources I need by looking in group shared folders and drives.	2.62	3	6	1.59

Note. Total $M = 3.18$, *Mode* = 2.50, *Range* = 6, $SD = 1.54$. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree*.
Reliability Cronbach's α = .88.

The element of active engagement had two items (shown in Table 4.4). The item with the highest agreeance was "I ask for resources" ($M = 3.14$, $SD = 1.75$), and the lowest was "I ask questions and/or for advice" ($M = 3.55$, $SD = 1.80$).

Table 4.4

Descriptive Statistics for the Active Engagement Construct of the Elements of Online Teacher Engagement Scale (N = 164)

Items	M	Mode	Range	SD
I ask questions and/or for advice.	3.55	3	6	1.80
I ask for resources.	3.14	3	6	1.75

Note. Total $M = 3.34$, $SD = 1.70$. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.*
Reliability Cronbach's α = .92

The element of discovery had a mode of "agree." Table 4.5 shows "I discover new teaching resources I had not intentionally set out to find," ($M = 2.33$, $SD = 1.26$) had the highest level of agreeance, as noted by the lowest PUSM score. "I connect to individuals I might not have otherwise connected with" ($M = 2.98$, $SD = 1.59$) had the lowest level of agreeance in the element of discovery, as noted by the highest PUSM score.

Table 4.5

Descriptive Statistics for the Discovery Construct of the Elements of Online Teacher
Engagement Scale (N = 164)

Items	M	Mode	Range	SD
I connect to individuals I might not have otherwise connected with.	2.98	2	6	1.59
I get connected to new teaching strategies I had not intentionally set out to find.	2.66	2	6	1.33
I become more aware of opinions and perspectives which are different than my own.	2.65	2	6	1.42
I learn about new technologies and digital tools even though I wasn't searching for them.	2.57	2	6	1.33
I get exposed to new ideas I didn't specifically go searching for.	2.38	2	6	1.23
I discover new teaching resources I had not intentionally set out to find.	2.33	2	6	1.26

Note. Total *M* = 2.65, *Mode* = 2.00, *Range* = 6, *SD* = 1.23. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree*.
Reliability Cronbach's α = .94

The element of experimenting had a mixed mode of "agree" and "somewhat" agree." Table 4.6 shows the item "I test ideas other teachers have suggested" (*M* = 2.51, *SD* = 1.09) has the highest level of agreeance, while "I make changes to how I teach my curriculum" (*M* = 2.86, *SD* = 1.27) has the lowest level of agreeance, indicated by a higher mean PUSM score.

Table 4.6

Descriptive Statistics for the Experimenting Construct of the Elements of Online Teacher Engagement Scale (N = 164)

Item	M	Mode	Range	SD
I make changes to how I teach my curriculum.	2.86	3	6	1.27
I experiment with new teaching strategies in my classroom.	2.69	3	6	1.67
I experiment with new approaches to teach my students.	2.63	2	6	1.13
I make changes to my teaching practices.	2.63	3	6	1.16
I experiment with new curriculum resources.	2.52	2	6	1.12
I test ideas other teachers have suggested.	2.51	2	6	1.09

Note. Total *M* = 2.64, *Mode* = 3.00, *Range* = 6, *SD* = 1.09. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.* Reliability Cronbach's α = .98

The element of sharing had the least level of agreeance of the six elements (Table 4.7). Modes in this element were split between 3 and 4. The lowest PUSM item mean was for the statement "I connect other teachers to resources. For example, tagging them or mentioning them in posts or retweets or sending them direct messages" (*M* = 3.62, *SD* = 1.83). "I share my feelings online" (*M* = 4.76, *SD* = 1.65) had the least level of agreeance as noted by a high PUSM score.

Table 4.7

Descriptive Statistics for the Sharing Construct of the Elements of Online Teacher Engagement Scale (n = 164)

Items	M	Mode	Range	SD
I share my feelings online.	4.76	4	6	1.65
I post, tweet, share about my personal experiences relating to teaching.	4.33	3	6	1.87
I share my opinion online.	4.33	4	6	1.72
I share ideas online.	3.98	3	6	1.78
I share resources online.	3.77	3	6	1.76
I respond to others posts with text and/or links to discuss my past experiences.	3.70	3	6	1.87
I connect other teachers to resources. For example, tagging them or mentioning them in posts or retweets or sending them direct messages.	3.62	3	6	1.83

Note. Total *M* = 4.07, *Mode* = 4.14, *Range* = 6, *SD* = 1.50. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree*.
Reliability Cronbach's α = .94

RO2

Research objective 2 sought to explain the variance of perceived usefulness of professional social media use and perceived usefulness of school sponsored professional learning. Table 4.8 shows the descriptive statistics for the PUSM and PUSSPL scales. Overall, the mean item scores for all items on the PUSM scale were a value of 2, with only one exception, indicating a "quite likely" level of agreeance. Items on the PUSSPL were values of 3, indicating a "slightly likely" response. Teachers had the highest level of

94

agreeance on PUSM scale with "makes it easier to perform my duties as a teacher" ($M =$ 2.71, $SD = 1.39$), while the same statement on the PUSSPL scale showed the least level of agreeance ($M = 3.94$, $SD = 1.41$). The item of "results in significant changes to my teaching" had the lowest level of agreeance on the PUSM ($M = 3.14$, $SD = 1.40$) and the PUSSPL scales ($M = 3.89$, $SD = 1.38$). There was the least agreeance with the item of "results in significant changes to my teaching" on the PUSM ($M = 3.14$, $SD = 1.40$) and the PUSSPL scale ($M = 3.89$, $SD = 1.38$)

Overall, teachers perceived social media for professional purposes ($M = 2.85$, $SD = 1.24$) to be more useful than their school sponsored professional learning (3.83, $SD = 1.29$). This difference, .98, 95% CI [.74, 1.21], was significant $t(163) = 8.15$, $p = < .001$, which represents a large effect size, $r = .54$ (Field, 2013).

Table 4.8

Perceived Usefulness of Professional Social Media Use and Mandatory School Sponsored Professional Learning (PL) (n = 164)

Item	Professional social media use[a]					Mandatory school sponsored PL[b]				
	M	*Mdn*	*Mode*	*Range*	*SD*	*M*	*Mdn*	*Mode*	*Range*	*SD*
Results in significant changes to my teaching	3.14	3	2[c]	6	1.40	3.89	4	3	6	1.38
Results in improved learning outcomes for my students	2.88	3	3	6	1.32	3.75	3	3	6	1.35
Improves my effectiveness as a teacher	2.84	3	3	6	1.29	3.86	4	3	6	1.41
Enhances my effectiveness as a teacher	2.82	3	2	6	1.33	3.75	3	3	6	1.35
Improves my ability to prepare and deliver high quality instruction for my students	2.72	3	2	6	1.32	3.80	3	2	6	1.36
Makes it easier to perform my duties as a teacher.	2.71	3	2	6	1.39	3.94	4	3	6	1.41

Note. Professional social media use Total *M* = 2.85, *SD* = 1.24. Mandatory school sponsored PL total *M* = 3.83, *SD* = 1.29. Instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely.* PL = Professional learning.
[a] In response to "Using social media professionally..." Reliability Cronbach's α = .96. [b] In response to "mandatory school sponsored professional learning…" Reliability =.97. [c] multiple modes exist, lowest value shown

Figure 4.4 shows new teachers have the greatest difference between their PUSM and PUSSPL scores. Early career teachers express the least perceived usefulness of school sponsored professional learning. In general, as years of teaching increases, the perceived usefulness of social media in professional learning decreases, with the exception of the Mid-Career teachers, who had the lowest perceived usefulness. While there was no significant difference for new and early career teachers in their PUSM, when mid and late ($n = 72$) teachers are compared as a group to new and early teachers ($n = 92$), there is a significant difference. The difference of -.60, 95% CI [-.98, -.22] was significant, $t(162) = -3.17$, $p = <.01$ represents a small effect size, $r = .24$ (Field, 2013).
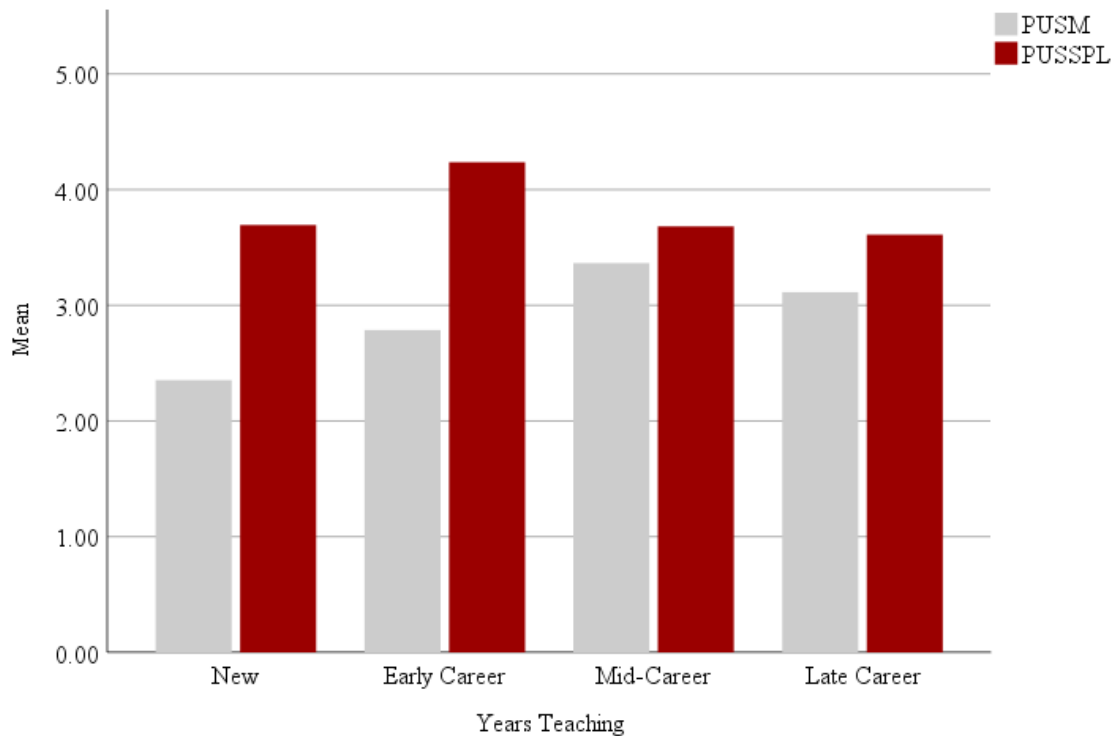
Figure 4.4 Years completed teaching compared to mean perceived usefulness of social media scores and perceived usefulness of school sponsored professional learning. Items coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.*

RO3

Research objective 3 sought to Identify relationships relating to teachers' perceived usefulness of social media use and other variables of interest. In this study correlation coefficients were utilized to describe relationships between teachers perceived usefulness of social media for professional purposes with demographic attributes and reported use and attitudes. No significant correlations were identified relating to teachers' region, so it was not included in the table. Table 4.9 shows the matrix of Pearson Correlations for the nine variables considered in relation to the PUSM. Several

significant correlations were identified. Age and PUSM has a significant correlation ($r =$ .21, $p = < .01$), with a small effect size. Years completed teaching is also significantly correlated with PUSM ($r = .22$, $p = < .01$), which indicates a small effect size. Social media use is significantly correlated with PUSM ($r = -.39$, $p = <.01$), and is characterized with a medium effect size. Social media use is also significantly correlated to teacher number of content specific professional learning days in the last 12 months ($r = -.25$, $p = < .01$), representing a small effect size. Teacher isolation is correlated with only one variable, years of teaching ($r = -19$, $p = .01$), this represents a small effect size. Teachers score on the EOTE scale is significant correlated with PUSM ($r = .66$, $p = <.01$), representing a large effect size.

