The Relationship between Teachers' Technology Integration and Entrepreneurial Intention

By

Tammy Estes Fry
Certification Instructional Design, University of Kansas, 2017
M.A., Pittsburg State University, 1985
B.Sc., Pittsburg State University, 1983

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Chair: Dr. Ron Aust

Dr. Young-Jin Lee

Dr. Yong Zhao

Dr. Robert Isaacson

Dr. Bruce Frey

Dr. Sally Roberts

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The dissertation committee for Tammy Estes Fry certifies that this is the approved version of the following dissertation:

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Chair: Dr. Ron Aust

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Abstract

In order to embrace the character of 21st century classrooms, teachers should model critical thinking, design thinking, and ultimately entrepreneurial thinking for students. Teachers who effectively integrate digital tools into their instructional practices at higher levels of technology integration not only promote this type of thinking but also become role models as entrepreneurial thinkers.

Lambert and Cuper (2008) establish that more professional development is needed to prepare practicing teachers as well as pre-service teacher candidates to modernize their practice, to integrate digital tools at higher levels for their teaching activities, and to quantify their own learning. This practice makes teachers more entrepreneurial in mindset and practice. Icek Ajzen (1991) in accordance with his Theory of Planned Behavior, contends that entrepreneurial actions are intentional, and several other researchers have included this concept when analyzing the characteristics of an entrepreneur. Accordingly, with the fairly new development of the term, “teacherpreneur”, there is a prominent focus on teachers and their influence in entrepreneurial practice (Berry, 2013).

Study participants were preK-12 teachers with a mean age of 46.7 years. The 43 male and 168 female participants, ranging in experience and their teaching level, responded to a four-part Likert scale survey. The survey included items adapted from Magana’s (2017) T3 Technology Integration Framework, items listed as agreed-upon entrepreneurial characteristics, items adapted from Liñán and Chen’s (2006) Entrepreneurial Intention Questionnaire, and demographic items teaching level, years of experience, gender, and age.

A significant relationship was found between overall technology integration and entrepreneurial characteristics and intention ($F(4,202) = 14.86$, $p = <.01$). Entrepreneurial characteristics and intention were also significantly related to the translational ($F(4,202) = 3.63$, $p = .01$), transformational ($F(4,202) = 15.73$, $p = <.01$), and transcendent ($F(4,202) = 23.68$, $p = <.01$) levels of technology integration. Neither overall technology integration ($F(5,203) = 1.11$, $p = .36$) nor overall entrepreneurial characteristics and intention ($F(5,204) = 0.11$, $p = .99$) had a significant relationship to demographics.

The findings confirm a relationship between levels of technology integration and entrepreneurial characteristics and entrepreneurial intention. The study demonstrates the necessity to include more professional development concerning higher-level use of technology to develop teaching practices that model entrepreneurial thinking for students.

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Table of Contents

List of Figures

List of Tables

Chapter I: Introduction

Teachers need to be intentional entrepreneurial thinkers because we need students to think more entrepreneurially. For the sake of this study, entrepreneurial intention is not only used in relation to the creation of a business venture, but also as a way of thinking that incorporates entrepreneurial attributes into intention. These attributes include in part the inclination to organize, innovate, assume risks, act as the source of new ideas, etc. The term entrepreneurial spirit has been used in some literature as an alternative, but throughout literature it is interchanged with intention. Because of the transfer of meaning from a business context to one of education, the skills, though similar, do not focus on starting an enterprise but do focus on attributes that, together with intention, indicate entrepreneurial thinking. This indication also reflects upon attitudes toward teaching and learning with the integration of technology. Entrepreneurial thinking's role in education relates to Sarasvathy's, (2014), concept of Effectuation Reasoning. The inverse of causal reasoning, effectuation, deemed to be the "new" entrepreneurship, concentrates on working with a given set of means and then creating goals from what is surrounding an individual's actions, more specifically, who they are, what they know, and whom they know (Sarasvathy, 2001). These means are then developed into goals. This is much like a teacher who, given environment and students, must make decisions about who he or she is and what he or she knows and what resources he or she has available in order to accomplish the task of engaging learners. In this way, teachers can be seen as entrepreneurial. Berry (2013), in fact, uses the term, "teacherpreneur" as … a teacher who "… represents the bold concept that teachers can continue to teach while having time, space, and incentives to incubate big pedagogical and policy ideas and execute them in the best interests of both their students and their teaching colleagues" (Chapter 2, Section 1, para. 1). Berry (2013) goes on to say that "teacherpreneurs" have a focus of intention and that they are willing to experiment, have an aptitude for problem solving, have the ability to prioritize, and have a belief in continued learning.

The International Society for Technology in Education (ISTE) in its 2017 Standards for Educators, clearly defines labels for teachers to push themselves in terms of educational technology practice and mastery (See Figure 1). As learners, teachers are asked to seek out new opportunities to engage with others and find opportunities to leverage technology to support student learning. The leader role is encouragement for teachers to support student empowerment and shared vision for equity. Teachers in the role as citizen are asked to inspire responsible digital participation and model curiosity, empathy, and ethics. In addition, teachers are asked to become collaborators who work with others to improve practice, designers who create authentic and personalized opportunities for students, facilitators who model taking ownership of learning and find creative solutions to solve problems, and analysts who use data to drive to them to a next level of practice (ISTE, 2017). All of these roles require the intention to seek out and put into action those practices to enhance learning, similar to a business interpretation of seeking out an opportunity to develop a sellable product. In fact, these standards set forth for teachers are similar to recognized characteristics of entrepreneurs and "teacherpreneurs": visionary, passionate, creative, empathetic, persistent, and fundraisers (ElRayess, 2012).

Figure 1. ISTE Standards for Educators

Note: **ISTE Standards for Educators**
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Statement of the Problem

Theoretically, technology integration has been at the heart of much controversy about student learning and teacher preparation. Questions about its integration have been considered in terms of assessment methods and time on task and the viability of technology used for effective learning. Technologies that promote and practice the top levels of Bloom's analysis, evaluation, and synthesis are at the forefront of the skills necessary for students performing in our ever-changing world, and cultural trends tell us that most of the students of our current teachers will be creating their own jobs…not just working at jobs already in process. With a new age of education reformation upon us, technology sits at a new, high level of priority in entrepreneurial education and philosophy, and teachers are the vehicle to drive that process.

Teachers have opportunity to develop their technology skills, but many do not. There are challenges and limitations for teachers attempting to push themselves and become more entrepreneurial in their technology practices. Some of these challenges are that teachers are not provided with the professional development necessary to develop their technology integration skills to a higher level. Teachers might be filtered out of many effective tools by their school district's filters that so not allow them to have access. Moreover, teachers may not be comfortable in a more student-centric dynamic which is fostered by the use of many instructional technologies used for communication, creativity, and collaboration. These and many other challenges face teachers, and developing their own levels of integration to higher points may not be an easy or attainable task.

Because the charge to increase levels of technology integration seems to be intention-based and requires desire, effort, and a sense of accomplishment, it seems that the "value proposition" concept of entrepreneurial practice does apply to teachers and their unending efforts to better their practice to increase value of learning for others. Technology is an integral part of the future lives of students, and most teachers continually seek to create better opportunities for their students. This would include creating activities that touch upon more of a constructivist or constructionist application in the classroom with students creating and manipulating technology as they learn. In this way, teachers are already thinking entrepreneurially. The interesting thing to think about is if there could be a relationship between the teacher's efforts to integrate the technology at higher levels for themselves and their students and the way they think about those efforts. Teachers who use technology at those higher levels could be considered to think more entrepreneurially.

A benefit of this study is the realization and acknowledgement that use of these tools at a higher level by teachers makes a difference in their thinking, and that this has a direct impact on their instruction, and subsequently, as vehicles of content and role models, the learning, and thought processes of their students.

There are those who would argue that constructivist and/or constructionist teaching and learning methods, along with integrating technology as a part, do not work effectively in educational settings. Based on experience with teachers, there are still too many who are neither willing to commit the time and research it takes to integrate technology into their classroom settings nor to change the ways they have taught for many years. Many teachers continue to insist that since they have had good results up to this point, there is no need to change. Sadly, many teachers form pre-conceived notions about instructional technology use and the change of teaching methods as just another phase, and they are resistant to change.

In order to change the direction of our schools to provide more relevant educational experiences and to provide more experiential and entrepreneurial learning, born from constructivist and constructionist thought, teachers need to begin early on to raise their level of technology awareness and integration and to develop their entrepreneurial focus of themselves and their profession. This awareness should be an integral part in teacher preparation programs in our nation's higher education institutions. The idea of role-modeling is important both in entrepreneurial practice and integrating technology. How the teacher approaches technology, learning, and problem solving has a direct impact on students. Estes, Simmons, and Hebert (2018) in Chapter 5 of the *Handbook of Research on Pedagogical Models for Next-Generation Teaching and Learning*, titled, *"*Modeling Technology Integration in Teacher Preparation Programs," conclude that "…faculty must model if the desire is to prepare teachers for the 21st century," (p. 82), and made "…positive findings that…faculty behaviors and attitudes affect students profoundly…" (p. 84).

It is important for future teachers to understand their impact as role models in the use of technology, and they must learn to effectively use the tools that are a part of their students' lives. Ignoring that part of the students' lives and continuing to follow a traditional model would not only exclude some students, but it would also not be relevant practice for these students for participation in a digital world.

Rationale

Teachers are already thought to be somewhat entrepreneurial in their traditional roles as teachers. Teachers are salesmen in a sense, selling a product, and a passion for learning, to students in the classroom that they want them to buy and use; they are natural fundraisers, looking for ways to add things to their curriculum and classrooms; they know when to "throw out the playbook" and take a different direction with their curriculum in an effort to get the best results from their students; they have an idea of what students want and strive to make their curriculum a good fit for all of them; and they already have empathy, the base concept that makes them good connectors of people and processes (Grimshaw, 2015).

In order to provide a framework for the responsibility of the teacher to be entrepreneurial and a higher-level integrator of technology, consider the 21st century skills of collaboration, communication, creativity, and critical thinking and the aforementioned ISTE NETS standards for the teacher role of learner, leader, citizen, collaborator, designer, facilitator, and analyst.