Table 4.9

Summary of Correlations of Variables Relating to Perceived Usefulness of Social Media Use for Professional Learning (n = 164)

Variables	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
PUSM[a] x_1		**.26***	**.21***	**.22***	-.25	-.18	-.10	**.66***	**-.39***
PUSSPL[a] x_2	**.26***		-.10	-.09	-.07	.05	.07	.14	-.08
Age x_3	**.21***	-.10		**.89***	-.15	-.01	-.15	**.27***	**-.20***
Career phase[b] x_4	**.22***	-.09	**.89***		-.11	.06	-.19	**.24***	-.24
Content PL[c] x_5	**-.25***	-.07	-.15	-.10		.13	.01	**-.13***	.11
Preps[d] x_6	**-.18***	.05	-.01	.06	.13		.12	-.21	.14
Isolation[e] x_7	-.10	.07	-.15	**-.19***	.01	.12		-.08	.14
EOTE[f] x_8	**.66***	.14	**.23***	**.28***	**-.21***	**-.21***	-.08		-.44
SM Use[g] x_9	**-.39***	-.08	**-.20***	-.24	.11	.14	.14	**-.44***	

Note. Significant correlations are shown in bold type.
[a] Instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. PL = Professional learning.
[d] Coded as 1 = 1 course, 2 = 2 courses, 3 = 3 courses, and 4 = 4 or more. [d] frequency count of number of different courses a teacher teachers [e] 1 = none, 2 = One or more course (on a site without another teacher teaching the same course) [f] Item responses coded as 1 = *strongly agree*, 2 = *agree*, 3 = *somewhat agree*, 4 = *neither agree nor disagree*, 5 = *somewhat disagree*, 6 = *disagree*, and 7 = *strongly disagree.* Mean scores for each element were combined as a summed score. [g] Summed minutes of use for all social media platforms combined.
* $p = <.05$

Table 4.10 shows the intercorrelations of social media use by platform. Several platforms were correlated. Instagram had the highest number of significant correlations with other platforms, with the only platform to not correlate was Twitter. Linked In and Twitter showed the least number of correlations. Snapchat showed the next fewest correlations, with only significant correlations with Facebook ($r = .19$, $p = <.02$), Instagram ($r = .35$, $p = <.01$), and YouTube ($r = .16$, $p = .05$). Facebook and Pinterest had a similar number of significant correlations. The presence of several significant correlations within each platform suggests teachers are using multiple platforms.

Table 4.10

Summary of Intercorrelations between Social Media Platform of Use by Teachers (n = 164)

Variables	x1	x2	x3	x4	x5	x6	x7
Facebook x1		.03	**.39****	**.42****	**.32****	**.19***	.47
LinkedIn x2	.29		.12	**.23****	.09	.10	-.26
Pinterest x3	**.40****	.12		**.49****	**.27****	.12	**.89****
Instagram x4	**.42****	**.23****	**.49****		**.33****	**.35****	.59
YouTube x5	**.32****	.09	**.27****	**.33****		**.16***	.21
Snapchat x6	**.19***	.10	.12	**.35****	**.16***		.93
Twitter x7	.47	-.26	**.89****	.59	.21	-.04	

Note. Significant correlations are shown in bold type. Reported by teachers in minutes per week.
* $p = <.05$, ** $p = <.01$

Table 4.15 shows the correlations between teaching assignments. In general courses did not show significant correlations with more than one or two courses, indicating a lack of pattern in typical teaching assignments, with the exception of Agriculture Mechanics. Several significant negative correlations were identified with Agriculture Mechanics, these courses included Agriscience ($r = -.25$), Animal Science ($r = -.24$), Agriculture Biology ($r = -.44$), Agriculture Chemistry ($r = -.30$), Agriculture Leadership ($r = -.21$), and Floral ($r = -.22$). These correlations represent small and medium effect sizes. This finding indicates agriculture mechanics teachers are not likely to teach courses outside of agriculture mechanics.

Table 4.11

Summary of Intercorrelations between Agriculture Teaching Assignments (n = 164)

Course	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}
Agriscience[a] x_1		-.06	-.12	.10	.04	-.11	-.12	**-.25****	-.04	.09	<.01	.03
Animal Science x_2	-.06		**.17***	-.05	-.03	-.10	-.17	**-.24****	-.03	**.20***	.15	.02
Biology x_3	-.12	**-.17***		.03	.04	.12	.08	**-.44****	.15	-.07	.01	.03
Business x_4	.10	-.05	.03		.03	-.06	.07	-.12	.15	-.06	-.01	-.08
Chemistry x_5	.04	-.03	.04	.03		.04	.07	**-.30****	.06	-.10	-.04	-.08
Earth Science x_6	-.11	-.10	.12	-.06	.04		<-.01	.03	-.06	-.03	-.10	-.07
Leadership x_7	.12	**.17***	.08	.07	.07	<-.01		**-.21****	.09	**.22****	-.06	-.09
Mechanics x_8	**-.25****	**-.24****	-.44	-.12	**-.30****	.03	**-.21****		**-.22****	-.12	-.09	-.13
Floral[b] x_9	.04	-.03	.15	.15	.06	-.06	.09	**-.22****		-.05	-.13	**.32****
Natural Resources x_{10}	.09	**.20***	-.07	-.06	-.10	-.03	**.22****	-.12	-.05		<-.01	-.06
Plant Science x_{11}	<.01	.15	.01	<-.01	-.04	-.10	-.06	-.09	-.13	<-.01		-.12
Other x_{12}	.32	.02	.03	-.08	-.08	-.07	-.09	-.03	**.32****	-.06	-.12	

Note. Coded as 0 = no courses, 1 = 1 or more sections. Course titles include Agriculture for the following: Business, Biology, Chemistry, Earth Science, Leadership, and Mechanics.

a Does not include agriculture biology or chemistry. [b] Includes Floral design and Floriculture.

* p = <.05, ** p =<.01

RO4

RO 4 sought to describe the effects of teacher career phase on PUSM compared to teachers' professional social media use in minutes. Table 4.12 shows teachers perceived usefulness by career phase ($N = 164$) for the PUSM, where a low score indicates the highest level of perceived usefulness, and high score indicates a level of low perceived usefulness. New teachers had the highest perceived usefulness of social media, and mid-career had the lowest.

Table 4.12

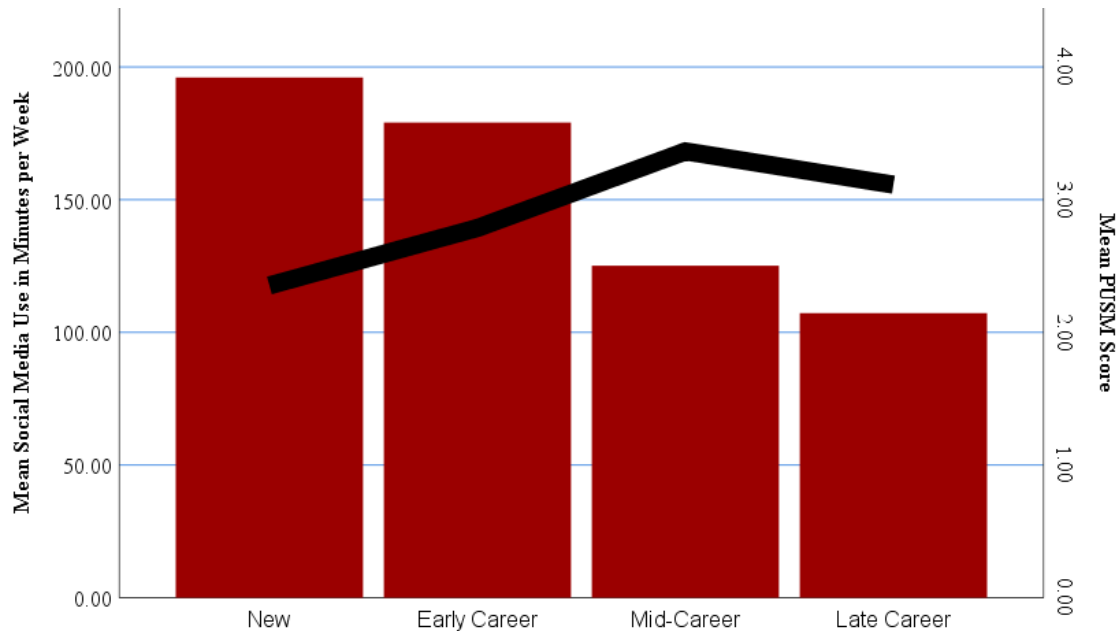*Perceived Usefulness of Social Media and Weekly Professional Social Media Use[a] by Teacher Career Phase (N = 164)*

| | | PUSM | | | | Social Media Use | | | |
| | | | | CI | | | | CI | |
Phase	*n*	*M*	*SD*	Lower	Upper	*M*	*SD*	Lower	Upper
Mid	22	3.36	1.31	2.78	3.94	125.09	119.86	73.20	141.32
Late	50	3.11	1.29	2.74	3.48	107.29	119.85	128.43	180.15
Early	50	2.79	1.15	2.46	3.11	179.08	217.42	117.29	240.87
New	42	2.35	1.05	2.03	2.68	196.05	155.84	147.48	244.61

Note. Total PUSM $M = 2.85$, $SD = 1.23$. Total Social Media Use $M = 154.29$, $SD = 167.71$. Career phases based on years completed, coded as New = 1-3 years, Early Career = 4-10, Mid-Career = 11-16, Late Career = 17 and over. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely.*
[a] reported in minutes of use on a combination of all social media platforms per week.

Figure 4.5 shows new teachers have the highest social media use, followed by a downward trend for subsequent groups. The trend line for PUSM shows new teachers had

the highest perceived usefulness of social media, subsequent groups had decreasing

perceived usefulness of social media, with the exception of the late career teachers.

Figure 4.5 Mean perceived usefulness of social media for professional learning purposes (PUSM) score compared to mean social media use per week in minutes by teachers' career phase.

The linear model discussed in Table 4.13 represents an increasing score on the

PUSM, which indicates a decreasing perceived usefulness of social media. An analysis of

variance test revealed there is a significant effect of teacher career phase on PUSM, $F(3,$

$160) = 4.61, p = <.01, \omega^2 = 0.22$, which represents a low effect size according to Kirk

(1996). This indicates that on average, as the years of teaching increases, the perceived

usefulness of professional social media use decreases.

Table 4.13

One-way Analysis of Variance Summary for Perceived Usefulness of Social Media by Teacher Career Phase (n = 164)

Variable	df	SS	MS	F	p	ω^2
Between Groups	3	19.84	6.61	4.61	<.01	.22
Within Groups	160	229.46	2.37	1.65		
Total	163	249.46				

Note. Career phases based on years completed, coded as New = 1-3 years, Early Career = 4-10, Mid-Career = 11-16, Late Career = 17 and over. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
* *p* < .05

Table 4.14 shows the results of the planned contrasts. When early career teachers were compared to all other groups, there was a significant difference, *t*(160) = -3.36, *p* = <.01, representing a small effect (*r* = .26). New career teachers have a significantly higher perceived usefulness of social media, as indicated by their lower PUSM mean score. In consideration of early and mid-career teachers combined in comparison to late career teachers, there was no significant difference in their PUSM. Early and late career teachers showed no significant difference in their PUSM. New and late career teachers did have significant differences in their PUSM, *t*(160) = -3.03, *p* = <.01, *r* = .23, which represents a small effect size.

Table 4.14

One-way Analysis of Variance Planned Contrasts for Perceived Usefulness of Social Media by Teacher Phase (n = 164)

Career phase	SE	*t*	df	*p*	*r*
New x Early, Mid, Late	.66	-3.36	160	<.01*	.26
Early & Mid x Late	.46	.17	160	.87	.01
New & Early x Mid & Late	.40	3.38	160	<.01*	.26
Early x Late	.24	1.36	160	.18	.11
New x Late	-.76	-3.03	160	<.01*	.23

Note. Career phases based on years teaching, coded as New = 1-3 years, Early Career = 4-10, Mid-Career = 11-16, Late Career = 17 and over.
* *p* < .05

RO5

RO5 sought to describe the effects of teaching assignment on PUSM. Table 4.15 shows the descriptive statistics for perceived usefulness of social media by teaching assignment. The agriscience group (*n* = 116) had the highest perceived usefulness of social media (*M* = 2.65, *SD* = 1.11), followed by the agriculture mechanics group (*n* = 30, *M* = 3.14, *SD* = 1.28), and then those who teach one or more courses of agriculture mechanics and agriscience (*n* = 16, *M* = 3.50, *SD* = 1.37). The Other group was the smallest group, indicating that most teachers fell into one of the first three categories. With a sample size of two and a large *SD*, the sample mean may be unreliable in this group (*M* = 4.83, *SD* = 3.06).