One of the most important things teachers can do as a part of this process is to network with other educators. Teachers who involve themselves in social networks, and use technology effectively in doing so, are increasing their learning networks as well. Those who use communication and collaboration tools such as Twitter, Google Plus, etc. engage with others and enhance their own learning in an entrepreneurial way. When they model that for students, the students see the power of learning collaboratively. Teachers also have resources at their fingertips. When they use technology to bring in experts to speak and provide global experiences for their students, they are showing the way they use the resources of who they know and what they know to provide those opportunities for their students. Again, modeling technology use develops the thinking processes of students who begin to recognize the resources around them and the ways they can access resources to develop ideas and processes, just as in the effectual model of entrepreneurial practice. Teachers who model for students the ways they find information demonstrate the connections to be made between academics and the real world. By participating in, and providing examples of, this type of practice, teachers are setting an entrepreneurial example for their students and providing relevance to what they are learning. This helps produce successful citizens for an unknown global economy and society. In addition, by taking an active part in using these tools regularly and effectively, the teacher develops a substantial web presence that makes him or her a part of a greater global community.

Purpose of the Study

Our classrooms of today need to be structured for teaching a different kind of skill set than what was taught in the past. This study is intended to determine if there is evidence of a positive relationship between teachers' entrepreneurial intention and technology integration.

Significance of the Study

Finding a positive relationship between teachers' levels of technology integration and entrepreneurial characteristics and intention would be an important step in the direction of changing thinking about technology's role in education. A positive relationship between the two could empower individuals who oversee teacher preparation programs, district purchasing patterns, and also professional development programs in order to promote the development of educators as change agents.

Teachers should be participating in authentic learning practices and should take ownership of their learning just as they ask their students to do. By using technology at higher levels and changing their thinking to one of a more entrepreneurial nature, they will be open to finding new and select learning opportunities for their students. According to Magana (2017), most teachers are at the first level of the T3 Technology Integration Framework which is characteristic of technology uses that are merely automation or consumption based (See Table 1). The goal is to drive teachers to Level 3 of inquiry design and social entrepreneurism in their technology use (Magana 2017). This drive is a transformational way to reform education and change its paradigm. Using technology at new levels can have an impact on teacher preparation and professional development intended to create a new, "teacherpreneurial" view of the classroom instructor.

Table 1. T3 Framework for Technology Integration

Level	*Sub-Categories*
T1 Translational	T1.1 Automation
	T1.2 Consumption
T2 Transformational	
	T2.1 Production
	T2.2 Contribution
T3 Transcendent	
	T3.1 Inquiry Design
	T3.2 Social Entrepreneurism

Note. Information found in Disruptive Classroom Technologies: A Framework for Innovation in Education by Sonny Magana (2017).

The emphasis on entrepreneurial skills and soft skills, (ie. Communication skills, listening skills, cooperation skills, etc. which allow students to participate effectively with others in the work force), being taught in schools as part of preparation for success in the 21st century makes a study such as this transformative as the role of technology in educational practices becomes increasingly important.

Research Question and Hypotheses

Research Question

To test this theory of a possible relationship between levels of technology integration and entrepreneurial characteristics and intent, one overall research question was formed: In relation to Pre-K -12 Teachers, how are Levels of Teaching, Years of Teaching Experience, Gender, Age, Entrepreneurial Characteristics, and Entrepreneurial Intent related to Levels of Technology Integration? Six hypotheses were then developed for analysis.

Hypothesis One

There is a relationship between the overall level of technology integration, (including subscales of the translational level, transformational level, and transcendent Level), and the participants' demographics of teaching level, years of teaching, gender, and age. A multiple regression analysis was used to determine this relationship. The criterion variable of overall technology integration was comprised of the mean of the sub-scales of the Translational Level (including sub-categories automation and consumption) (See Appendix X); Transformational Level (including sub-categories production and contribution) (See Appendix X), and Transcendent Level (including sub-categories inquiry design and social entrepreneurism) (See Appendix X). A five-point Likert scale was used to collect participants' answers of 1) strongly disagree to 5) strongly agree. Sample of items (includes examples from all levels--Translational, Transformational, Transcendent) were "I use digital tools to save time," "I use digital tools to track student progress," and "I use digital tools to help solve authentic problems." Demographics used as predictor variables were level of teaching, years of teaching experience, gender, and age. These included the variables level of teaching (elementary and secondary), years of teaching experience (1-10 and 11 or more), gender (male and female), and age as a numeric value.

Hypothesis Two

There is a relationship between the overall level of technology integration, (including subscales of the translational level, transformational level, and transcendent Level), and the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs). A multiple regression analysis was used to determine this relationship. The criterion variable of overall technology integration was comprised of the mean of the sub-scales of the Translational Level (including sub-categories automation and consumption) (See Appendix B); Transformational Level (including sub-categories production and contribution) (See Appendix C), and Transcendent Level (including sub-categories inquiry design and social entrepreneurism) (See Appendix D). A five-point Likert scale was used to collect participants' answers of (1) strongly disagree to (5) strongly agree. Sample of items (includes examples from all levels-- Translational, Transformational, Transcendent levels) were "I use digital tools to save time," "I use digital tools to track student progress," and "I use digital tools to help solve authentic problems." Overall entrepreneurial characteristics and intention used as the predictor variable was comprised of responses of participants asked to respond if characteristics listed were true of them on a five-point Likert scale ranging from (1) Definitely False to (5) Definitely True. Sample of items were Visionary, Passionate, Design Thinker, Risk Taker. The predictor variable also included questions of entrepreneurial intent divided into sub-categories of control beliefs, behavioral beliefs, and normative beliefs. Participants were asked to choose answers in each section using a five-point Likert scale of (1)Strongly Disagree to (5)Strongly Agree. Sample of items were “to start a new educational program and keep it progressing would be easy for me,” “a career as an entrepreneur is attractive for me,” and “my close family would support my decision to start a new educational program.”

Hypothesis Three

There is a relationship between the participants’ overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs), and the participants’ demographics of teaching level, years of teaching, gender, and age. A multiple regression analysis was used to determine this relationship. Overall entrepreneurial characteristics and intention used as the criterion variable was comprised of responses of participants asked to respond if characteristics listed were true of them on a five-point Likert scale ranging from (1) Definitely False to (5) Definitely True. Sample of items were Visionary, Passionate, Design Thinker, Risk Taker. The criterion variable also included questions of entrepreneurial intent divided into sub-categories of control beliefs, behavioral beliefs, and normative beliefs. Participants were asked to choose answers in each section using a five-point Likert scale of (1)Strongly Disagree to (5)Strongly Agree. Sample of items were “to start a new educational program and keep it progressing would be easy for me,” a career as an entrepreneur is attractive for me,” and “my close family would support my decision to start a new educational program.” Demographics used as predictor variables were level of teaching, years of teaching experience, gender, and age. These included the variables level of teaching (elementary and secondary), years of teaching experience (1-10 and 11 or more), gender (male and female), and age as a numeric value.

<u>Hypothesis Four</u>

There is a relationship between the Technology Integration Subscale level, "Translational," and the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs). A multiple regression analysis was used to determine this relationship. The criterion variable of translational level of technology was comprised of the mean of participants' responses in the sub-categories of the translational level, automation and consumption. Sample items were "I use digital tools to save time," " I use digital tools to create and share documents," and "I use websites to access information." Participants' choices were provided on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Overall entrepreneurial characteristics and intention used as the predictor variable was comprised of responses of participants asked to respond if characteristics listed were true of them on a five-point Likert scale ranging from (1) Definitely False to (5) Definitely True. Sample of items were Visionary, Passionate, Design Thinker, Risk Taker. The criterion variable also included questions of entrepreneurial intent divided into sub-categories of control beliefs, behavioral beliefs, and normative beliefs. Participants were asked to choose answers in each section using a five-point Likert scale of (1)Strongly Disagree to (5)Strongly Agree. Sample of items were "to start a new educational program and keep it progressing would be easy for me," "a career as an entrepreneur is attractive for me," and "my close family would support my decision to start a new educational program." Demographics used as predictor variables were level of teaching, years of teaching experience, gender, and age. These included the variables level of teaching (elementary and secondary), years of teaching experience (1-10 and 11 or more), gender (male and female), and age as a numeric value.

Hypothesis Five

There is a relationship between the Technology Integration Subscale level, "Transformational," and the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs). A multiple regression analysis was used to determine this relationship. The criterion variable of transformational level of technology was comprised of the mean of participants' responses in the sub-categories of the transformational level, production and contribution. Sample items were "I use digital tools to produce works that represent my learning or knowledge," " I use digital tools to create tutorials or learning guides for my students," and "I use digital tools for brainstorming activities." Participants' choices were provided on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Overall entrepreneurial characteristics and intention used as the predictor variable was comprised of responses of participants asked to respond if characteristics listed were true of them on a five-point Likert scale ranging from 1) definitely False to 5) definitely True. Sample of items were Visionary, Passionate, Design Thinker, Risk Taker. The criterion variable also included questions of entrepreneurial intent divided into sub-categories of control beliefs, behavioral beliefs, and normative beliefs. Participants were asked to choose answers in each section using a five-point Likert scale of (1)Strongly Disagree to (5)Strongly Agree. Sample of items were "to start a new educational program and keep it progressing would be easy for me", "a career as an entrepreneur is attractive for me," and "my close family would support my decision to start a new educational program."

Hypothesis Six

There is a relationship between the Technology Integration Subscale level, "Transcendent," and the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs). A multiple regression analysis was used to determine this relationship. The criterion variable of transcendent level of technology was comprised of the mean of participants' responses in the sub-categories of the transcendent level, inquiry design and social entrepreneurism. Sample items were "I use digital tools to solve authentic problems," " I use digital tools to improve my teaching and learning," and "I use digital tools to scale the implementation of a digital solution to an authentic problem." Participants' choices were provided on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Overall entrepreneurial characteristics and intention used as the predictor variable was comprised of responses of participants asked to respond if characteristics listed were true of them on a five-point Likert scale ranging from (1) definitely False to (5) definitely True. Sample of items were Visionary, Passionate, Design Thinker, Risk Taker. The criterion variable also included questions of entrepreneurial intent divided into sub-categories of control beliefs, behavioral beliefs, and normative beliefs. Participants were asked to choose answers in each section using a five-point Likert scale of (1)Strongly Disagree to (5)Strongly Agree. Sample of items were "to start a new educational program and keep it progressing would be easy for me," " a career as an entrepreneur is attractive for me," and "my close family would support my decision to start a new educational program."