Table 4.15

Descriptive Statistics for Perceived usefulness of social media use by courses Teaching Assignment (N = 164)

Teaching Assignment	n	M	SD
Agriscience[a]	116	2.65	1.11
Agriculture mechanics[b]	30	3.14	1.28
Agriscience and agriculture mechanics[c]	16	3.50	1.37
Other[d]– non agriscience or mechanics	2	4.83	3.06

Note. Total $M = 2.85$, $SD = 1.23$. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
[a] Coded as 1, includes agriculture biology, chemistry, earth, general agriscience and pathway concentrators with science base including plant and animal science. [b] Coded as 2, includes all agriculture mechanics courses, welding, power mechanics, small engines. [c] Coded as 3, includes teachers with one or more sections from the agrisicence and agriculture mechanics category. [d] Course include agriculture business, leadership, floral design.

Table 4.16 shows an analysis of variance test which revealed there is a significant effect of teaching assignment on PUSM, $F(3, 160) = 4.61$, $p = <.01$, $\omega^2 = 0.22$, which represents a low effect size according to Kirk (1996). There was a significant difference in PUSM depending on the courses they taught, indicated by a declining linear trend of those who teach Agriscience having the highest perceived usefulness of social media, followed by a with lower perceived usefulness by Agriculture Mechanics, then Agriscience and Agriculture Mechanics, and finally the group of Other.

Table 4.16

One-way Analysis of Variance Summary for Perceived Usefulness of Social Media by Teaching Assignment (N = 164)

Variable	df	SS	MS	F	p	ω^2
Between Groups	3	21.70	7.23	5.08	<.01*	.07
Within Groups	160	227.60	1.42			
Total	163	249.30				

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely.*
[a] Coded as 1, includes agriculture biology, chemistry, earth, general agriscience and pathway concentrators with science base including plant and animal science. [b] Coded as 2, includes all agriculture mechanics courses, welding, power mechanics, small engines. [c] Coded as 3, includes teachers with one or more sections from the agrisicence and agriculture mechanics category. [d] Course include agriculture business, leadership, floral design.
* $p < .05$

Analysis of the Games-Howell and Hochberg's GT2 did not reveal any significant differences in the groups for teaching assignments. Table 4.17 shows the homogeneous subsets for PUSM by teaching assignment. Subset 1 examined agriscience (*n*= 116, *M* = 2.65), agriculture mechanics (*n* = 30, *M* = 3.14), and agriscience and agriculture mechanics (*n* = 16, *M* = 3.50), this was represented with a non-significant difference in the group, *p* = .73. Subset 2 examined agriculture mechanics (*n* = 30, *M* = 3.14), agriscience and agriculture mechanics (*n* = 16, *M* = 3.50), and other (*n* = 2, *M* = 4.83), there was no significant difference in this group, *p* = .06.

Table 4.17

One-way Analysis of Variance Post Hoc Tests for Perceived Usefulness of Social Media by Teaching Assignment[a] (N = 164)

Content area	n	Subset 1	Subset 2
Agriscience[b]	116	2.65	
Agriculture mechanics[c]	30	3.14	3.14
Agriscience and agriculture mechanics[d]	16	3.50	3.50
Other– non agriscience or mechanics[e]	2		4.83

Note. Subset 1 *p* = .73, Subset 2 *p* = .06. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
[a] Characterized by one or more courses in the content area. [b] Coded as 1, includes agriculture biology, chemistry, earth, general agriscience and pathway concentrators with science base including plant and animal science. [c] Coded as 2, includes all agriculture mechanics courses, welding, power mechanics, small engines. [d] Coded as 3, includes teachers with one or more sections from the agriscience and agriculture mechanics category. [e] Course include agriculture business, leadership, floral design.

Table 4.18 shows perceived usefulness of social media by the number of courses a teacher teaches. Those who teach one course have the least perceived usefulness of social media (*M* = 3.24, *SD* = 1.42), as indicated by the highest mean PUSM. Teachers who teach 4 or more course have the most perceived usefulness of social media (*M* = 2.44, *SD* = 1.82).

Table 4.18

Perceived Usefulness of Social Media by Teacher Age Post Hoc Comparison (n = 164)

					95 % CI	
Groups	n	M	SE	SD	Lower	Upper
1 course	42	3.24	.22	1.42	2.80	3.69
2 courses	49	2.76	.17	1.20	2.42	3.11
3 courses	47	2.83	.17	1.17	2.49	3.17
4 or more courses	26	2.44	.18	1.82	2.06	2.81

Note. Total M = 2.85, SD = 1.23 Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely.*
[a] Coded as 1 = 1 course, 2 = 2 courses, 3 = 3 courses, and 4 = 4 or more courses

Table 4.19 shows the ANOVA summary for perceived usefulness of social media by the number of courses a teacher teaches. There was no significant difference in teachers perceived usefulness of social media based on the number of courses a teacher teaches, $F(3, 160) = 2.53$, $p = .06$, $\omega^2 = .03$, which is a low effect size.

Table 4.19

One-way Analysis of Variance Summary for Perceived Usefulness of Social Media by Number of Courses Taught [a] *(n = 164)*

Variable	*df*	*SS*	*MS*	*F*	*p*	ω^2
Between Groups	3	11.31	3.77	2.53	.06	.03
Within Groups	160	237.99	1.49			
Total	160	249.30				

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
[a] Coded as 1 = 1 course, 2 = 2 courses, 3 = 3 courses, and 4 = 4 or more courses
* *p* < .05

RO6

RO6 sought to describe the effects of age and gender on PUSM. Table 4.20 shows the descriptive statistics for PUSM by age groups of teachers. There was a trend of increasing mean scores on the PUSM as age increased, indicating a decreasing perceived usefulness of social media as age increases. The 29 years and under group (*n* = 56, M = 2.46, *SD* = 1.11) had the highest perceived usefulness of social media, as indicated by their low PUSM score, followed by the 30-39 age group (*n* = 49, *M* = 2.84, *SD* = 1.09). Although as a group the trend appeared to be generally linear, the 40-49 age group (*n* = 30, *M* = 3.39, *SD* = 1.57) had the least perceived usefulness of social media. The perceived usefulness increased slightly in the 50-59 age group (*n* = 22, *M* = 3.00, *SD* = .89), but then decreased in the 60 and over age group (*n* = 7, *M* = 3.21, *SD* = 1.24).

There was significant difference in perceived usefulness of social media between males (*n* = 56, *M* = 3.13, *SD* = 1.35) and females (*n* = 107, *M* = 2.71, *SD* = 1.16), *t*(161) =

2.03, $p = .04$, $r = .16$, which represents a small effect size. Where females had a lower

PUSM score, indicating a higher perceived usefulness.

Table 4.20

Descriptive Statistics for Perceived Usefulness of Social Media Use
Age Group (N = 164)

Variable	*n*	*M*	*SD*	SE	95% CI Lower	95% CI Upper
Age						
29 and under	56	2.46	1.11	.15	2.17	2.76
30-39	49	2.84	1.09	.16	2.53	2.53
40-49	30	3.39	1.57	.29	2.81	2.80
40-59	22	3.00	.89	.19	2.61	2.61
59-60	7	3.21	1.24	.64	1.65	1.65
Gender						
Male	56	3.13	1.35	.18	.01	.81
Female	107	2.71	1.60	.11	-.01	.83
Not Disclosed	1	2.67				

Note. Age Total *M* = 2.58, *SD* = 1.23. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.

Table 4.21 shows a significant linear trend for decreased perceived usefulness of

SM as indicated by increasing PUSM scores as age increases, $F(4, 159) = 3.24$, $p = .01$,

$\omega^2 = .05$, which is considered a small effect.

Table 4.21

One-way Analysis of Variance Summary for Perceived Usefulness of Social Media by Age (n = 164)

Variable	df	SS	MS	F	p	ω^2
Between Groups	4	18.83	4.71	3.24	.01*	.05
Within Groups	159	230.47	1.40			
Total	163	249.30				

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely.* Age coded as 1 = less than 29, 2 = 30 - 39, 3 = 40 - 49, 4 = 50 - 59, and 5 = 60 and over

* *p* < .05

Table 4.22 shows the post hoc comparison of age groups. The only groups that showed a significant difference were the 29 and under group compared to the 40-49 age group (*p* = <.01), where 29 and under had a higher perceived usefulness of social media than the 40-49 age group. All other groups had no significant difference.

Table 4.22

Perceived Usefulness of Social Media by Teacher Age Post Hoc Comparison ($N = 164$)

Groups	Mean Diff.	SE	p	95 % CI Lower	Upper
29 and under x 30-39	-.39	.23	.66	-1.05	.28
29 and under x 40-49	-.93	.27	<.01*	-1.71	.16
29 and under x 50-59	-.55	.30	.52	-1.40	.31
29 and under x 60 and over	-.75	.48	.72	-2.12	.61
30-39 x 40-49	-.54	.28	.41	-1.34	.24
30-39 x 50-59	-.16	.31	1.00	-1.04	.71
30-39 x 60 and over	-.37	.49	1.00	-1.75	1.01
40-49 x 50-59	.39	.34	.94	-.57	1.35
40-49 x 60 and over	-.18	.51	1.00	-1.25	1.62
50-59 x 60 and over	-.21	.52	1.00	-1.69	1.28

Note.

* $p < .05$

RO7

RO7 sought to describe the effects of teacher credentialing on degrees and PUSM.

Table 4.23 shows the descriptive statistics for credential type and highest degree held.

Teachers with a traditional credential had a lower perceived usefulness of social media ($n = 140$, $M = 2.88$, $SD = 1.28$) than teachers with an alternative credentialing path ($n = 24$, $M = 2.72$, $SD = .94$) as indicated by their higher score on the PUSM. Teachers with a bachelor's degree had a higher perceived usefulness of social media ($n = 81$, $M = 2.77$, $SD = 1.28$) than those with a master's and beyond ($n = 83$, $M = 2.94$, $SD = 1.20$).

Table 4.23

Descriptive Statistics for Perceived usefulness of Social Media use by Credential Type and Teacher Level of Education (N = 164)

Variable	N	M	SD
Credential Type			
Traditional	140	2.88	1.28
Alternative [a]	24	2.72	.94
Degree			
Bachelor's	81	2.77	1.28
Masters and beyond	83	2.94	1.20

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
[a] Includes alternative credential types of intern and designated subject, as well as other.
[b] Includes Masters and Doctoral degrees.

Table 4.24 shows the comparison of means for PUSM by credential type and highest degree held. There was no significant difference in PUSM between the credential types of traditional and alternative, $t(162) = .59$, $p = .56$, $r = .05$. There was also no significant difference between teachers who held a bachelor's degree versus those who had a masters or doctoral degree, $t(162) = -.87$, $p = .39$, $r = .03$.

Table 4.24

Perceived Usefulness of Social Media Comparison of Means by Degree and Credential Path (N = 164)

Variable	SE	t	df	p	95% CI Lower	Upper	r
Credential type[a]	.27	.59	162	.56	-.38	.70	.05
Degree[b]	.19	-.87	162	.39	-.55	.21	.03

Note.
[a] Coded as 1 = traditional, 2 = alternative - including intern, designated subject and other credit by exam. [b] 1 = traditional, 2 = alternative - including intern, designated subject and other credit by exam
* $p < .05$

RO8

RO 8 sought to examine the effects of geography and teaching assignment on PUSM. Table 4.25 shows the descriptive statistics for perceived usefulness of social media as they relate to forms of teacher isolation. Geographic location was investigated by teacher region. Superior region has the lowest perceived usefulness ($n = 18$, $M = 3.20$, $SD = .40$), as indicated by the highest PUSM score. Southern ($n = 21$, $M = 2.65$, $SD = .68$) and San Joaquin ($n = 66$, $M = 2.68$, $SD = 1.05$) had the high perceived usefulness of social media. Isolation relating to collaborative capability with another teacher on the same campus was investigated as no courses in isolation ($n = 21$), or one or more courses ($n = 138$). There was not a significant difference in perceived usefulness of social media between groups who identified themselves as teaching one or more courses in isolation ($n = 138$, $M = 2.80$, $SD = 1.24$) versus those that teach no courses in isolation ($n = 26$, $M = 3.21$, $SD = 1.23$), $t(162) = 1.21$, $p = .23$, $r = .09$.