Summary

Teachers have an opportunity to make a direct impact on the educational processes used to prepare students for an uncertain future. Traditional teacher-centric methods of teaching that focus on the objective view of learning as teacher-directed do not coincide with the lifestyles and economy of our changing world. Students now demand more opportunities to follow non-traditional career and learning paths. Those demands are representative of the idea that individuals must be entrepreneurs of their own thoughts and must take ownership of their own academic paths.

Students are more in tune with the world and willingly take on problems around them to try to solve situations for themselves and for others. This "value-creation" mindset and opportunity-seeking practice directly falls into the practice of entrepreneurial thought and action and creates within the students an entrepreneurial mindset reflective of these practices. Teachers, in working with this new age of students, must also adhere to this type of thinking so that they can model behavior and provide guidance to their students as they follow these practices.

Answering to demands of the 21st century, teachers must learn to appreciate the role social media and other technology tools play in the presence of this type of thought. When using these tools, a level of integration occurs reflective of the entrepreneurial mindset. Magana's T3 framework of technology integration can be used to discover the relationship between integration of technology and entrepreneurial thought processes. This entrepreneurial way of thinking is critical for teachers who are working with students of this digital and entrepreneurial age.

Sarasvathy (2014) studied entrepreneurial mindsets of individuals and developed a new framework of understanding in reference to entrepreneurs and their practices. Her effectuation method of entrepreneurism contends that entrepreneurs work effectively when they consider the resources at hand and readily available to them to engage in their entrepreneurial pursuits, reforming the traditional entrepreneurial practice of reaching outward to find resources to develop a business or action plan. By following the effectuation model of entrepreneurial thinking, teachers can use the resources around them and that they have at their disposal in order to develop their own entrepreneurial mindsets. When looking at these resources surrounding them in their daily teaching activities, some of the most readily available resources are those such as social networks used for marketing, learning, and sharing. By accessing these tools and using them effectively, teachers can intensify their practice by developing expertise at varied levels of integration. This study is done to investigate whether integrating digital tools according to the T3 Framework of technology integration, shows a positive relationship with entrepreneurial thinking.

Chapter II: Literature Review

Introduction

There is a paucity of literature surrounding the topics of entrepreneurism and technology integration. Most writings about entrepreneurism are theoretical and subjective, especially in trying to define just what entrepreneurism is and what makes an entrepreneur. Peter Drucker (1985) refers to the definition of "the entrepreneur" as early as the 1800's and claims that since that time, there has been confusion over the definitions of entrepreneurs and entrepreneurism (Drucker, 1985, p. 21). Liñán, Rodriguez-Cohard, and Rueda-Cantuche (2010) also comment on this: "…the factors that determine the individual's decision to start a venture are still not completely clear" (p. 195). They also contend that an "average" entrepreneur just does not exist, making the determination of just what makes an individual an entrepreneur even more vague and undetermined (p. 197). Technology Integration has various frameworks used to try to encourage teachers to integrate technology in a more advanced and effective way. Joining the two, however, for any pattern of connection, is scarcely discussed. First, in considering literature surrounding entrepreneurism, patterns begin to emerge. Most literature surrounding entrepreneurism considers its execution to be intentional, meaning that an individual makes a choice at some point in the process based on some aspect of his or her life either personal or professional. Also, there are different reasons an individual may develop this type of thinking and intention leading to distinctions between different types of entrepreneurs: necessity entrepreneurs, opportunity entrepreneurs, intrapreneurs, policy entrepreneurs, and social entrepreneurs. Secondly, some of the literature presents the idea that entrepreneurial intention can be developed in some way by the individual through example and practice. This aligns with the attempt to relate teachers and their levels of technology integration with their entrepreneurial intentions, considering the idea that teachers could have some choice in becoming this type of thinker. Third, some of the literature recognizes that considering the concept of entrepreneurial intention only in a business venture sense is narrow and should be expanded to consider it on a broader scale to be applied to a more generalized population. As the literature has diverse views on pinpointing the components of an individual's entrepreneurial tendencies in business practices, so does the field of education in determining the best ways to promote and determine entrepreneurial thinking in teachers.

As early as the 1970's entrepreneurism has been considered an integral part of social capital and social reform. Technology in the 1970's and 1980's aligns similarly with the idea of technology in the 21st century as a resource to enhance entrepreneurial thinking. Sarasvathy's, (2001) work with the concept of "effectuation" allows a move from "economic inevitability to entrepreneurial contingency" (p. 243). Much like a lean start up in the entrepreneurial world (methodology that allows for shortening new product development), teachers must take a design approach to learning about new technologies and integrating them. Lambert and Cuper (2004) establish that more professional development is needed to prepare practicing teachers, as well as pre-service teacher candidates, to modernize their practice and integrate these tools into their teaching activities and to quantify their own learning. They also contend that students no longer process information in a sequential manner and more needs to be done to prepare teachers to apply technology tools in order to process multiple views of world issues (Lambert & Cuper, 2004). Also, the North Central Regional Educational Laboratory (NCREL) and the Metiri Group, according to Lambert and Cuper, (2004), believe that technology can increase the frequency of this learning with a global, problem-solving focus. This approach to learning is much like effectuation as presented by Sarasvathy in her conceptualizations of entrepreneurship in a modern culture. Rather than using an established set of parameters, teachers, much like those in entrepreneurial startups consider who they are, who they know, and what they already have with which they can work. This philosophy fits well with social networking tools such as Twitter and Google as ways to discover self and especially to build that social networking into developing a personal network and establishing deeper learning. With such a strong emphasis on differentiation, problem- and project-based learning, and personalization in learning practices, teachers, with the assistance of targeted instructional technology tools demonstrate their interactions through the three factors of entrepreneurship (Dewald 2017).

Altan (2012) contends that teachers who teach entrepreneurially are powerful forces in developing innovation and contributing to our world's economic growth and productivity. Altan continues to say that entrepreneurship is not a linear or predictable concept and determines that the traditional education framework currently caters more to left-brain learners. Even the ISTE NETS standards for educators stress some of these same critical areas of collaboration, communication, creativity, and critical thinking as they align educators' practice with these proposed 21st century skills necessary for living as a productive member of our modern society in the form of becoming life-long learners, leaders, citizens, collaborators, designers, facilitators, and analysts (ISTE, 2017).

Meyer (2003) defined “entrepreneurial academics” as “scientists in the public sector who are not necessarily interested in setting up a fast-growing company but looking for other avenues in which they can pursue their research interests” (p. 107). Going further, he discusses the new mode of knowledge as the “triple helix” that joins the university [education], industry, and government in a joint effort of educating citizens to succeed in society (Meyer, 2003, p. 107). Teachers already have a role that allows them to develop entrepreneurial thinking if they find ways to foster this type of thought. Cole (2015) states five ways in which teachers are already prone to entrepreneurial thinking: sales and marketing come naturally, they are natural fundraisers, they know when to throw out the playbook, they know what students want, and they care.

Bransford, Brown, and Cocking (1999) presented many advantages for teachers who embrace and use social networking technologies in instructional settings. This allows teachers to use the knowledge of experts, visualize and analyze data, link learning to authentic concepts, and provide opportunities for online shared reflection.

In terms of teacher preparation, these technologies cannot simply be incorporated into college coursework but must be presented as integrated frameworks to enhance personalized learning. Even the ISTE (NETS) standards for Teachers focus more on integration than the tools, but it’s what the tools can do that provides the magic to develop entrepreneurial thinking creating curiosity, intrigue, and interest, and also challenging deeper thought (ISTE, 2017).

The Texas Collaborative for Teaching Excellence, even in 2007, referred to “contextual learning,” and thought the learning that would take place would be learning new knowledge that made past knowledge make sense, reveal relationships between the abstract and the practical, and allow the internalization of learning which would personalize the experience (Teachers as Educational-Social Entrepreneurs 2007).

Some of the tools mentioned as ways to promote this new thinking are concept mapping tools such as Inspiration, taking PowerPoint a step further with Mix features and hotlink navigation features, Blogging, and Podcasting. Added to that list should be Twitter and Google tools. Lynch (2017) added to the list with Tumblr, Google +, ePortfolio, and assessment tools that would promote, interactions in many different ways.

All of these innovative practices coincide with the idea of thinking like entrepreneurs. Political Scientist Joseph Schumpeter (1947), in the mid 20th century, referred to "creative destruction" as doing things already done in a new way and said that this, along with the spirt of adventure, is "essential for the formulation of entrepreneurial function." From then until now, the evolution of entrepreneurial thought has progressed and brought new frameworks, and, in an innovative and iterative society, entrepreneurial teachers are a must to promote social change.

LaRocca (2017) highlights a keynote presentation given by John Seely Brown at the 2012 Digital Media and Learning (DML) Conference in San Francisco in March of 2012. LaRocca discusses Brown's view of the entrepreneurial learner as one who is always looking for new opportunities and for new individuals with whom to collaborate. LaRocca also notes Brown's connection of entrepreneurial thinking to education and the necessity to create entrepreneurial environments for learning. From Brown's presentation, LaRocca took away many key points of that connection. One key concept is the idea of a "blended epistemology" including man as "…knower and maker incorporated with play" (LaRocca, 2017, p. 12). According to LaRocca, Brown characterizes entrepreneurs as makers and tinkerers and contends that this includes critical thinking as a notion of grounded truth (LaRocca, 2017). Just as it is important to adapt teacher and learning strategies to a changing educational landscape, the tools that are used to do so are important and must be scalable for future use and sustainability (LaRocca, 2017). In his review, LaRocca uses Brown's views to comment on the work of Maria Montessori and John Dewey whose philosophies emphasized play, imagination, innovation, and entrepreneurial thinking. Seemingly before their time, it seems that their practices have not been sustainable for a changing educational canvas. LaRocca (2017) reflects on Brown's idea that, while their intuitions were right, their tool sets were wrong. As certain tools and skills decrease in effect, and the networked world moves at a faster pace, individuals need to be taught to leverage the new learning ecosystem (LaRocca, 2012). Brown's views also included the idea of technology tools as "curiosity amplifiers," indicating the importance of viewing the tools as the amplifiers of knowledge not because of the tools themselves, but for what learning can be gained from and performed with the tools (LaRocca, 2012, p. 4). Along the same path as recognizing the importance of social entrepreneurism and global communities, LaRocca related Brown's importance placed on the power of social, global networks of practice and also the concept of personalized mentoring.

Disruptive Practice and the 21st Century Teacher

Daniel Pink (2012) said in *Drive: The Surprising Truth About What Motivates Us* "Greatness and nearsightedness are incompatible. Meaningful achievement depends on lifting one's sights and pushing toward the horizon" (p. 58). n considering the blend of levels of technology and entrepreneurial thinking, it is interesting to consider educational disruptions using technology as a tool to reach social entrepreneurial levels.

Research has decidedly contradicted the traditional teacher-centered approach to learning. A review of the literature on teaching for deeper learning found that traditional academic approaches won't play a part indeveloping students who can think critically or speak effectively, and these are the skills that are necessary for success in the digital age (Darling-Hammond, et al., 2008). There is a growing consensus that authentic problems and projects afford unique opportunities for learning, but that authenticity in and of itself does not guarantee learning (Basye, et al. 2015). Active learners of our digital age must be accommodated by a combination of pedagogy, technology, and space or environment, and a flexible learning space can make this easier for teachers to provide activities that appeal to all three accommodations.

Gordon MacKenzie (1998), formerly at Hallmark, used the term “responsible creativity” when talking about embarking on creative avenues to systematic change. In order to create a sustainable program from the start, pioneers of the program should definitely have the desire to innovate and create a differentiated, effective learning environment for their extended community, but they also need to leverage the change so as not to be so radical that an environment totally refutes and ridicules the system currently in place and in which many still hold great value (MacKenzie, 1998).

Technology is more powerful than ever before, and its impact on the lives of students and practice of educators is critical as a part of the disruptive practice of teaching and learning differently in the 21st century.

In Cookson's (2017) article entitled, "Ten Disruptions That Will Revolutionize Education," published online by *Education Week*, the following disruptions are listed:

1. Digital Learners will rebel against intellectual conformity.
2. Learning avatars will become commonplace.
3. Participatory-Learning hubs will replace isolated classrooms.
4. Inquiry skills will drive learning.
5. Capacities will matter more than grades.
6. Teachers will become inventors.
7. School leaders will give up their desks.
8. Students and families will become co-learners and co-creators.
9. Formal credentials will no longer be the Holy Grail.
10. Policymakers will form communities of continuous improvement.

Of these ten disruptions, there are some concepts that especially pair with the idea of viewing teachers as entrepreneurial. Considering number six on the list, teachers who are digital learners and leaders will be rebelling against traditional learning constructs in order to focus on new methods in their practice and changing the educational paradigm. In consideration of number three, "participatory learning hubs" will be replaced by these entrepreneurial teachers as they expand their global networks. Inquiry skills will surface as these teachers seek out their own learning and model that for their students. And, finally, forming communities of continuous improvement through professional learning communities both face-to-face and online in a global environment will foster innovation and success (Cook, 2017).

When thinking of the future and the role of technology, it is interesting to think about peoples' perceptions of the "big picture." Futurist Alvin Toffler (1980), in his book *The Third Wave,* discusses the evolution of society as "Social Wave Front Analysis," claiming that social evolution occurs in waves with each encompassing change that is vastly accelerated from the wave before, and each having its own "super-ideology." Each wave characterizes changes in culture and in society focus, and the transition from one to another incorporates a breaking point in the way of life for all. The first, the Agricultural Wave was a time in society when agriculture was the basis for society and family life. When the second wave, the Industrial Wave occurred, changes began to take place to alter the way individuals thought about life. There was mass production of items, standardization, and an obsession with time and synchronization. There was also a split between production and consumption (Toffler, 1980).

In the third wave, also deemed the "information age," scientific breakthroughs and manipulative abilities through computers vastly changed the landscape. Electronics and computers have become personalized, and intelligent environments are upon us (Toffler, 1980).

When we think of Toffler's ideas of the future, many of which have actually come to fruition, it is amazing that education has not kept up with not only technological advancements but also advancements of ideologies and practices. For this reason, technology integration and a risk-taking, curious, and opportunity-seeking mindset are more important than ever. Though Toffler died in 2016, it is thought by some that a fourth wave is actually looming.

Rogers (2003), discusses the "diffusion of innovation" as a form of social change. While the diffusion to which he refers involves the idea of communicating a new idea, he includes time and the social system in which the idea is presented as critical (Rogers, 2003, p. 10). He claims that often the terms “innovation” and “technology” are used synonymously, and refers to technology as “…a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome…” (Rogers, 2003, p. 12). In reference to time, Rogers describes the “innovation decision process” in which the individual “…passes from first knowledge of innovation to forming an attitude toward the innovation, to a decision to adopt or reject the innovation…” (Rogers, 2003, p. 19). This fits closely with the idea of entrepreneurial intention and the beliefs involved in making the decision to act upon an opportunity. Rogers also presents the idea of a “change agent” as an “…individual who influences decisions in a direction…” that is desirable to the individual’s social agency (Rogers, 2003, p. 27). The concept of “change agent” is repeated throughout literature when referring to entrepreneurial thinkers, and teachers, in their practice, should be no exception.

Teachers who integrate instructional technology that fosters communication, creativity, and collaboration such as Twitter, Google tools, and others into their teaching think more like entrepreneurs. Literature reflects that teachers already have entrepreneurial tendencies in the way they manage classrooms and make decisions for students based on problems that arise during the learning process. Differentiating instruction, teachers try different teaching and learning approaches with students. Some of these methods are very different than traditional approaches in the past, and technology plays a key role in making some of these changes.

Personalization of learning is becoming more of a necessity in a world of dynamically changing cultures. Encouraging students to think independently and initiate ideas to solve world problems is at the forefront of educational reform. Instructional technologies (i.e., digital tools) allow teachers to vary learning opportunities for students. Lado (1996) states that in

1985, Tepstra and David defined technology as, “a cultural system concerned with the relationship between humans and their environment” (Lado, 1996). Though the technology available has changed drastically over the last 30+ years, the concept of what it can do for individuals has really not changed. Teachers who integrate targeted technologies form those cultural relationships that make them think differently.

<u>T3 Framework of Technology Integration</u>

Magana (2017) presents the T3 framework which categorizes technology integration as translational (automation, consumption), transformational (production, contribution), or transcendent (inquiry design, social entrepreneurship). Magana contends that few students and teachers get to the highest level. In fact, there seems to be a great deal of use at the translational and transformational levels but not much at the transcendent level. The transcendent level is the use of technology that takes the learner beyond what is imaginable. One example of transcendent use of technology would be programming a 3D printer to produce something that didn’t exist before or learning coding to understand how something works (Magana, 2017). The translational model is simply using technology to do a usual task digitally. The transformational level refers to using technology to make a change in the learner or content by using technology tools. Guides are provided in the book by Magana for self-reflection and for observation of teachers for all categories to determine levels of integration. The terms used by Magana even correspond with some of the terminology used by Toffler when discussing his predicted fourth wave of society, namely “producer” and “consumer,” and Magana mentions Toffler’s term “prosumer,” or one who “consumes and produces a product” as he reflects upon the importance of teachers using technology tools at the higher level

(Magana, 2017). While the language used in Magana's framework reflects on student work, it can easily be replaced with the idea of teachers' work since the framework deals not only with the students' use of technology but also how the teachers integrate technology for those students and the levels at which they use technology for their own practices as professionals.

Translational Integration

The translational integration level is divided into two categories: automation and consumption (See Appendix B). At this level, teachers simply perform the same tasks as always but find technology as the tool that allows their work to be more efficient and error-free (Magana, 2017). They are also able to complete more work within a shorter time span. In this way, teachers are simply "automating" a task that they have always done but have found a way to do it differently. Thornburg (2013), in his book *From the Campfire to the Holodeck* which focuses on classroom design, refers to the translational level at which most teachers fall: "The idea behind the technology was that by connecting computers to display boards, teachers could present material in new ways. Instead of drawing a triangle by hand, it could now be drawn automatically on the board using a projected image on an interactive surface" (p. 38). This is a very low level of integration, merely digitizing an analog task, according to Magana, and is labeled T1.1. Moreover, Magana states that this is the level at which most teachers use technology (Magana, 2017).

At this level, the original task remains the same. Magana likens this to playing a favorite song on the guitar. Even though the song is interpreted by the guitar player in his or her own way, the base song remains the same. In fact, the less variance in interpretation, the deeper the mutual understanding of the original piece (Magana, 2017).

Magana labels the second part of the translational phase T1.2, Consumption. This label relates to the teachers' use of technology as a means to consume information or thought. Tasks in this category might include using eBooks or websites to consume information provided in a digital format (Magana, 2017).

Both automation and consumption …"mark the translational steps of applying educational technologies to administrative, instructional, or learning tasks" (Magana, 2017, p. 28). The translational model is simply using technology to do a usual task digitally. In contrast, the transformational level refers to using technology to make a change in the learner or content by using technology tools.

Transformative Integration

The next level, the transformative level of integration, is divided into two parts: T2.1 Production and T2.2 Contribution (See Appendix C). According to Magana, "…to be considered transformational, technology use must give rise to dramatic or substantive changes in both the task to which the technology tool is applied and the person enacting the task" (Magana, 2017, p. 38). "To generate transformative value within an education context, the technology use ideally should (a) primarily focus on learners' achieving content and skill mastery, and (b) catalyze a change in a learner's mindset, understanding, and cognizance to a higher-order state" (Magana, 2017, p. 38).

Magana uses the cognitive psychology terms of "novice" and "master," (rather than expert), to explain the cognitive changes that occur at this level of integration. Teachers and students begin to realize the relationship between effort and achievement which tends to increase "…confidence, agency, and willingness to take intellectual risks beyond the known limits of their cognitive comfort zones" (Magana, 2017, p. 38). Magana's definition of technology integration at this level is the following: "…the intentional application of digital technologies to unleash students' learning expertise, in ways not possible without technology, to achieve ever higher levels of knowledge and mastery (p. 39). The "…transformational use of technology in classrooms is transferring the locus of control of the learning experience, and the cognitive load, from teachers to students (Magana, 2017, p. 41).

The T2.1 Production level of integration involves the creation of "digital knowledge artifacts" that can be preserved (Magana, 2017, p. 42). A definition of technology used at the production level would include "…production of authentic evidence of improvement and even mastery, the quality of that evidence created with digital tools, and the thought processes necessary to produce these digital artifacts" (Magana, 2017, p. 42).