Table 4.25

Descriptive Statistics for Perceived usefulness of Social Media use by Region[a] *and Teacher Isolation*[b] *(N = 164)*

Groups	n	*M*	SE	*SD*	95 % CI Lower	95 % CI Upper
Region						
Superior	18	3.20	.40	1.72	2.35	4.06
South Coast	13	3.06	.49	1.78	1.99	4.14
Central	35	3.03	.23	1.38	2.55	3.50
North Coast	11	2.87	.24	.82	2.33	3.42
San Joaquin	66	2.68	.13	1.05	2.42	2.94
Southern	21	2.65	.14	.68	2.34	2.96
Teacher isolation						
None	21	3.21	.24	1.23		
One or more	138	2.80	.10	1.24		

Note.
[a] Coded as 1 = Superior, 2 = North Coast, 3 = Central, 4 = San Joaquin, 5 = Southern, 6 = South Coast. [b] Coded as 1 = none, 2 = one or more course in isolation.

Table 4.26 shows perceived usefulness of social media by the regions in which teachers reside. There is no significant difference between in perceived usefulness by the regions in which teachers teach, $F(5, 158) = .75$, $p = .59$, $\omega^2 = .01$.

Table 4.26

One-way Analysis of Variance Summary for Perceived Usefulness of Social Media by Teacher Region [a] *(N = 164)*

Variable	*df*	*SS*	*MS*	*F*	*p*	ω^2
Between Groups	5	6.67	1.33	.75	.59	<.01
Within Groups	158	242.62	1.53			
Total	163	249.30				

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*.
[a] Coded as 1 = Superior, 2 = North Coast, 3 = Central, 4 = San Joaquin, 5 = Southern, 6 = South Coast
* *p* < .05

RO9

RO9 sought to predict PUSM based on variables of interest in this study. Table 4.27 shows the regression of PUSSPL, social media use, days of content specific professional learning, career stage, gender, degree, credential type, region, teaching assignment and number of courses taught on PUSM. The model showed a linear combination of professional learning attributes (r^2 = .25, $F(3,160)$ = 17.37, *p* = <.01) and teacher demographics and teaching assignment characteristics (r^2 = .35, $F(10,153)$ = 8.29, *p* = <.01). Professional learning attributes accounted for 25% of the variation in PUSM with a medium effect, and when the predictor of demographics and characteristics is added, 35% of the variation is explained by the model with a large effect. All predictors in Step 1 are significant, including PUSSPL (*t* = .62, *p* = <.01), social media use (*t* = -4.08, *p* = <.01), and content specific professional learning (*t* = -2.40, *p* = .01), indicating that perceived usefulness of social media increases (PUSM scores decrease)

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when PUSSPL increases, social media use increases as well as content specific professional learning days. Step 2 only had two significant predictors for teacher demographics, which included career stage ($t = 2.45$, $p = .02$) and teaching assignment ($t = 2.92$, $p = <.01$). This finding indicates that teachers' perceived usefulness of social media decreases (PUSM score decreases) as teachers move through career phases and when teachers are teaching courses outside of agriscience.

Table 4.27

Linear model of predictors of Perceived Usefulness of Social Media (PUSM)

Variables	R^2	R2 change	F	*p*	B	t	*p*	95% CI Lower	95% CI Upper
Step 1	.25	.23	17.37	<.01					
PUSSPL					.23	3.62	<.01*	.12	.36
Social media use[a]					<.01	-4.08	<.01*	< -.01	< -.01
Content specific PL[b]					-.03	-2.40	.02*	-.06	-.01
Step 2	.35	.31	8.28	<.01					
Career stage[c]					.20	2.45	.02*	.03	.37
Gender [d]					.10	.47	.64	-.31	.51
Degree [e]					.03	.16	.88	-.32	.40
Credential type[f]					-.21	-1.75	.08	-.45	.03
Teaching assignment[h]					-.38	2.92	<.01*	.12	.64
Region[g]					-.07	-1.11	.28	-.19	-.06
Number of courses[i]					-.13	-1.41	.15	-.30	.05
(Constant)[g]					2.97	8.77	<.01*	2.30	3.64

Note. Perceived usefulness instrument adapted with permission from the Perceived Usefulness scale by Davis (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. Six-point Likert-type scale, coded as 1 = *extremely likely*, 2 = *quite likely*, 3 = *slightly likely*, 4 = *neither likely or unlikely*, 5 = *slightly unlikely*, 6 = *quite unlikely*, 7 = *extremely unlikely*. PL = Professional learning.
[a] Reported in minutes per week, as a total for all platforms combined. [b] Reported as days in the last 12 months. [c] Based on years completed, coded as New = 1-3 years, Early Career = 4-10, Mid-Career = 11-16, Late Career = 17 and over. [d] Coded as 1 = Male, 2 = Female, 3 = Not disclosed. [e] 1 = Bachelor's, 2 = Master's and beyond. f 1 = Traditional, 2 = Intern, 3 = Designated Subject, 4 = Other. [g] Coded as 1 = Superior, 2 = North Coast, 3 = Central, 4 = San Joaquin, 5 = Southern, 6 = South Coast. [h] Characterized by one or more courses in the content area, coded as 1 = agriscience includes agriculture biology, chemistry, earth, general agriscience and pathway concentrators with science base including plant and animal science; 2 = includes all agriculture mechanics courses including welding, power mechanics, small engines; 3 = includes teachers with one or more sections from the agriscience and agriculture mechanics category; 4 = All other non-agriscience and agriculture mechanics including agriculture business, leadership, and floral design. [i] Coded as 1 = 1 course, 2 = 2 courses, 3 = 3 courses, and 4 = 4 or more courses.
* *p* <.05.

CHAPTER V

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Overview

This research sought to determine California high school agriculture teachers'
perceived usefulness of social media in their professional learning. A survey instrument
was used to gather data on teachers perceived usefulness of social media (PUSM) and
their school sponsored professional learning (PUSSPL), as well as their social media use
behaviors (EOTE) relating to their professional learning. This chapter discusses the
conclusions, implications and recommendations for each of the research objectives.

Professional social media use in California agriculture teachers is widespread,
with more than 98% of teachers in this study reporting using social media for
professional purposes. While the use is widespread, the frequency of engagement in
minutes per week, and combination of platforms used by each teacher had a wide range.
The standard deviations for minutes used per week were large, which indicates teachers
were engaged in professional social media use in a wide range of minutes per week.
Teachers primarily utilized the platforms of YouTube, Facebook, Pinterest and
Instagram. Their use averaged almost an hour per week for those that did use each of the
most popular networks, and on average teachers were engaging just over 2.5 hours per
week of professional social media use for all platforms combined. With several popular
social media platforms identified in this study, it substantiates the Trust et al. (2016)
recommendation to avoid focusing on specific platforms, as this data shows teachers
PLNs are multifaceted and unique to each individual. When working with teachers to

build and design their PLNs to include social media platforms, LEA's and professional learning program planners need to allow adults the autonomy to engage in ways that align their personal learning needs and preferences.

Many researchers agreed that professional learning is required to make significant changes in teaching, which in turn impacts student learning outcomes (Darling-Hammond et al., 2009; Guskey, 2002; Wilson & Berne, 1999). Teachers in this study attended nearly 30 days of professional learning each year, with an average of almost 12.5 of them being content related. Darling-Hammond et al. (2009) reported that nationally, 60% of teachers attended just 16 hours of content specific professional learning (Darling-Hammond et al., 2009). The above average number of content specific professional learning days California agriculture teachers attended may be attributed at least in part to requirements for professional learning which are tied to agriculture program funding structures in the state (Agriculture Career Technical Education Incentive Grant, n.d.).

Objectives of the study sought to identify relationships and explain the variance, as well as predict teachers perceived usefulness of social media in relation to independent variables of interest. The research objectives were:

RO1 Examine teachers' self-reported engagement in professional social media use.

RO2 Explain the variance of perceived usefulness of professional social media use and perceived usefulness of school sponsored professional learning.

RO3 Identify relationships relating to teachers perceived usefulness of social media use and other variables of interest.

RO4 Describe the effects of teacher career phase on PUSM compare to reported

professional social media use.

RO5 Describe the effects of teaching assignment on teachers' perceived

usefulness of social media.

RO6 Describe the effects of age and gender on teachers' perceived usefulness of

social media.

RO7 Describe the effects of teacher credentialing and degrees on teachers'

perceived usefulness of social media.

RO8 Examine the effects of geography and teaching assignment isolation on

teachers' perceived usefulness of social media.

RO9 Predict perceived usefulness of social media use in teachers based on

demographic and teaching assignment characteristics.

RO1

Conclusions for RO1: While early responders had a lower EOTE score than late

responders, indicating more behaviors relating to the use of social media as professional

learning, there was no significant difference in their social media use (in minutes per

week). As days to respond increased, early and late responders had a similar attitude

toward the usefulness of social media (PUSM and PUSSPL scores), but their behaviors of

actual use (EOTE) decreased, as indicated by increasing EOTE scores. This finding

suggests that while teachers who responded to the survey perceived social media to be

useful, those who were considered late responders exhibited fewer behaviors of

engagement in professional social media use.

Low scores on the EOTE scale indicate strong agreeance with items relating to behaviors of professional social media use. The Discovery and Experimenting elements had the highest level of agreeance, followed by Reflecting, Active and Passive Engagement, ending with Sharing. The low level of agreement on the Sharing subscale could be attributed to teachers comfort level with expressing feelings in public forums. This explanation is supported by high agreeance with the subscales of Discovering and Experimenting, as these interactions occur internally or offline.

Implications for RO1 On average, teachers agreed they engaged in reflection as a result of their online interactions; this finding is supportive of Trust et al. (2016). In the element of Passive Engagement, teachers were primarily searching for shared resources, although they still somewhat agreed they search for individuals to connect with professionally, supportive of Visser et al. (2014). In the area of the Experimenting element, teachers had high agreeance with behaviors relating to utilizing their online findings in their classroom, this finding is supportive of (Trust et al., 2016). Rentner et al. (2016) found teachers expressed a need for access to mentors to assist in exploring personal learning needs, as well as access to curriculum resources in a digital format. Most teachers agreed they discovered ideas, resources, individuals, strategies, curriculum and differing opinions as a result of their professional social media use, which was supportive of the Trust et al. (2016) and Visser et al. (2014) conclusions. Also, Davis (2015) and Krutka et al. (2016) noted exposure to new ideas as a benefit of teachers' engagement in PLNs. Exposure to innovations through PLNs allows innovations to diffuse (Rogers, 2003). On average, the Sharing construct had a neutral response, which was the lowest agreeance for all elements of the EOTE scale. This was also supportive of

the Lantz-Andersson et al. (2018) finding, where most teachers were considered lurkers, and made no contribution to the online platforms they engaged in. Sharing is not only an important reflection, but also a means by which innovations can be diffused (Rogers, 2003).

As a result of the factor loadings, the researcher proposes the exploration of a revised model of Elements of Online Teacher Engagement (Krutka et al., 2016), where the element of engagement is distinguished between active and passive. Items loading on the passive behavior factor were indicative of lurking as described by Lantz-Andersson et al. (2018). Lurking activities are difficult for researchers to observe because there is often no evidence of teachers searching for content or a catalog of what they have viewed. This can be compared to activities of active engagement where teachers are openly seeking resources or asking questions which can be identified through content analysis.

Recommendations for practitioners for RO1. On average, teachers have positive attitudes toward professional social media use for their professional learning. LEA's should consider their technology policies in relation to teachers' use of social media on their campus, and if not accessible from LEA-issued devices, consideration should be given to addressing the issue.

Recommendations for researchers for RO1. This study supports the validity of the Lindner et al. (2001) methods for addressing non-response error. When early versus late responders were compared as defined by Lindner et al. (2001), there was a significant difference determined by a t-test with $p = <.05$ when comparing scores on the EOTE scale as well as its individual subscales using the methods outlined in their Method 1. This was true for the method of comparing the last group to the prior groups, and when

the final two groups were compared to the first two groups. The first stimulus generated a larger response than subsequent groups, which made it was unclear if there were distinctive groups as described by Lindner et al. (2001); therefore the first 50% of respondents were compared to the last 50%. In this instance the EOTE summed score was significant ($p = <.05$) between early and late responders, but three of the six subscales were not significant ($p = >.05$). Method 2 suggests the days to respond to the instrument be regressed on the variable of interest. This method revealed a significant difference ($p = <.05$) with the EOTE summed score, and with all but one of the sub constructs. The data of this study is supportive of the Lindner et al. (2001) method to evaluate non-response error, as each of their methods was effective at detecting a significant difference between the groups.