Magana indicates the T2.2 Contribution level contains parts of all of the previous levels of integration and is a level at which "…students use technology to produce and exhibit digital artifacts that will contribute not only to their own knowledge but to the knowledge of others as well" (Magana, 2017, p. 53). "Students automate tasks by using digital tools for efficiency, consume information for learning, and then create learning artifacts that can be shared with others for their learning" (Magana, 2017, p. 53). Specifically, Magana mentions that the creation of student tutorials could fit into this category. In this way, students will begin to understand the idea of a value proposition as in seeing the value of what they are doing for others, and they will be considering the end user in the process of creation. This idea fits nicely into an emerging way of thinking and acting entrepreneurially.

Transcendent Integration

The third level of the T3 framework includes two levels: T3.1 Inquiry Design and T3.2 Social Entrepreneurism (See Appendix D). "Transcendent experiences occur when we push hard against the edges of what is currently known, or possible, until we surmount those temporal limits and realize some new and superior level of performance" (Magana, 2017, pp. 63). Transcendent use of technology not only disrupts previous ways of doing things, but also far exceeds limitations and expectations, and is said to be dependent on an individual's passion, another thing that parallels to a huge part of entrepreneurial thinking (Magana, 2017). At this level, learners create their own learning goals instead of following those created by others. In reference to teachers, an example could be the act of teachers creating their own professional development rather than learning what has been prescribed by others as important to their practice.

Teachers working at a higher level of technology integration are those who elevate their professional practice to levels of inquiry design and encourage social entrepreneurship. By realizing the importance of these types of activities, it is apparent that they are role modeling transformational practices for learning.

Also important to and indicative of this level of integration is the concept of working with a global audience, mapping out pathways never approached before and doing something that only the technology could make possible (Magana, 2017). Inquiry Design refers to designing one's own learning by following paths that align with his/her passions. Social Entrepreneurship refers to taking that learning and using it in a way that makes a difference not only for oneself but for others on a global scale. Included, and at the forefront, of course, are the 21st century competencies of communication, creativity, collaboration, and critical thinking.

The roles of teachers and also the training provided to prepare them needs to be reevaluated. As technology progresses at a rapid pace, it is important that we harness the impact that instructional technology (digital) tools can have on learning and teaching. Technology can have a large part in reshaping how teachers teach. To teach the 21st century skills of collaboration, communication, creativity, and critical thinking, teachers need to find relevant and authentic ways to make learning meaningful to students who have been exposed to the power of information provided by technology for their entire lives. It is assumed that the preparation that future teachers are receiving does not adequately provide the thoughtful and intentional use of technology to help in learning.

The use of technology in instruction is industry-driven. The demands of communication and technology use in the workplace, not to mention the exponential growth of the abilities of technology tools and operations, require our teachers to teach to a future that is unknown. In that frame of mind, we need to make sure that students know how things work, how to create things, how to analyze things, and how to communicate those ideas to others, and to do this,

Change in Teacher Practices for the 21st Century

Magana, in *Disruptive Classroom Technologies*, says that, “Life and work in the 21st century clearly demand new learning outcomes for students,” and that “…disruption in education is…discomforting…given the…complexities and variability inherent in the processes of teaching and learning” (Magana, 2017, p. 3). Change is difficult, but teacher preparation should be disruptive and should incorporate a good understanding of why educational technology should be a part of teacher training and practice for the sake of their students.

There are ways to for teachers to think entrepreneurially and reach the transcendent level of technology integration, using sites like www.wix.com or google sites or www.weebly.com, to create a digital presence. The importance of updating materials and postings, especially if a blogging or journaling component is added, can emphasize to students the importance of rethinking, revising, and re-publishing. The authentic audience that comes with a digital presence is especially valuable in stressing constant revision.

Collaborating and networking tools are everywhere as the very framework of social media, but there are some specific ones that can be used for collaboration and networking. Younger students could be a part of a teacher or class account on Twitter, GroupMe, Google +, Google classroom tools, Padlet, Edmodo, Voicethread, The World Cafe http://www.theworldcafe.com, www.epals.com , and others. Older students could have accounts of their own, and this would be a great time to teach digital literacy to all students and professionalism online to older students.

In order to promote entrepreneurial thinking and action to market their ideas and themselves, students and teachers need to have tools that allow them to publish and create artifacts that can be used for marketing and promotion depending on the targeted instructional and learning objectives. There are many ways to do this. Students and teachers should be allowed to use their creative skills such as creating 30-second elevator speeches that promote their passions, attributes, and future goals. They could create avatars to recite their speeches on a tool such as Tellagami, (www.tellagami.com). After the avatar video is completed, they could create a QR code at goqr.me and then print the codes out to post for public viewing. As visitors walk past, they can scan the code to see the avatar videos and hear their speeches. By doing this, students and/or teachers are marketing themselves, and they are also preserving and publicizing their speeches as artifacts to share and to save.

Taking the creations further, videos can be created as “auras” to use with augmented reality apps such as www.hpreveal.com in the HP Reveal studio. These students and teachers are engaged in creativity while developing their skills.

Considering another form of digital tools, online reading opportunities are allowing students to enhance themselves as life-long learners. Students can load the axis360 app and check out books virtually from various public libraries. The Kindle app and Audible are a couple of other tools that have assisted in keeping resources easy to reach. Additionally, class activities such as “Resource Rodeos” and “Twitter Treasure Hunts” get students in the habit of searching sites of other professionals for new classroom ideas and strategies as well as online resources that contain a wealth of information.

These and other digital tools are important for growth as well as developing entrepreneurial skills of evaluation and self-reflection. Peer and self-reflections can be done using an online format such as Google Docs or Google Forms. In addition, journaling or blogging for the purpose of developing a larger eBook or portfolio later are good methods for students to see their progress and to keep their goals in vision. www.blogger.com, Google +, Wikispaces, https://edublogs.org, weebly.com, kidblog.org and others can provide free and intuitive platforms for student voices to be heard. Additionally, tools that assist students with practicing their interview skills are important. A tool provided at http://www.perfectinterview.com/ incorporates an actual person on video who "interviews" the student and provides timely feedback. The website also provides resources to assist students in preparation for interviews.

Evaluating values and priorities and developing professional and entrepreneurial confidence can be done in many ways, but there are digital surveys and other tools that can be used for self-evaluation. Knowing who they are and how their interactions with others are shaped are key when students work with tools from Indigo, Project Wayfinder, Strengths by Management and others. These tools are backed by algorithms that allow the students to answer attitudinal questions that interpret into the results as feedback for them to understand themselves and their roles in interacting with others. By understanding that feedback reports can indicate why others in their group interactions may or may not react to them in a certain way, students can begin to adjust their roles in individual and social settings.

Similarly, tools such as Inklewriter, https://www.inklestudios.com/inklewriter/education, that allow students to create their own interactive stories online can allow students to express themselves and their ideas in a very creative way promoting confidence and a place to share their views. Another tool, Twine http://twinery.org/ allows students to create open-ended stories. My students enjoy the Alexa skill, *The Magic Door* for the fact that they are allowed to continually choose different endings to a story created as a branching scenario. Creating stories here for their colleagues could provide practice in evaluation of self, of others and elements of design. As a response to problem-based learning, these tools could be ways to develop their thinking after analyzing a situation and generating a solution.

Many of these tools, besides developing entrepreneurial skills also could be developing higher order thinking skills. If we consider Bloom's upper levels of analysis, we want technology tools that create, evaluate, and analyze. While some of the tools mentioned such as "the perfect interview" seem to only ask students to remember and repeat, something at the lower end of Bloom's, students can be asked to create their own interview video in which they use themselves or an avatar with tools such as Powtoon and Edpuzzle to create them. Creating the activity would allow students to create a physical product for which they would need to evaluate their audience, create their training video, and analyze the results to see if their training is successful.

Entrepreneurial Intention

There is a global awareness that the educational paradigm needs to change to provide students with the necessary skills to be effective global citizens. The desire to encourage students to think more entrepreneurially is critical. Entrepreneurism has a reputation for being only business driven, but modern reflections on the characteristics of entrepreneurial thinkers determine that these are characteristic of students who strive to live productive lives in the 21st century and beyond.

Forbes presents the skills every entrepreneur should have as the following: resiliency, focus, investment for the long term, find and manage people, sell, learn, self-reflection, self-reliance (Aileron, 2013). In student and teacher terms, these could be interpreted as:

- Embracing failure and using it as a way to redesign or improve (resiliency)
- Managing a project and timeline (focus)

- Committing to continual updating and iteration (invest for the long term)
- Collaborating and Networking (find and manage people)
- Marketing their ideas and themselves (sell)
- Becoming a life-long learner (learn)
- Evaluating values and priorities (self-reflection)
- Developing professional confidence (self-reliance)

Bhaskar and Garimella (2017) differentiate types of entrepreneurs, two of which are the necessity entrepreneur and the opportunity entrepreneur (p. 630). The necessity entrepreneur is one who is forced to exhibit entrepreneurial behavior because of a particular situation. For example, if a water source is depleted for a community of people, an individual might be prone to act to try to use resources to solve the problem. The authors continue to say that this usually happens in societies of need. An opportunity entrepreneur, in contrast, follows opportunities as they are provided to him or her.

Schilling (2018), in her book entitled *Quirky,* discusses the characteristics of innovators as a focus of her study. Aligning to the concept of entrepreneurial intent, she states that "…all of the innovators…exhibited extreme faith in their ability to overcome obstacles" (Schilling, 2018, p. 13). She termed this faith as "self-efficacy" and commented on these innovators' willingness to continue with projects even if there was a high chance of failure (Schilling, 2018, p. 13). Ultimately, she contends that self-efficacy can lead to greater "risk taking and entrepreneurship" (Schilling, 2018, p. 78). Her findings coincide with not only the idea of entrepreneurial intention and acting on opportunities but also tap into common entrepreneurial characteristics such as self-efficacy and risk taking. Risk taking has been a common characteristic of those considered entrepreneurial. As far back as 1985, Peter Drucker characterizes being entrepreneurial as “enormously risky,” especially in terms of innovative technology (Drucker, 1985, p. 27).

Schilling (2018) also mentions that the innovators have “vicarious experiences” following outside influence by seeing the experiences of those around them (p. 82). The idea of normative entrepreneurial intention, (Ajzen, 1991), is similar to this in terms of the innovator or entrepreneur being guided in his/her action by the opinions and viewpoints of those around him or her.

Models

While it is mentioned that researchers have not been successful in finding personality traits, gender, age, or education connected to entrepreneurial thinking, there are still some attempts to measure entrepreneurial intention while using these constructs. Liñán, et al. (2010) state that authors and researchers have looked for personality characteristics and demographics that could determine the intent of an individual to act entrepreneurially, but claim that the “…predictive capacity has been very limited” (p. 197). Liñán, et al. (2010) continue to state that entrepreneurial tendencies could be determined by cultural and social factors in relation to an individual’s values system and would be the “…result of the (conscious or unconscious) analysis carried out by the person about the desirability and feasibility of the different possible alternatives in that situation” (p. 198). Their analysis substantiates the study of entrepreneurial intention as determination of entrepreneurial action and thought. As the case with other researchers, Bhaskar and Garimella (2017) believe that there is an element of conscious intent in entrepreneurial activity and that the focal point of research should "…shift from psychological profile of the entrepreneurism but to the entrepreneur" (p. 631).

Besides the Theory of Planned Behavior, two other theories of entrepreneurial intent are used as measures of entrepreneurial intention. Bird's (1988) model assumes that personal and social background dictates entrepreneurial action while Shapero's (1975) model contends that entrepreneurial action is a consequence of a sudden event (Bhaskar & Garimella, 2017, p. 632). They go further to discuss motivations and barriers for the entrepreneurial individual. Motivations include "…independence, achievement, implementation of own ideas, aligning of a job with passion, having a need for achievement, taking advantage of personal talents" (Bhaskar & Garimella, 2017, pp. 633-635).

The barriers mentioned seem to reflect many of the issues in education that could perhaps be barriers for the entrepreneurial actions of teachers, too. Barriers include-access to finance, skill shortage, institutional hindrances, need for external services, unfair competition, lack of access to financials, risk, lack of formal help, and uncertainty of future (Bhaskar & Garimello, 2017, pp. 633-635). Sadly, more of the barriers mentioned seem to coincide with teachers in a traditional education system when looking at things such as funding for curriculum and activities, lack of effective professional development, taking risks, and institutional roadblocks.

Throughout the literature, there are many attempts to measure just what makes an individual entrepreneurial. Lichtenstein and Monroe-White (September 14, 2017) reviewed 22 assessments designed to measure the entrepreneurial mindset and have published them in a list, the *Entrepreneurial Mindset Assessment Reviews*. The following assessments are a part of that list:

- Entrepreneurial Self Efficacy Scale ESE: Determining entrepreneurial tendency in college students and possibly workforce
- Tolerance for Ambiguity (TA) Instrument: cross cultural contexts
- Curiosity and Exploration Inventory: N/A
- I-Corps for Learning: Entrepreneurial Performance Assessment (EPA): team-level assessment
- The Engineering Entrepreneurship Survey: undergraduate engineering students
- Entrepreneurial Attitude Orientation (EAO) Scale: assesses entrepreneurial attitudes, scale development, reliability, and validity testing
- Entrepreneurial Behavior Inventory: identify EM (profit generation) among undergraduates
- Innovator Mindset: assesses personal innovativeness using an innovativeness index
- Entremetric Quotient Assessment (EQA): self-assessment of entrepreneurial mindset strengths and weaknesses
- Individual Entrepreneurial Orientation: assessing higher education students
- Growth vs. Fixed Mindset Instrument for Assessing EM in Freshmen: assesses EM in Freshmen
- Entrepreneurial Mindset Profile (EMP): assess strengths and weakness using personality traits and skills

- Entrepreneurial Attitude Orientation (EAO) Scale: measurement of entrepreneurial trainings among undergraduates
- Entrepreneurship Knowledge Inventory (EKI): assesses entrepreneurial knowledge of engineering undergraduates
- Gallup Entrepreneurial Profile (10): entrepreneurial talent detector and development tool
- Entrepreneurial Behavior Inventory (EBI): business owners and corporate entrepreneurs (intrapreneurs)
- Proactive Behavior Orientation (PBO): college students' and working professionals' proactive behavior
- Entrepreneurial Competence Behavioral Assessment: high school junior and senior students' generic entrepreneurial competence
- Assessment of Engineering Entrepreneurship Education: assessment of Engineering Entrepreneurship education
- Entrepreneurial Self-Efficacy: identifying entrepreneurial self-efficacy
- Entrepreneurial Mindset Rubric: assesses entrepreneurial mindset of upper level engineering undergraduates taking entrepreneurial technology courses
- Some are very specific to particular professions or groups of people, and it is difficult to find one to use because of their specific orientations. The most important thing, in terms of thinking of teachers in conjunction with entrepreneurial mindsets, is that many include the concept of "development" which would indicate that the skills to become entrepreneurial could be learned or advanced. Actually, the Entrepreneurial Mindset Profile, or EMP, was a consideration for use

in this study; however, it was discovered that it would not effectively measure the constructs to be analyzed with this study's particular variables.

Entrepreneurial Mindset Profile (EMP)

The Entrepreneurial Mindset Profile, listed previously, had a strongly validated process for finding entrepreneurial tendencies in individuals. The Entrepreneurial Mindset Profile (EMP) was developed by the Leadership Development Institute at Eckerd College in St. Petersburg, FL., and is a part of the Center for Creative Leadership.

In a report (Davis et al., 2014) discussing the formation of the Entrepreneurial Mindset Profile, the authors refer to literature and past studies in entrepreneurial focus areas. One note of importance is the realization that the entrepreneurial mindset is no longer the exclusive property of business owners and the context of only being related to commerce and business product development (Davis et al., 2014, p. 2). Higher education degrees in entrepreneurship are becoming more numerous, but there is "…currently little consensus regarding hallmarks of entrepreneurial mindset." Most of the research so far is theoretical and anecdotal (Davis et al., 2014, p.2).

As noted by Hisrich, Langan-Fox, and Grant (2007), "…the search for individual differences between entrepreneurs and non-entrepreneurs, and between more and less successful entrepreneurs, has produced a rather inconsistent body of evidence. So, we designed a project to identify a set of variables that clearly distinguish between entrepreneurs and non-entrepreneurs, and to create a tool to measure these variables" (Davis et al. 2014, p. 3).

While most entrepreneurial research has given thought to factors that might influence the chances of entrepreneurial success, the research that focuses more on innovation and creativity seems to be more concerned with situational characteristics that may be predictors (Davis et al., 2014, p. 3). This concept is in line with this study's focus on the measurement of entrepreneurial intent and predictors of behaviors.

Davis (2014) and his colleagues hypothesized that there were certain characteristics that distinguished entrepreneurial intent and that this construct could be measured, so they set their sights on creating a tool to do just that (p. 5). To start their work, they used a sample of 300 working adults who answered questions from scales to measure skills and personal characteristics, asking how the statement described them on a five-point Likert scale ranging from "does not describe me" to "describes me very well" (Davis et al., 2014, p. 5). After an item analysis and exploratory factor analysis was performed on the data, a second version of the profile was created which added a scale for interpersonal sensitivity which they thought to be an attribute of leadership effectiveness. Also added was an assessment of the willingness to take on risk, a commonly presented attribute of entrepreneurs (Davis, et al., 2014).

It was important to the creators that the measurement scale could make a distinction between entrepreneurs and non-entrepreneurs. Any variable that was found not to do this was not included in the second version. There was good internal reliability, "…Cronbach alpha .67 to .85 with only one value below .70, so everything was moved on to the second phase" (Davis et al., 2014, p. 7).

Through their analysis, they found that entrepreneurs and non-entrepreneurs showed significant differences at $p < .01$ level on each of the scales used in the measurement, so they knew that they had a reliable measurement tool (Davis et al., 2014, p. 8).

The EMP used the following scales/criteria for measurement: a)Personality scales: independence, preference for limited structure, nonconformity, risk acceptance, action orientation, passion, need to achieve; and b)Skills scales: future focus, idea generation, execution, self-confidence, optimism, persistence, interpersonal sensitivity (Davis et al., 2014).

The creation team was careful to suggest the tool was more one of skill development and warned against using it as a way of selecting employees, etc., as the skills and characteristics measured could vary greatly by situation. It was also realized that some of the participants might not have been valid in self-reporting. An interesting find of the team, however, was that "…personality dimensions predicted entrepreneurial status more strongly than did skills" (Davis et al., 2014, p. 13). This is interesting because in other literature, personality traits were not seen as effective in determining an entrepreneurial mindset. It validates, however, that entrepreneurial characteristics are important in determining thinking and intent that is entrepreneurial.

Entrepreneurial Intention Questionnaire (EIQ)

Another measurement tool, The Entrepreneurial Intention Questionnaire, or EIQ, is adapted from Ajzen's Theory of Planned Behavior or TPB (1991). Liñán and Chen (2006) used some of the elements of the TPB to create an assessment tool to measure entrepreneurial intention. Their intent was to do this for cross-cultural discoveries and realized that they needed a way to measure. First, their thinking was that the TPB was limited when considering social norms in determining entrepreneurial intent. “Ajzen (1991) calls “antecedents” the set of cognitive variables that would exert their influence on intention (personal attitude towards the behavior, perceived social norms, and perceived behavioral control).” It was felt that a more favorable view of these “antecedents” would influence an individual to act (Liñán & Chen, 2006, p. 3).

Liñán and Chen (2006) contend that there are three attitudes towards the behavior: Personal Attraction, or (PA), which deals with the attractiveness of the idea of entrepreneurship, Perceived Social Norms, or (SN) the social pressure involved in acting, and Perceived Behavioral Control, or (PBC) which is the perceived option to act and also the decision to act. The idea of PBC is similar to the characteristic of self-efficacy, but it would include not only being able to act but controlling the act. It is also similar to Shapero’s (1975) Entrepreneurial Event (SEE) theory which is closely aligned with Ajzen’s (1991) Theory of Planned Behavior (TPB).

The EIQ was developed with three goals in mind. First, it was an attempt to create a measurement tool that would work across cultures, and it was developed initially to compare the construct in two countries. A second goal was to develop a new instrument that would solve issues of other attempted measurement tools, and a third was to try to incorporate social norms into the process in a different way. The measurement tool was found to be effective, but it was very similar to the TPB, even using the three theories of behavior in a similar way (Liñán & Chen, 2006).

Theory

In the article, "*Competing Models of Entrepreneurial Intentions*," by Krueger, Reilly, & Carsrud (2000), a comparison is made between two theories, Ajzen's (1991) Theory of Planned Behavior, (TPB), and Shapero's (1975) Theory of the Entrepreneurial Event, (SEE).