Future researchers should explore the items on the EOTE scale. While factors were identified in this study, future researchers should randomize these items in their instrumentation to reduce possible error due to question order (Dillman et al., 2014). Studies with samples in a variety of populations with a large sample size to determine if the additional factor loading is actually a missing element from the Krutka et al. (2016) model (as suggested in Figure 5.1), or an anomaly of this population.

Based on the exploratory factor analysis, the element of Engagement was divided into Active Engagement and Passive Engagement. The addition of the Active-Engagement element was characterized by teachers' initiation of communication in the form of soliciting interaction from others. This is compared to Passive Engagement, where teachers were interacting with content others had initiated, sometimes in ways that can be witnessed by others, but often not. Instances where individuals are being exposed

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to others online interaction without taking a role in the form of liking, retweeting, commenting, pinning or other similar action are often referred to as lurking (Lantz-Andersson et al., 2018). Splitting these elements would allow for a more accurate appraisal of teachers' behaviors which often cannot be quantified because they are not documented in a way that a content analysis can be conducted at later date. Active Engagement; however, can be documented, as these behaviors include activities such as posts, likes, retweets. Provided the researcher is given appropriate permissions or the use of adequate algorithms, behaviors of Active Engagement can be identified.

While a factor loading of two items on the Active Engagement element may not be considered substantive enough to be considered their own factor, it does warrant further exploration. The author suggests the item *I ask questions and/or for advice* be split into two separate items. Additional items of *I ask for feedback*, *I ask for inspiration*, and *I ask for support* should also be included as items on the Active Engagement subconstruct.

Further research should be conducted to provide empirical evidence to support the validity of the model as well as the EOTE scale as a measure of PLN engagement behaviors. Additional populations should be sampled beyond agriculture teachers, to include other secondary career technical education teachers and other secondary core subject areas, to multiple subject and post-secondary teachers is suggested.
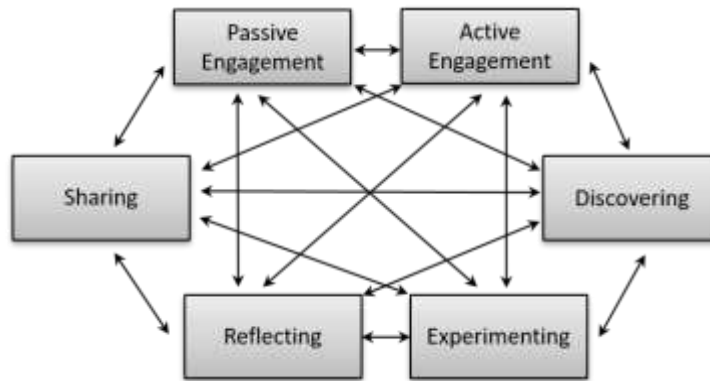
Figure 5.1 Elements of Online Teacher Engagement Model. Adapted from Krutka, D. G., Carpenter, J. P., & Trust, T. (2016). Elements of engagement: A model of teacher interactions via professional learning networks. *Journal of Digital Learning in Teacher Education, 32*(4), 150-158.

Further research should be conducted to explore the barriers and motivations to sharing behaviors, as reflection has the capacity to drive significant changes in teaching and subsequent student learning outcomes (Guskey, 2000; York-Barr et al., 2005). A case with a purposive sample of both male and female teachers who score low, medium and high on the EOTE construct of sharing would provide insight and inform future research relating to motivations and barriers to sharing online. Reflection is a personal act, which means individuals may not be sharing this process in open forums online. Further, to what extent might these reflections be happening with other elements of teachers' PLNs including non-public interaction with members of PLNs as well as at the site level through PLC's where groups are small, and teachers may feel more comfortable sharing their feelings?

RO2

Conclusions for RO2. School sponsored professional learning is not always connected to teachers professional learning objectives, whereas teachers' professional

interactions on social media are likely a direct result of teachers pursuing their own objectives. Because teachers were pursuing objectives which were relevant and timely, they perceive social media to be more useful than their LEA sponsored professional learning.

Implications for RO2. Based on the findings of Nussbaum-Beach and Ritter Hall (2012), Guskey (2000), and Trust et al. (2016), it is not surprising teachers regarded their professional social media use as more useful than their school sponsored professional learning. Professional development has traditionally been something LEA's do to teachers (Guskey, 2000). This is different than professional learning, where teachers are engaged in active construction of their learning and movement on their professional learning continuum. PLNs that include social media allow teachers to explore professional learning objectives on their own timeline. The nature of professional social media use aligns with the assumptions of andragogy (Birkenholz, 1999; Knowles et al., 2015), which is often disregarded by traditional school sponsored professional learning (Guskey, 2000). Teachers who go online to pursue professional learning demonstrate an implied readiness to learn, orientation to learning and motivation, as their actions are indicative of a self-directed learner. Further, professional learning through social media allows teachers the ability to pursue their own learning objectives based on their need with the autonomy to engage in the way they choose which honors their learning experiences as they see fit.

A teacher attitude of lifelong learning and continuous growth is necessary to continue to improve student learning, and in order for significant changes in teaching to occur (Guskey, 2000). Teachers were using social media for more than 2.5 hours per

week, in addition to their average of 12.5 days of content specific professional learning

per year. Teachers with strong PLNs could be pursuing specific learning goals over a

sustained time, that well exceeds the Darling-Hammond et al. (2009) recommendation of

50 hours of sustained professional learning to make a change to teaching and subsequent

student learning. PLNs offer teachers an avenue by which to pursue their professional

learning objectives on a flexible timeline, which also allows access to a variety of ideas,

resources and connections that are likely not available to teachers at their school sites

(Davis, 2015; Trust et al., 2016; Visser et al., 2014).

Recommendations for practitioners for RO2. Teachers reported connecting to

resources and engaging in reflection on their professional practice. Unfortunately, most

LEA's do not recognize the contributions of social media and PLNs as part of teachers

professional learning, despite a growing body of research that suggests positive outcomes

for student learning (Krutka et al., 2017). Even so, for those who lead teachers, it is

important to realize implementing required engagement in PLNs may not result in

widespread implementation, as the act of forcing social media on adults may have

adverse effects (Krutka et al., 2017). Other factors to consider relating to PLN

engagement relate to the Knowles et al. (2015) assumptions for andragogy. If these

assumptions are not met, the adult learner's ability to leverage social media in their PLN

may be limited. For example, if adult learners lack self-awareness to identify their areas

of need, they may be unable to determine an appropriate course of action to meet their

need, and without a feeling of need, motivation to pursue learning is diminished. In this

context, teachers may not identify appropriate social media platforms, groups, hashtags

and other tools. Therefore, in order to increase the incidence of adoption of the

innovation, several methods should be employed by the PL facilitators. Facilitators can work to support adoption by making explicit how building a PLN that includes social media can incrementally be implemented with concrete contexts related to a teacher's current situation (Guskey, 1986). This practice also supports the literature by Knowles et al. (2015) on adult learning, as it can help adults to connect with a felt need, and to see how the proposed change is more effective than their current practice.

Many LEAs may have technology policy's or other systems in place that prevent teachers from accessing social media during their scheduled work time on district owned devices (Rodesiler, 2017; Visser et al., 2014). LEAs should consider the systems they have in place that may be acting as barriers to teachers' professional social media use in the workplace, and how those barriers could be addressed (Rentner et al., 2016).

Recommendations for researchers for RO2: Although teachers perceived their school sponsored professional learning to be less useful than their professional social media use, it still is a positive relationship. This means teachers with a high perceived usefulness of social media also have a high perceived usefulness of school sponsored professional learning. Andragogy assumes adult learners are self-directed (Knowles et al., 2015). This research did not seek to identify teachers' motivation to learn. Further correlational survey research could determine to what extent relationships exist between motivation to learn and teachers perceived usefulness of social media and school sponsored professional learning through the use of the Davis (1989) perceived usefulness scales and the addition of a motivation to learn instrument.

RO3

  Conclusions for RO3. Teachers' perceived usefulness of professional social

media use was correlated to an increase in their professional social media use, increased

course load (number of courses taught), increased number of content specific professional

learning days, and lower EOTE scores, which indicated a greater level of implementation

behaviors relating to PLNs. As age and years of teaching increased, teachers perceived

usefulness of social media decreased, as did their use of social media for professional

purposes. The PUSM and EOTE constructs were significantly correlated. This

relationship can also be extended to include teachers' actual use of social media,

indicating that those that perceive social media to have high value also used the platforms

frequently and engaged in the behaviors reflective of the elements outlined by Krutka et

al. (2016) which included the elements of engagement, discovery, experimenting,

reflecting, and sharing.

  Other relationships relating to the intercorrelation of independent variables

revealed two major patterns. Facebook, Instagram, YouTube, and Pinterest showed the

greatest number of significant correlations, indicating individual teachers were utilizing

multiple social media platforms. The second pattern related to the negative correlation

between teaching agriculture mechanics and most other subjects. This relationship

indicates agriculture mechanics teachers are not typically teaching other agriculture

courses.

  Implications for RO3. While overcoming isolation is cited as a benefit of

professional social media use (Trust et al., 2016), teacher isolation had no correlation to

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variables of interest (PUSM, PUSSPL, EOTE or days of content specific professional learning) in this study.

The findings of Visser et al. (2014) and Wesely (2013) support the findings of this study, where teachers are engaged in a variety of platforms for a wide range of time each week. This study found that few teachers were using Twitter, which was supportive of the Visser et al. (2014) finding. However, those that do use Twitter highly value their interaction there (Davis, 2015). Twitter users may have specific patterns of learning objectives which drive them to use the platform. For example, Twitter users identify themselves as technology proficient (Visser et al., 2014), and actively seek technological innovations (Wesely, 2013). If teachers do not meet these criteria, they may not be interested in engagement on the platform of Twitter. Further, Visser et al. (2014) noted a theme of participatory culture, in which teachers were sharing and engaging in public ways. While the EOTE scale which measured behavior in this study is limited in its generalizability to the population, there may be evidence that the behaviors exhibited in this sample were not similar to the types of behaviors Visser et al. (2014) identified on Twitter, as the sub constructs of sharing and active engagement had higher scores indicating fewer use behaviors.

Recommendations for practitioners for RO3. Teachers are engaging in a variety of social media platforms. In the process of assisting teachers to build their PLN to include social media, LEA administrators and program planners should focus their initial efforts on promoting the exploration of the most popular platforms: Facebook, Pinterest, Instagram, Pinterest, and YouTube. Platforms like Twitter are often considered intimidating and confusing by teachers due to its fast pace (Davis, 2015). Given

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opportunity to explore with support from mentor teachers, new users may be able to build the necessary self-efficacy and familiarity to aid in adoption with the platforms that have been shown to have the highest use (Tucker, 2018; Wesely, 2013). In addition to the opportunity to explore social media platforms and their logistics, it is necessary for teachers to have opportunity to consider the content and social culture of these groups and how they align with their personal learning goals.

Recommendations for researchers for RO3. Although Trust et al. (2016) cautioned researchers from focusing on specific platforms, a content analysis of the social media platforms identified in this study with the highest and lowest correlation coefficients is necessary to identify patterns within platform features and types of interactions that occur there. Identifying these patterns could assist in providing suggestions to individuals based on their expressed needs and current level of engagement in their PLN. This approach could help to ensure teachers are exposed to content they perceive to be useful, and therefore persist in professional social media use (Davis, 1989; Rogers, 2003).

Although sampling error prevents the results of the EOTE variable from being generalized, the positive relationship between the EOTE and PUSM scores support the findings of Davis (1989), where individuals who perceive a technology innovation to be useful will continue to use it. The EOTE represents behaviors of use, when the EOTE score decreases there is a positive relationship, meaning the PUSM score also decreases, indicating a greater perceived usefulness of social media. A replication of this study design with larger samples in a variety of populations could provide insight into the

relationship and seek to explain the variance between perceived usefulness and behaviors relating to professional social media use in contexts that are generalizable.