Both theories are associated with self-efficacy; however, Shapero's theory adds the desire to act along with the theories of behaviors that both theories include. As stated earlier when discussing the EIQ measurement tool, the theories are categorized as Personal Attraction, or PA, which deals with the attractiveness of the idea of entrepreneurship, Perceived Social Norms, or (SN) the social pressure involved in acting, and Perceived Behavioral Control, or (PBC) which is the perceived option to act and also the decision to act (Liñán & Chen, 2006). The propensity to act is added as a part of the Shapero theory. Some entrepreneurial individuals may have the desire to act don't ever follow through (Krueger, et al., 2000).

Both theories lean toward predicting behavior rather than explaining behavior. This involves observation of an individual's intentions instead of looking at personal attitudes, beliefs, personality, or demographics (Krueger et al., 2000). For both theories, it is presented that entrepreneurial activity is intentionally planned behavior and not something that is a personality type or something that can be predicted by an individual's possession of certain characteristics. Even when an event takes place that spurs action, the desire may have been there for a long time but there was not an intentional push until now. According to Ajzen, "…when behavior is rare or difficult to observe, intentions offer critical insights into underlying processes such as opportunity recognition, making clear that these activities are planned and not responses to stimuli" (Krueger et al., 2000, p. 414).

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior is based on concepts of social psychology and contends that people are more likely to carry out certain behaviors when they feel that they can be successful, and perceived behavioral control has an impact on action.

Kim and Hunter's (1993) meta-analyses found that intentions successfully predict behavior, and attitudes successfully predict intentions. "Intentions explain 30% or more of the variance in behavior whereas 10% is usually explained by trait measures or attitudes" (Krueger et al. 2000, p. 416).

Entrepreneurial Event (SEE)

While the TPB contends that there are no barriers to action, the SEE Theory incorporates the propensity to act upon an event or opportunity. Based in entrepreneurial theory, the SEE requires an event to be presented to the individual before he or she feels the propensity or desire to act, and it also considers the degree to which an individual feels able or capable to act (Krueger et al., 2000).

Conclusions of the study were that every component of the Shapero model was supported statistically at $p<.05$, but the variance explained uniquely by the social norms of the Ajzen model was non-significant. The study did provide evidence that …"Intentions consistently and robustly predict planned behaviors. As entrepreneurship is a planned behavior, we should find intentions models quite useful. Understanding the antecedents of intentions implies understanding the behavior. Attitudes influence behavior through effects on intentions.

Intentions and attitudes depend on the situation and person" (Krueger et al., 2000, pp. 425-26). This last statement is critical in looking at the three components of entrepreneurial intent, behavioral, normative, and control.

Teachers and Entrepreneurial Intentions

Elements of the TPB and the SEE can be used to predict entrepreneurial behavior. Teachers' decision-making each day in their practice depends on some of the same things on which the two theories are based. These elements can also be applied to technology integration in the classroom. Teachers are often drawn to ideas and activities that they feel can "better" their practice. The new idea, however has to be attractive to the teacher and have a purpose before they will buy in (PA). However, the culture around them may dictate how they feel about the new technology (SN). If there is a reluctance on the part of colleagues or administrators to support a new endeavor, the teacher may not feel justified in acting. The option and the decision to act could be affected by the teacher's own determination of what he or she is or is not capable of, leaving integration to only those who have a strong propensity to move forward when given the opportunity (SBC). Whitaker, Zoul, and Casas, in *What Connected Educators Do Differently,* (2015) believe that teachers make conscious decisions to become connected educators using technology and that teachers should model technology literacies for students. They also contend that teachers intentionally create meaningful ways to help students (Whitaker, et al., 2015).

Chand and Misra (2009) see teachers as social entrepreneurs and refer to them as "…people driven by the need to create social value…and by a cause or need or opportunity that has been spotted" (p. 221). They go on to say that these teachers have "…the skills to envision solutions and implement them" (p. 221). They further reference teachers as social entrepreneurs when they characterize them as "…those who are passionate about a cause, the fulfillment of which provides value or social return" (Chand & Misra, 2009, p. 221). In this respect, it is appropriate to say that teachers possess the seeds of becoming entrepreneurial. As an integral part of social capital and social reform, and in order to embrace the changes of the 21st century, teachers need to be intentional about acting upon activities that will improve their teaching and learning.

It is apparent from review of the literature surrounding frameworks formed to measure teachers' levels of technology integration and also studies of measures created for the purpose of measuring the entrepreneurial characteristics and intentions of indlviduals, that there is merit in analyzing the relationship between these two constructs among preK-12 teachers. For this purpose, the six hypotheses aforementioned are used to test the assumption that there is a relationship between the teachers' levels of technology integration and their entrepreneurial characteristics and intention.

Chapter III: Methods

Participants

The study was conducted by convenience sampling of 213 participants who were drawn from a population of Pre-K-12 Teachers (See Table 2). The participants, 43 male and 168 female, were recruited through communication technologies to take part in the study, and their identity was anonymous. The mean age of participants was 46.39 and ranged from 19 to 70. Levels of teaching included were Early Childhood, Elementary, Middle School, and High School. Also for the purpose of the study, teachers were categorized into two categories of years of teaching: 1-10 and 11 or more.

Table 2. Demographics Information for 213 PreK-12 Teachers Across Variables

Variable	***Descriptives***
Level of Teaching[a]	102 Elementary
	135 Secondary
	24 Multiple Level
Years of Teaching[b]	43 1-10 Years
	170 11 or More Years
Gender[c]	43 Male
	168 Female
Age[d]	Mean 46.39

Note. [a]*The elementary level contains those teachers who teach early childhood and elementary students. The secondary level contains teachers who teach middle school and high school. Twenty-four of those teachers teach more than one level and had opportunity to choose "all that apply."* [b]*Based on the years of teaching determined as 1-10 years or 11 or more years, recoded to two categories..* [c]*Items available as male, female, other, prefer not to answer, recoded to male and female and eliminating other responses.* [d]*The age of participants ranged from 19-70 years.*

Procedures

A four-part survey developed in Qualtrics was distributed to participants by a public hyperlink. Social networking and online communication tools were used to distribute the link to a population of Pre-K -12 teachers. Participants of the study were all PreK-12 Teachers. Geographic area was not requested in the demographics. Participants were given just short of one week to take the survey. All participants were given the same Qualtrics survey, and questions were identically ordered and presented. All received the same instructions, posted at the beginning, for taking the survey. By creating a public hyperlink, the survey could be distributed through various social networks and professional communities.

A recruitment email was sent to a public domain listserv provided to the investigator by a local university through the Constant Contact online program (See Appendix H). Twitter messages were created and dispersed using hashtags for educational communities across all 50 states. Invitations for participation were also dispersed to members of Google+ communities of which the investigator is a part. In addition, email invitations were dispersed to a multi-state network of educational communities which are part of the investigator's work community and to volunteers directly within the investigator's work community. Snowball sampling occurred as participants were given the option to relay the survey link to others in their educational communities. All participants were presented with informational consent at the beginning of the survey (See Appendix I).

Of the 213 participants, 43% reported themselves as elementary-level teachers (early childhood and elementary) and 57% reported themselves as secondary-level teachers (middle school and high school). In addition, 24 of the participants reported teaching at more than one level. 20% of the participants had been teaching only 1-10 years, while 80% had been teaching 11 years or more. In terms of gender, 20.2% of the participants were male, and 78.9% were female. Two of the participants either marked, “other,” or, “prefer not to answer,” and were excluded from the analyses, as gender was dummy coded to 0 male and 1 female. Finally, the mean age of participants was 46.39, ranging from 19 to 70, a span of 51 years from youngest to oldest. All participants were given the same Qualtrics survey, and questions were ordered the same. All received the same instructions, posted at the beginning, for taking the survey.

Instruments

The four-part survey was distributed to participants by electronic link. <u>Part one</u> contained 27 items asking participants how they used or integrated technology. These questions, on a five-point Likert scale measured as (1) strongly disagree to (5) strongly agree, were adapted from the T3 Technology Framework concentrating on three levels of integration, translational, and transcendent. Translational level of integration had sub-categories of automation and consumption; transformational, sub-categories of production and contribution; and transcendent, sub-categories of inquiry design and social entrepreneurship. Sample items include “I use digital tools to save time,” “I use digital tools to produce works that represent my learning or knowledge,” and “I use digital tools to solve authentic problems.”

The questions contained in the technology integration portion of the survey (See Appendix B,C, and D) were adapted from the T3 Framework discussed in *Disruptive Classroom Technologies: A Framework for Innovation in Education* (Magana, 2017). Magana’s Framework has been used by school districts and has been a part of Magana’s consulting and professional development practices. Among those who provided testimonials to its merit are many educational futurists and technology advocates including Dr. Michael Fullen, Professor Emeritus, University of Toronto; Dr. Yong Zhao, Distinguished Professor, University of Kansas; Alan November, Founder of *November Learning* and author of *Empowering the Future with Technology*; Dr. Edwin Gragert, iEARN; Mark Sparvell, Microsoft Worldwide Education Team; and administrators and technology coordinators in school districts both national and international. Magana's impetus for writing the book and creating the framework came from research and many years in education. The founder of *Magana Education*, Dr. Magana, a Milken national award winner, is an entrepreneur himself with many startups to his name including founding and serving as principal of Washington State's first CyberSchool in 1996 (Magana, 2017). The questions used in the survey solicited responses characteristic of each of the three levels of technology that form the T3 framework. It is believed that the responses of the participants created a realistic profile of technology use and integration.

<u>Part two</u> contained a list of 20 Entrepreneurial characteristics as presented and repeated throughout the literature (See Appendix E). Participants responded per a 5-point Likert scale on how each characteristic described him/her as measured by (1) definitely false to (5) definitely true. Sample items were "visionary," "passionate," and "creative and innovative."

The entrepreneurial characteristics listed as choices for participants were repeated throughout literature and research. The items were pulled from a larger set of characteristics that were sent to individuals of entrepreneurial practice and study. The list was sent to these individuals through a survey using a five-point Likert scale and they were asked to rate 27 characteristics as (1) do not prefer to (5) prefer a great deal. Through analysis, the list was condensed to those characteristics only receiving a rating of 3.5 or above to create a core set of characteristics for entrepreneurial individuals.

Part three contained questions adapted from the central elements of the Entrepreneurial Intention Questionnaire (EIQ) as they relate to the Theory of Planned Behavior (TPB). Questions were divided into sub-categories of control beliefs (6 questions), behavioral beliefs (5 questions), and normative beliefs (3 questions). (See Appendix F). Participants answered all questions on a 5-point Likert scale measured as (1) strongly disagree to (5) strongly agree.