RO4

  Conclusions for RO4. Age and years teaching were highly correlated. In general, new teachers are under 29, and have likely been accustomed to engaging in social media for some time, as this age group has the highest social media use and are considered to be the earliest adopters (Pew Research Center, 2018b). Although new teachers had the highest perceived usefulness of social media, early career and late career teachers had similar and slightly lower perceptions, and the middle career teachers had the lowest. Middle career teachers are likely to feel comfortable with their curriculum and have become proficient at classroom management and teaching strategies, which are many of the topics which are discussed and shared on social media. Not feeling a need for these resources could result in their lower perceived usefulness.

  Implications for RO4. Within teacher career phases there was a downward trend of social media use per week, which was characterized by a decreased perceived usefulness of social media use. This is in conflict with Trust et al. (2016) who, suggested that middle career teachers may be the most heavy users of social media.

  Recommendations for practitioners for RO4. Teacher educators and PL facilitators should identify opportunities for professionals to build and leverage social media for professional purposes, and more broadly their PLN. Teachers should be afforded opportunities to explore various platforms, and be given adequate opportunity to reflect on their potential benefit. Rogers (2003) and Nussbaum-Beach and Ritter Hall (2012) noted the need for personal connection to assist in the spread of ideas and

adoption of innovation. For this reason, teacher leaders can be used as mentors to help others navigate the process (Krutka et al., 2017). Additionally, administrators and teachers at all levels of social media use and PLN engagement should explore and reflect on their PLN with resources like PLN Enrichment Framework, which provides reflective questions in the area of people, spaces, and tools (Krutka et al., 2017).

Beyond giving teachers the opportunity to explore social media platforms to determine the best fit for their learning preferences, it may be beneficial to assist in identifying and helping teachers to see value in heterogenous interactions. Ranieri et al. (2012) found teachers in groups where there were no personal ties to other individuals in the group were more likely to try new ideas. At first glance, this finding appears to be in conflict with Rogers (2003). However, in the context of education, exposure to new ideas can occur in social media and social systems to support adoption of innovations may come from additional sources such as PLC's at the local level.

Recommendations for researchers for RO4. The discrepancy with the Trust et al. (2016) findings may at least be partially due the definition of middle career teachers. Middle career teachers in this study were defined as those who are in their 11-16 year of service. It is unknown how the definition used in this study aligns with the Trust et al. (2016) finding that middle career teachers would be the heaviest users of PLNs. Regardless, new teachers (1-3 years) clearly had the highest perceived usefulness and actual use of social media when compared to other groups. Additional studies with larger sample sizes in a variety of populations of teachers may provide more clarity into teacher use. Further, as professional social media use and the widespread use of PLNs has increased, past findings relating to usage by career stage may not be transferable to

current populations due to the increasing popularity of social media. Therefore, a longitudinal study could allow for the comparison of teachers' perceived usefulness of social media by career stage over the course of several years. A study of this nature would provide insight into whether the relationship between age and perceived usefulness of social media would change as current new teachers (the earliest adopters) with high perceived usefulness shift into early and mid-career phases, or if the high perceived usefulness in young teachers is a result of the prevalence of use in their age group.

RO5

Conclusions for RO5. Agriscience courses accounted for the majority of teachers' teaching assignments. Many of these teachers were teaching at least one course in isolation, meaning they were the sole teacher of that course on their campus. Even so, they showed no additional perceived usefulness of social media as a result of their isolation from possible collaboration partner(s) on their campus. While collaboration partners may be available on a school site, collegial relationships that enable collaboration may not be present. Further, even when relationships are workable, there may be barriers within the school system that prevent or provide limited opportunity for collaboration. Adequate time including appropriate duration and scheduling within the work day, is likely the largest barrier. Although most schools have dedicated PLC time each week, this is often limited to an hour, and several topics may occupy the agenda which prevent collaboration between teachers who teach the same content. Teachers perceive social media to be useful due to their ability to leverage their PLNs and engage in professional learning in ways that fit their personal learning objectives and not those

suggested or mandated by their LEA or other teachers within their PLC, on their own timeline regardless of availability of collaboration partners on their campus.

Implications for RO5. Teachers reported getting access to curriculum resources and teaching strategies through their use of social media (Davis, 2015; Trust et al., 2016). In this study, teaching assignment had a significant effect on perceived social media use. This may be related to specific needs and demands relating to teaching agriscience courses compared to agriculture mechanics and non-science-based agriculture courses. In consideration of the number of different courses a teacher teaches, there was no significant difference. This is likely an indication of teachers' perceived usefulness relating to the content of the courses, as opposed to the sheer number of courses. Further, this phenomenon may also be related to the traditionally male-dominated agriculture mechanics teaching assignments. As noted in other research objectives, males have a lower perceived usefulness of social media, and in this study, there was a higher frequency of males with teaching assignments that included agriculture mechanics.

Recommendations for practitioners for RO5: Teachers associations, mentors and other teacher leaders should work to identify relevant groups, individuals, hashtags, and Pinterest boards to suggest for individuals seeking to build their PLN through social media (Tucker, 2018). This is especially important because researchers like Xing and Gao (2018) found the types of discourse associated with online interaction determine whether teachers persist in engagement in the platform. Meaning, if teachers fail to see the need or connection to their current context, they will likely abandon the innovation, and "educators cannot benefit from a community if they leave it" (Xing & Gao, 2018, p. 395).

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Recommendations for researchers for RO5. An instrumentation similar to this study should be repeated to explore the interaction effect of gender on perceived usefulness of social media (outcome) for teaching assignments of agriculture teachers (predictor). A model of this nature could be useful in determining to what extent gender is a moderator for the outcome of perceived usefulness of social media.

RO6

Conclusions for RO6. In consideration of gender, there was a significantly higher perceived usefulness of social media by females. This finding is supportive of national general use statistics reported by the Pew Research Center (2018b). In reference to age, as age increases, the perceived usefulness of social media decreased, where those in the under 29 group had the highest perceived usefulness.

Implications for RO6. Although many teachers report social and emotional benefits of social media (Davis, 2015; Trust et al., 2016), this may not be equally true for both genders and could at least in part, account for the difference in the perceived usefulness by gender. The decreased perceived usefulness as a result of age may be due, at least partially, to social media use as a whole in the U.S., as the Pew Research Center (2018b) has identified a declining trend of use as age increases. Young people were the first to adopt the innovation of social media, and continue to be the heaviest users, although use in 30 years and older age groups continues to increase. Additionally, this may also relate to exposure to adopters of social media, access to adequate mentoring, as well as LEA attitudes toward professional social media use (Krutka et al., 2017).

Recommendations for practitioners for RO6. With a body of research to support the use of social media in professional learning, professional learning

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programmers and LEA administrators should use caution when mandating engagement in PLNs (Krutka et al., 2017). Learners must feel their own need (Knowles et al., 2015), and if forced to engage may reject the innovation altogether. Mentors should use the identified patterns relating to age and gender to anticipate possible objections to use based on those demographics and be prepared to offer alternatives or explanations to build or increase the usefulness of PLNs which include social media.

Recommendations for researchers for RO6. Males had a lower perceived usefulness of social media. Case studies focusing on a purposive sample of males and females of different levels of engagement with PLNs could provide valuable insight into the specifics of why males have lower perceived usefulness of social media. Identifying why this disparity occurs could assist practitioners in designing future professional learning programs as well as creating media plans for professional organizations which could address the findings and create appropriate content based on teachers' preferences.

RO7

Conclusions for RO7. Regardless of credential path and highest degree earned, there was no significant difference in teachers PUSM. This is an indication that with education beyond a bachelor's degree or a credential in agriculture, there was no additional perceived usefulness of social media.

Implications for RO7. In order to teach in the state, individuals must possess at least a bachelor's degree, regardless of credential path. The Pew Research Center (2018b) reported a high rate of use by those with some college and college degrees. Birkenholz (1999) suggested that with increased education, adults ask more questions and seek more

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opportunities to learn. While this may be true, in this study, there was no additional perceived usefulness of social media for those with a bachelor's versus a master's degree.

Recommendations for practitioners for RO7: Although this study provided evidence that new teachers had the highest social media use and perceived usefulness, it should be noted these teachers may need mentoring and opportunity to build their PLN just as much as other career stages (Krutka et al., 2017). The majority (85%) of teachers attained their credential through a traditional credential path. Assisting preservice teachers in building a strong PLN needs to be a part of their curricula. Supporting teachers in the process of building their PLN before they enter the teaching field could have substantial benefits for the teacher and their students.

Recommendations for researchers for RO7: Asking preservice teachers to critically reflect and build their PLN could result in greater perceived usefulness once preservice teachers enter the field. Reflective tools like the PLN Enrichment Framework, provide reflective questions in the area of people, spaces, and tools that may assist preservice teachers in identifying areas of improvement for their PLN (Krutka et al., 2017). A study with a quasi-experimental design would provide a more comprehensive explanation for teachers' perceived usefulness of social media in their professional learning. This study should utilize the Krutka et al. (2017) framework to test the use of the tool for the purpose of building and reflecting on PLNs for preservice teachers. A study of this design could allow for a pre and posttest of perceived usefulness of social media prior to instruction, and then later after teachers have completed their first year of teaching.

RO8

   Conclusions for RO8. Isolation was explored from two views in this study. Geographic location was found to have no effect on teachers perceived usefulness of social media, as was isolation from possible collaboration partners in the form of another teacher on their campus teaching the same course. While being isolated may entice teachers to be slightly more frequent users of social media, it did not increase their perceived usefulness.

   Implications for RO8. Overcoming isolation is frequently cited as a benefit of engaging in PLNs (Trust et al., 2016), but was not found to increase perceived usefulness of social media. This may indicate the isolation Trust et al. (2016) identified was related to social forms of isolation as opposed to geography and the availability of a teaching partner to collaborate with. This finding is also supported by Wesely (2013), as teachers can experience isolation regardless of the availability of a collaborative partner, as availability does not always translate to willingness.

   Recommendations for practitioners for RO8. Causes of teachers' feelings of isolation may yet to be documented, but what is known is that teachers are using social media to overcome their isolation (Trust, 2012), wherever those feelings stem from. Fostering the development of a PLN including social media, which assists teachers in meeting their emotional needs as well as gaining content support is likely to have positive outcomes for the teacher.

   Recommendations for researchers for RO8. Literature identified overcoming isolation as a benefit to social media use by teachers (Ranieri et al., 2012; Trust et al., 2016). Case studies are necessary to investigate the source of teacher's feelings of

isolation, and how social media is helping them to overcome those feelings. A purposive sample of teachers who use social media, representing a variety of possible forms of isolation including the absence of collaboration partners and rural schools may provide further insight. These findings could also address the low engagement with the Sharing sub construct of the EOTE scale.

RO 9

Conclusions for RO9. The biggest predictors for perceived social media use related to teachers attitudes toward professional learning, where those with the highest attitudes toward school sponsored professional learning, attend the most content specific professional learning, and use social media the most, are those who are predicted to have the highest perceived usefulness of social media use. These variables are all connected to teachers attitude toward their professional learning, and are demonstrated by their increased participation in days of professional learning and minutes of social media use. Only a small portion of the variance in the model could be explained by a limited number of demographic variables, teaching assignment and career stage. Those who teach one or more agriscience course are likely to need the most support from their PLN, as the demands of rigorous instruction in agriscience courses is a need for all who teach these courses, regardless of age or career stage. Many California agriscience courses are university approved for laboratory science credit, therefore, these courses must meet Next Generation Science Standards as well as Career Technical Education (CTE) standards for the state. Only a limited number of agriculture mechanics courses in the state are approved for university entrance credit, and those that are, are given Elective credit. In agriculture mechanics courses, there is not the added demand of meeting science

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standards in addition to CTE standards, and therefore these teachers may feel less of a need to engage in social media for professional purposes.

In relation to the second demographic predictor, career stage, new teachers have limited teaching resources and skills; therefore, they perceive social media to be useful in their professional learning. Further, they are also more accustomed to using social media due to their age group.

Implications for RO9. While there was a significant difference in teachers PUSM and PUSSPL, the relationship was still positive, meaning those who perceived social media to be useful also perceived school sponsored professional learning to be useful, just to a lesser extent. Knowles et al. (2015) proports that adults' orientation to learning is related to their life experiences, which necessitate their learning. Further, adults are motivated when they feel personal need to solve their problems. Guskey (2000) reported teachers need continuous engagement in professional learning to keep current with emerging research discoveries. The findings of this study support the samples commitment to life-long learning, where their social media use has become a regular part of their professional learning routine. Block 1 of the model in this study combined variables relating to teachers' attitude (PUSSPL) and behaviors (days of content specific professional learning and social media use) relating to their professional learning. These variables were the biggest predictors in the model and are supported by the assumptions of andragogy (Knowles et al., 2015).

Recommendations for practitioners for RO9. Based on the findings of this objective teacher educators, professional learning programmers and LEA administrators should consider avenues to encourage teachers' positive views toward their professional

learning including a greater feeling of internal locus to control. Positive views toward professional learning could increase teachers' attendance at content specific professional learning as well as increase the amount of professional social media use. Combined these behaviors can allow teachers to meet their self-identified learning objectives, which aligns well with Knowles et al.'s (2015) recommendations for adult learners.

Recommendations for researchers from for RO9. Researchers should examine additional populations of secondary single subject teachers with the EOTE scale, PUSM, and PUSSPL scales in addition to a scale that quantifies individuals' attitudes toward professional learning. A study of this nature would substantiate the findings in this study relating to teachers attitudes toward professional learning being the biggest predictor of their perceived usefulness of social media.

Future Research

Further research is necessary to continue to work toward bridging the qualitative and quantitative findings of teachers complex online interaction. professional learning is a cognitive and emotional processes, which is a result of individual and collaborative interactions (Avalos, 2011; Guskey, 2000). Professional learning through social media is no different. These processes are both internal and external; therefore, difficult to explain the complexity of teachers' interaction with their PLN and their resulting professional learning. Teacher educators, professional learning programmers, and LEA administrators would benefit from a growing body of literature surrounding teachers' unique and individual interactions in their PLNs which include social media.

Qualitative and quantitative research methodologies each have strengths and limitations so, a mixed method study design would allow for a more dynamic and robust

understanding of teachers perceived usefulness of social media while working to compensate for the inherent limitations in qualitative and quantitative research designs (Creswell & Creswell, 2017; Fraenkel et al., 2012). Thoughtful and thorough analysis of both qualitative and quantitative data is necessary to triangulate attitudes, use and behaviors responsible for teachers perceived usefulness of social media. Although technology may be able to identify and measure metrics related to time or content of pubic postings, it is limited in its ability to express the interpersonal nature of PLNs, and the engagement of teachers with several platforms. Further, interactions that happen in closed groups may not be accessible to researchers for analysis. Behaviors of self-reflection and changed attitudes, may not be measured accurately with technology or with survey research due to its inherent limitations with self-reporting (Fraenkel et al., 2012).

A convergent mixed method, also known as triangulation design (Creswell & Creswell, 2017; Fraenkel et al., 2012) would continue to build on the qualitative findings of Trust et al. (2016), and the quantitative findings of this study. This design would allow for the researcher to further explain relationships as well as substantiate identified relationships between variables (Fraenkel et al., 2012). The EOTE instrument utilized in this study was designed as a result of qualitative research findings by Trust et al. (2016), and the resulting model created by Krutka et al. (2016). To continue to build upon the literature, a quasi-experimental design is the next logical step. However, the experimental design is limited in its ability to clarify and explain relationships in this context, as most of the phenomenon which occurs with teachers' social media use behaviors occurs internally. Mixed methods would allow the opportunity to cross validate findings which occur as a result of the qualitative and quantitative research portions of the study.

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This study found new teachers have the highest perceived usefulness of social media and social media use per week. Even so, Krutka et al. (2017) cautioned against generalizing that young teachers are without need of mentorship relating to building their PLN. The objective of the future study should be to determine if there was a significant difference in first year teachers' perceived usefulness of social media in their professional learning compared to a control group who had not participated in a PLN building module as preservice teachers. The purpose of that study would be to examine first year teachers change in perceived usefulness of social media when PLN building curriculum is taught in their preservice teacher preparation programs. This line of inquiry could inform future efforts relating to curriculum and training material development relating to building teachers' PLNs. Opening this study to include secondary teachers beyond the single subject credential type of agriculture allows for larger samples sizes, as California only has five university programs to prepare agriculture teachers. Beyond this, expanding to allow additional preservice teachers of other subject areas would allow for comparison to agriculture teachers to see if differences exist in teachers perceived usefulness between single subject content areas.

A matching-only quasi experimental design would be the most feasible, as assigning individuals to treatment and control groups at random would be difficult, whereas assigning Universities to treatment and control groups would be practical. The study should include at least 10 groups, five for control and five for experimental, each of which would be randomly assigned (Fraenkel et al., 2012). The control and treatment groups should have at least 30 members in each, doing so would allow for increased

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statistical power, as well as account for the threat of mortality to internal validity (Field, 2013; Fraenkel et al., 2012).

As a first step in the research process the Krutka et al. (2017) framework should be used to create an instructional module with the learning objective of preservice teachers reflecting on, and creating a plan for building their PLN to include social media. In addition to the EOTE, PUSM, and PUSSPL, participants would be asked for free responses relating to items of the afore mentioned constructs. Researchers would also conduct a content review of individuals public postings on the social media platforms they identify using. These interactions would be coded, and then analyzed for themes. Study participants, both in the control and treatment groups would be given a pretest to identify demographics and their behaviors using the EOTE, as well as the PUSM. Because preservice teachers have not participated in school sponsored learning, this scale would not be administered as part of the pretest. Following the pretest, the control group would participate in a PLN building module. At the conclusion of both groups first year teaching, they would be asked to complete the posttest instrument which includes demographics the EOTE, PUSM, and PUSSPL. Researchers would also conduct a follow up review of public postings on social media platforms identified on the teachers' posttest. Qualitative data should be reviewed, coded and then after careful review the researchers should identify themes (Creswell & Creswell, 2017; Fraenkel et al., 2012). Quantitative data should be analyzed with descriptive and inferential statistics which identify relationships and explain the variance in perceived usefulness in reference to treatment and control, gender, age, university, credential subject area, geographic region, and isolation of collaborative partners. A one way repeated measures ANOVA would

allow for the treatment and control groups to be compared on their change in perceived usefulness of social media on the variables previously discussed at the conclusion of their first year teaching (Field, 2013). The qualitative and quantitative data should then be analyzed to identify patterns and themes.

The results of the research described in this section would provide valuable insight into the utility of providing instruction on PLN development with preservice teachers, which may be testable with additional populations including practicing teachers participating in conference workshops or through LEA sponsored professional learning at the site level. While the research described here would be a valuable addition to the *Journal of Agricultural Education*, because of its sample of teachers including all secondary subject areas this research may also be appropriate for publication in a variety of other journals which have a body of related research including *Computers in Education, Journal of Research on Technology in Education, Journal of Digital Learning in Teacher Education* and *Tech Trends.* Beyond publication in research journals, the teaching module created for this research could be distributed to professors of secondary credential programs and shared online through PLN connections of the researchers. Due to the labor intensive nature of mixed methods research, a team of researchers who each offer an area of expertise to the objectives is recommended (Fraenkel et al., 2012). Funding for this research would need to account for a variety of processes and tasks. First, the cost and time involved with writing a teaching module. Costs of hosting an online survey would be low, however time would need to be dedicated for creating and managing the survey administration windows and procedures that adhere to IRB guidelines, as participants would be students in University courses during the time of

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pretest and module instruction. Further budgetary considerations would include the labor involved with maintaining a contact list with participants through their first-year teaching, and the tasks involved in setting up and following up on the posttest administration. Considerable time would be required to analyze the quantitative and qualitative data, including collaboration of researchers as they combine and interpret the results (Fraenkel et al., 2012).

Summary

Social media use is prevalent in California secondary agriculture teachers. Individuals engage in a variety of networks for a wide range of minutes each week. New teachers have the highest perceived usefulness of social media and were the heaviest users in minutes per week, these trends declined with additional years teaching. Other predictors of perceived usefulness of professional social media use related to teachers' positive attitudes toward their professional learning, as those with high perceived usefulness of social media also had high perceptions of their school sponsored professional learning and participated in a greater number of days of content specific professional learning, indicative of a preference for life-long learning.

The results of this study provide valuable data to substantiate the need for teacher preparation programs to examine the methods by which they prepare their student teachers for self-directed learning in their early career. Further, this research can inform teachers associations and professional learning programmers of trends and relevant attitudes of teachers which could be used to consider the options and opportunities to explore professional learning that aligns with teachers' professional use of social media.

These findings are supported by andragogical principles, where professional social media use allows teachers to explore their personal learning objectives with the autonomy that is often lacking from school sponsored professional learning. With lower perceived usefulness of school sponsored professional learning, LEA's should consider the methods by which they are engaging teachers in professional learning, and to what extent the assumptions of andragogy may be violated (Knowles et al., 2015). Further, while the EOTE construct of this study had threats to external validity that warrant caution when generalizing, it did have high reliability within its subscales and provided insights into the sample's behaviors. The findings of the EOTE encourage additional study to explore how teachers are interacting with social media as part of their PLN.

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APPENDIX A

COMPLETE QUALTRICS INSTRUMENT

**AGRICULTURE
& LIFE SCIENCES**
TEXAS A&M UNIVERSITY

English ▼

Informed Consent

Thank you for your interest in taking the survey!

The purpose of this survey is to gain an understanding of California Agriculture teachers' professional learning attitudes and engagement which occurs at their school site as well as with online interactions.

I hope you will take a moment to complete the survey. If you choose to participate, it will only take about 15 minutes of your time. Those who complete the survey will be entered into a drawing for a $50 gift card.

Thank you,
Nicole Ray

Demographics

Which region do you currently teach in?

Superior
North Coast
Central
San Joaquin
South Coast
Southern

Which best describes your path to teacher credentialing?

Traditional
Alternative - Teacher intern

How many years have you <u>completed</u> as a teacher? *First year teachers answer 0.*

[⬍]

How old are you?

[⬍]

What is the highest degree you have earned?

Bachelor's Degree

Master's Degree

Doctoral Degree

Which best describe your current teaching assignment? *Select all that apply.*

Agriscience: non-biology or chemistry

Agriculture biology

Agriculture chemistry

Plant science

Animal science

Agriculture mechanics

Natural resources

Agriculture business

Agriculture leadership

[   ] Other

On your campus, are you the only teacher for any specific courses? *For Example, are you the only teacher on your campus that teaches Botany?*

No

Yes

Which courses are you the sole teacher for on your campus? *Select all that apply.*

Agriscience: non-biology or chemistry

Agriculture biology

Agriculture chemistry

Plant science

Animal science

Agriculture mechanics

Natural resources

Agriculture business

Agriculture leadership

[_____] Other

Professional learning related to your content area:

In the last 12 months, how many day(s) of professional development have you attended which **are** related to your content area?

[_____ ⇕]

Professional learning related to your content area:

Of the content area professional development days related to your content, how many do you consider **mandatory** by your school site?

[_____ ⇕]

Professional learning NOT related to your content area:

On your campus, how many professional development day(s) have you completed in the last 12 months which are not directly related to your content area?

[_____ ⇕]

Professional Social Media Use (in minutes per week)

Adjust the slider to indicate the approximate number of minutes per week you utilize each social media platform for purposes relating to your professional learning.

For those platforms which you do not use, adjust slider to the 0 position.

0   21   42   63   84   105   126   147   168   189   210   231   252   273   294   315

Google +

Facebook

LinkedIn

Pinterest

```
        0   21  42  63  84  105 126 147 168 189 210 231 252 273 294 315
```

Instagram

YouTube

Snapchat

Other

[   ]

Other

[   ]

Perceived Usefulness

Identify your attitudes toward professional social media use below. Consider the use of any social media platform (including but not limited to *Facebook, Twitter, Pinterest, Google+, LinkedIn, YouTube, Snapchat, etc.*) for the purpose of your professional learning and collaboration.

Using social media professionally...

	Extremely likely	Quite likely	Slightly likely	Neither likely nor unlikely	Slightly unlikely	Quite unlikely	Extremely unlikely
improves my effectiveness as a teacher.	○	○	○	○	○	○	○
improves my ability to prepare and deliver high quality instruction for my students.	○	○	○	○	○	○	○
results in significant changes to my teaching.	○	○	○	○	○	○	○
results in improved learning outcomes for my students.	○	○	○	○	○	○	○
enhances my effectiveness as a teacher.	○	○	○	○	○	○	○

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	Extremely likely	Quite likely	Slightly likely	Neither likely nor unlikely	Slightly unlikely	Quite unlikely	Extremely unlikely
makes it easier to perform my duties as a teacher.	○	○	○	○	○	○	○
	Extremely likely	Quite likely	Slightly likely	Neither likely nor unlikely	Slightly unlikely	Quite unlikely	Extremely unlikely

Identify your attitudes toward school sponsored professional learning. These include events or experiences required by your district or site in the form of workshops, training, and mandated collaborations with grade level or content area or other arrangement.

Mandatory school sponsored professional learning ...

	Extremely likely	Quite likely	Slightly likely	Neither likely nor unlikely	Slightly unlikely	Quite unlikely	Extremely unlikely
improves my effectiveness as a teacher.	○	○	○	○	○	○	○
improves my ability to prepare and deliver high quality instruction for my students.	○	○	○	○	○	○	○
results in significant changes to my teaching.	○	○	○	○	○	○	○
results in improved learning outcomes for my students.	○	○	○	○	○	○	○
enhances my effectiveness as a teacher.	○	○	○	○	○	○	○
makes it easier to perform my duties as a teacher.	○	○	○	○	○	○	○
	Extremely likely	Quite likely	Slightly likely	Neither likely nor unlikely	Slightly unlikely	Quite unlikely	Extremely unlikely

Social Media Engagement

Directions: In this section you will be asked to consider your social media use for professional purposes, and then respond to statements about your professional learning and teaching.

What is professional use of social media? Professional use relates to interactions and resources you search and find in the form of groups, chats, and other that enhance your ability to positively impact student learning.

What is social media? Any major social media platform including but not limited to *Pinterest, Facebook, YouTube, Google +, Snapchat, Twitter, etc.* You do not need to specify any specific social media platform. Your responses will be a combination of all the platforms you use.

When I use social media for professional purposes

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I respond to others posts with text and/or links to discuss my past experiences.	O	O	O	O	O	O	O
I reflect on my experiences relating to ideas I found on social media.	O	O	O	O	O	O	O
I spend time thinking about the teaching resources I am currently using.	O	O	O	O	O	O	O
I reflecting on how I can become a more effective teacher.	O	O	O	O	O	O	O
I post ,tweet, share about my personal experiences relating to teaching.	O	O	O	O	O	O	O

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

When I use social media for professional purposes

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I ask questions and/or for advice.	○	○	○	○	○	○	○
I ask for resources.	○	○	○	○	○	○	○
I interact with things others have posted by using features such as liking, pinning, sharing, retweeting.	○	○	○	○	○	○	○
I search for resources I need by looking in group's shared folders and drives.	○	○	○	○	○	○	○
I search for resources I need by searching hashtags or key term searches within the social media platform.	○	○	○	○	○	○	○
I search for people and/or groups I would like to connect with.	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

When I use social media for professional purposes

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

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	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I get exposed to new ideas I didn't specifically go searching for.	○	○	○	○	○	○	○
I discover new teaching resources I had not intentionally set out to find.	○	○	○	○	○	○	○
I connect to individuals I might not have otherwise connected with.	○	○	○	○	○	○	○
I get connected to new teaching strategies I had not intentionally set out to find.	○	○	○	○	○	○	○
I learn about new technologies and digital tools even though I wasn't searching for them.	○	○	○	○	○	○	○
I become more aware of opinions and perspectives which are different than my own.	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

When I use social media for professional purposes

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I make changes to how I teach my curriculum.	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I experiment with new curriculum resources.	○	○	○	○	○	○	○
I experiment with new teaching strategies in my classroom.	○	○	○	○	○	○	○
I experiment with new approaches to teach my students.	○	○	○	○	○	○	○
I test ideas other teachers have suggested.	○	○	○	○	○	○	○
I make changes to my teaching practices.	○	○	○	○	○	○	○
	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

When I use social media for professional purposes

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I share ideas online.	○	○	○	○	○	○	○
I share resources online.	○	○	○	○	○	○	○
I connect other teachers to resources. For example, tagging them or mentioning them in posts or retweets or sending them direct messages.	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
I share my opinion online.	○	○	○	○	○	○	○
I share my feelings online.	○	○	○	○	○	○	○
	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Powered by Qualtrics

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Survey Participation Request

Hello,
Professional learning plays an important role in teachers' growth. As the internet has become widely available, some teachers are connecting with other educators beyond their school sites.

This email is a request to complete a short online survey about your attitudes toward formal and informal professional learning. You have been selected for this survey because you are a secondary agriculture teacher in California.

Your opinions about your professional learning are important. Even if you don't use social media to connect with other teachers online, it is still important we hear from you. This research project will provide important information about teachers' attitudes toward professional learning, both on and offline. The results of this survey could be used to assist with teacher preparation, as well as to provide teachers with professional learning opportunities which hold greater value. Participants will be entered into a drawing for a $50 gift card.

If you choose to participate you will receive a link later in the week.

Thank you,
Nicole Ray

Email reminder 1

Hello,

Please take moment to complete the survey on your attitudes toward professional learning. Your responses will play an important role in how informal professional learning, both on and offline, can be refined and supported by teachers' associations and other organizations to best meet your needs and preferences. Participants will be entered into a drawing for a $50 gift card.

Information Sheet <hyperlinked text>

How to get to the survey:
Option 1: Click the hyperlink <hyperlinked text>
Option 2: Or copy and paste the URL below into your internet browser:
<URL>

Thank you,
Nicole Ray

Email reminder 2

Hello teachers,
If you have already completed the survey you can disregard this email.

There is a limited sample size in this study, your responses will help to ensure the most accurate results. Your input may help to guide teacher preparation programs in assisting students in developing professional learning networks and structures which may help them to transition and be successful in their teaching career. Additionally, current teachers may benefit from the results of this study as those who plan professional learning opportunities can work toward meeting your preferences and needs. Participants will be entered into a drawing for a $50 gift card.

Please note the research window for this study is ending soon.

Information Sheet <hyperlinked text>

How to get to the survey:
Option 1: Click the hyperlink <hyperlinked text>
Option 2: Or copy and paste the URL below into your internet browser:
<URL>

Thank you,
Nicole Ray

Email reminder 3

Hello teachers,
If you have already completed the survey you can disregard this email.

Please note the research window is ending soon. Please take a moment to voice your opinion if you haven't already done so. Participants will be entered into a drawing for a $50 gift card.

Information Sheet <hyperlinked text>

How to get to the survey:
Option 1: Click the hyperlink <hyperlinked text>
Option 2: Or copy and paste the URL below into your internet browser:
<URL>

Thank you,
Nicole Ray

APPENDIX C

IRB APPROVAL PART ONE TAMU

DIVISION OF RESEARCH

TEXAS A&M
UNIVERSITY

EXEMPTION DETERMINATION

December 07, 2018

Type of Review:	Initial Review
Title:	Pin It, Share It, Like It, Retweet It: California Agriculture Teachers Perceived Usefulness of Social Media in their Professional Learning
Investigator:	Robert Strong Jr, PhD
IRB ID:	IRB2018-1367M
Reference Number:	084625
Documents Reviewed:	IRB Application Version 1.1; Information Sheet Version 1.0; Survey Version 1.0; Recruitment Email and Reminder Emails Version 1.0

Dear Robert Strong Jr, PhD:

The HRPP determined on 12/07/2018 that this research meets the criteria for Exemption in accordance with 45 CFR 46.101(b) under Category 2: Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior unless: the information is recorded in an identifiable manner and any disclosure of the subjects' responses outside of research could reasonably place the subject at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation.

This determination applies only to the activities described in this IRB submission and does not apply should any changes be made. If changes are made you must immediately contact the IRB. You may be required to submit a new request to the IRB.

Your exemption is good for five (5) years from the Approval Start Date. At that time, you must contact the IRB with your intent to close the study or request a new determination.

If you have any questions, please contact the IRB Administrative Office at 1-979-458-4067, toll free at 1-855-795-8636.

Sincerely,
IRB Administration

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APPENDIX D

IRB APPROVAL PART TWO TAMU

TEXAS A&M UNIVERSITY HUMAN RESEARCH PROTECTION PROGRAM

Title of Research Study: "Pin It, Share It, Like It, Retweet It: California Agriculture Teachers Perceived Usefulness of Social Media in their Professional Learning."

Investigator: Dr. Robert Strong and F. Nicole Ray

Funded/Supported By: This research is funded/supported by Texas A&M University.

Why are you being invited to take part in a research study?
You are being asked to participate because you are a high school agriculture teacher in California.

What should you know about a research study?
- This study will use a survey to examine your attitudes toward professional learning conducted by your school and your professional social media use attitudes and frequency of use.
- Whether or not you take part is up to you.
- You can choose not to take part.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Who can I talk to?
If you have questions, concerns, or complaints, or think the research has hurt you, talk to the researcher F. Nicole Ray nray@tamu.edu or by phone at (559) 901-8516. You may also contact the Human Research Protection Program at Texas A&M University (which is the group of people who review the research and protect your rights) by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu if

- You cannot reach the research team.
- Your questions, concerns, or complaints are not being answered by the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Why is this research being done?
Your opinions are important, as are your reported professional social media use. Even if don't use social media to connect with other teachers, it is still important we hear from you. The results of this study may be useful for teacher preparation programs to examine methods to prepare their student teachers for ongoing professional learning once they enter the career, as well as useful to practicing teachers of all subjects in the way that the findings can help professional learning planners to explore ways to provide teachers greater options and opportunities to explore their individual learning goals via professional use of social media.

How long will the research last?
The survey will be completed online on the device of your choice, and should take around 15 minutes to complete.

IRB NUMBER: IRB2018-1367M
IRB APPROVAL DATE: 12/07/2018

What happens if I say "Yes, I want to be in this research"?

In this study you will be asked to complete an online survey relating to your agreeance or disagreement to statements relating to formal and informal professional learning. You will also be asked how frequently or infrequently you engage in professional social media use. The survey should take less than 15 minutes to complete.

What happens if I say "Yes", but I change my mind later?

You can leave the research at any time before you submit your responses to the survey by closing the survey. Leaving will not be held against you. Once your responses are submitted you can no longer withdrawal from the survey, however no identifiable data will be collected.

What happens to the information collected for the research?

Efforts will be made to limit the use and disclosure of your personal information, including research study and other records, to people who have a need to review this information. We cannot promise complete privacy. Organizations that may inspect and copy your information include the TAMU HRPP/IRB and other representatives of this institution.

What else do I need to know?

Participants will be entered into a drawing for a $50 Gift Card. If your name is drawn, you will be notified by email.

APPENDIX E

IRB APPROVAL TTU

TEXAS TECH UNIVERSITY
Human Research
Protection Program

Jan 31, 2019 12:26 PM CST

Courtney Meyers
Ag Education and Communication

Re: IRB2018-1194 Dissertation - Perceived Usefulness of Social Media in Professional Learning Networks

Findings: *The UT Reciprocity Agreement has been fully executed.*

Dear Dr. Courtney Meyers, Frances Ray:

A Texas Tech University IRB reviewer has approved the proposal referenced above for an Institutional Authorization Agreement (IAA). The IAA has been fully executed and the investigators are now authorized to engage in research as outlined in the approved protocol. The IAA is effective beginning January 23, 2019.

Please notify the IRB of record and Texas Tech of any reportable events, modifications, renewals, and closures. Any change to your protocol requires a Modification Submission to the IRB of record for review and approval prior to implementation. Then submit a modification in Cayuse IRB to Texas Tech and attach the approved modification letter. Should a subject be harmed or a deviation occur from either the approved protocol or federal regulations (45 CFR 46), please complete an Incident Submission form at Texas Tech and contact the IRB of record. Once your research is completed, please use a Closure Submission to terminate this protocol at Texas Tech.

Your study may be selected for a Post-Approval Review (PAR). A PAR investigator may contact you to observe your data collection procedures, including the consent process. You will be notified if your study has been chosen for a PAR.

Sincerely,

Scott Burris, Ph.D.
Chair Texas Tech University Institutional Review Board
Professor, Department of Agricultural Education and Communications
Human Research Protection Program
357 Administration Building
Lubbock, Texas 79409-1075
T 806.742.2064
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