For entrepreneurial control beliefs, participants were given the following prompt: "To what extent do you agree or disagree with the following statements regarding your entrepreneurial capacity to start a new educational program?" Sample items include "To start a new educational program and keep it progressing would be easy for me," and I am prepared to start a new educational program."

For entrepreneurial behavioral beliefs, participants were given the following prompt: "Consider this definition of ENTREPRENEURSHIP: The capacity and willingness to develop, organize, and manage a significant educational initiative such as a new curriculum, new program, or new institution along with any of its risks in order to improve teaching and learning. Indicate your level of agreement with the following." Sample items include "Being an entrepreneur implies more advantages than disadvantages to me," and "A career as an entrepreneur is attractive for me."

For entrepreneurial normative beliefs, participants were given the following prompt: Indicate your level of agreement with the following." Sample items include "My close family would support my decision to start a new educational program," and "My friends would support my decision to start a new educational program."

The questions on entrepreneurial intention provided responses from participants that measured their entrepreneurial intentions in three areas: control beliefs, behavioral beliefs, and normative beliefs. The questions used in the survey were adapted to reflect educational terminology taken from questions that are part of the Entrepreneurial Intention Questionnaire used in a study conducted by Liñán and Chen (2006), "Testing the Entrepreneurial Intention Model on a Two-Country Sample," and adapted from Ajzen's Theory of Planned Behavior. Similar scales have been used by other researchers, and Liñán and Chen (2006) verified the construct validity and psychometric properties validation of the EIQ as a scale for measuring entrepreneurial intention. The section of this questionnaire used questions to solicit responses from participants to measure their beliefs concerning entrepreneurial intention, and it is believed that the questions on this survey have provided the same.

Part four asked participants to give demographic information of teaching level (selection included early childhood, elementary, middle school, or high school), years of teaching (selection of 1-10, 11 or more), gender (selection of male, female, other, prefer not to answer), and age (numeric entry). Participants could select all levels of teaching that applied to them (See Appendix G). The demographics used would allow other research to be conducted for a generalized population.

Design and Analysis

Below is a description of the applicable instruments, measurements scales, and sample items for each of the six hypotheses tested (See Table 3). The complete survey instruments including all items appear in the appendices. For the survey, participants were provided two definitions for clarity. Digital tools was defined as electronic technology that creates, stores, or manipulates content to be used in a teaching and learning context. Entrepreneurship was defined as the capacity and willingness to develop, organize, and manage a significant educational initiative such as a new curriculum, new program, or new institution along with any of its risks in order to improve teaching and learning.

Repeated Multiple Regression Analyses were run in SPSS to look for relationships among levels of technology integration, entrepreneurial characteristics, entrepreneurial intention, and demographics. The criterion variable for most of the analyses was Total Technology Integration which was a mean of the responses of participants on 27 items adapted from the T3 Technology Integration Framework. This included eight items related to the Translational Level labeled T.1.1 or Automation, three items related to the Translational Level labeled T1.2 or Consumption, four items related to the Transformational Level labeled T2.1 or Production, six items related to the Transformational Level labeled T2.2 or Contribution, three items related to the Transcendent level labeled T3.1 or Inquiry Design, and four items related to the Transcendent level labeled T3.2 or Social Entrepreneurship.

Table 3. Research Questions, Hypotheses, and Analyses

Research Question	In relation to Pre-K -12 Teachers, how are Levels of Teaching, Years of Teaching Experience, Gender, Age, Entrepreneurial Characteristics, and Entrepreneurial Intent related to Levels of Technology Integration?

Hypotheses	**Analysis**
Hypothesis 1[a]: There is a relationship between the overall level of technology integration, (including subscales of the translational level, transformational level, and transcendent Level), and the participants' demographics of teaching level, years of teaching, gender, and age.	Multiple Regression
Hypothesis 2[b]: There is a relationship between the overall level of technology integration, (including subscales of the translational level, transformational level, and transcendent Level), and the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs).	Multiple Regression
Hypothesis 3[c]: There is a relationship between the participants' overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs), and the participants' demographics of teaching level, years of teaching, gender, and age.	Multiple Regression
	Multiple Regression

Hypothesis 4[d]: There is a relationship between the Technology Integration Subscale level, “Translational,” and the participants’ overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs).	
Hypothesis 5[e]: There is a relationship between the Technology Integration Subscale level, “Transformational,” and the participants’ overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs).	Multiple Regression
Hypothesis 6[f]: There is a relationship between the Technology Integration Subscale level, “Transcendent,” and the participants’ overall Entrepreneurial Characteristics and Intent, (including intent subscales of control beliefs, behavior beliefs, and normative beliefs).	Multiple Regression

Note. [a]*Criterion Variable: Overall Technology Integration. Predictor Variables: Demographics.* [b]*Criterion Variable: Overall Technology Integration. Predictor Variables: Entrepreneurial Characteristics and Intention.* [c]*Criterion Variable: Overall Entrepreneurial Characteristics and Intention. Predictor Variables: Demographics.* [d]*Criterion Variable: Translational Level of Technology Integration. Predictor Variables: Overall Entrepreneurial Characteristics and Intention.* [e] *Criterion Variable: Transformational Level of Technology Integration. Predictor Variables: Overall Entrepreneurial Characteristics and Intention.* [f] *Criterion Variable: Transcendent Level of Technology Integration. Predictor Variables: Overall Entrepreneurial Characteristics and Intention.*

The criterion variable for two of the analyses was Total Entrepreneurship. This included Entrepreneurial Characteristics and Entrepreneurial Intention. Entrepreneurial characteristics were a list of 20 characteristics presented as characteristic of entrepreneurs. These terms came from the literature, and many were repeated throughout much of the literature on entrepreneurism. Originally a longer list, a survey with the list of characteristics was sent to entrepreneurship professors at the University of Kansas, practicing entrepreneurs, and students studying entrepreneurism in order to create a shorter and more valid list of characteristics. The survey allowed these participants to rate the characteristics in terms of their relevance. All items that received a rating of a 3.5 or higher on a five-point Likert scale were retained, leaving 20 items to be listed as items on the study survey.

The total entrepreneurship variable also included the means of participant responses to questions based on entrepreneurial intent, modeled after that section of the Entrepreneurial Intention Questionnaire (EIQ) adapted from the Theory of Planned Behavior (TPB). This included six questions related to the participants' intention control beliefs, five questions related to the participants' intention behavioral beliefs, and three questions related to the participants' intention normative beliefs.

The sub-scales for technology integration, entrepreneurial characteristics, and sub-scales of entrepreneurial intention were used throughout the analyses as predictor variables. Demographics were also used as predictor variables. Demographics included four items. Level of teaching was requested with choices early childhood, elementary, middle school, and high school, recoded as two items, elementary (early childhood and elementary), and secondary (middle school and high school). Years of experience was requested with four choices 1-10, 11-20, 21-30, and 31 or more, recoded to two items, 1-10 and 11 or more. Gender was requested with four choices, male, female, other, prefer not to answer, recoded to two items, male and female. Age was requested as a numeric entry.

Chapter IV: Results

Reliability

The survey instrument was mostly based on Likert responses, so the 62 interval measured variables were tested for reliability. A Cronbach's alpha of .70 or more was desired. An indication of reliability of items was determined (Cronbach's α = .95). In addition, a bivariate matrix of all variables was examined and no multicollinearity was found.

Analysis

Hypothesis One. A multiple linear regression was conducted using SPSS statistical software for hypothesis one to predict the relationship of K-12 teachers' levels of overall technology integration as measured by the T3 Technology Integration Framework with subscales translational, transformative, and transcendent and demographics of teaching Level, years of teaching, gender, and age. Hypothesis one was not supported. Table 4 presents data to show the relation of the individual predictors.

A regression equation was found (F (5,203) =1.11, p=.36), resulting in an R^2 not significant at.03 and an adjusted R^2 at .00 which reflected no variance in the criterion variable of overall technology integration accounted for by the demographics of level of teaching, years of experience, gender, and age.

The teacher participants' predicted Technology Integration Level is equal to 3.57 +.20 (secondary teaching level) + .11 (elementary teaching level) -.06 (Years of Teaching) +.22 (Gender) +.00 (Age), where Teaching Level is measured as Elementary 0, Secondary 1; Years of

Teaching is measured as 0 (1-10), 1 (11 or more); Gender is measured as 0 (Male), 1(Female); and Age is numerically measured as years.

Table 4. Summary of Multiple Regression Analysis for Demographic Variables Predicting Overall Levels of Technology Integration

	Overall Technology Integration including subscales of Levels[a]				
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	3.58	.35		10.29	.00
Years of Teaching Experience	-.06	.12	-.04	-.51	.61
Gender	.22	.12	.14	1.88	.06
Age	.00	.01	.00	.02	.98
Secondary Teaching Level	.20	.12	.16	1.62	.11
Elementary Teaching Level	.11	.12	.08	.89	.38
Overall					
R^2_{adj}					.00
F					1.11
Sig.					.36

Note. [a]*T3 Framework Technology Integration Levels as subscales of Criterion Variable: Translational, Transformative, Transcendent*

None of the demographics used had a significant relationship to Technology Integration levels at the .05 level of significance although gender was close: secondary teaching Level (B=.20, p =.11), elementary teaching level (B=.11, p =.38), Years of Teaching (B=-.06, p =.61), Gender (B=.22, p =.06), and Age (B=.00, p =.98).

Hypothesis Two. A multiple linear regression was conducted using SPSS statistical software for hypothesis two to predict the relationship to K-12 teachers' levels of overall technology integration as measured by the T3 Technology Integration Framework with sub-scales translational, transformative, and transcendent and overall entrepreneurial characteristics and entrepreneurial intention with sub-scales of control beliefs, behavioral beliefs, and normative beliefs. Hypothesis two was supported. Table 5 presents data to indicate the relation of the individual predictors. A regression equation was found (F (4,202) =14.86, p=<.01), resulting in a significant R^2 at .23 and an adjusted R^2 at .21 meaning that near a high amount, 21%, of the variance in the criterion variable of overall technology integration was accounted for by entrepreneurial characteristics and intention. The teacher participants' predicted Technology Integration Level is equal to 1.53 +.55 (mean entrepreneurial characteristics) +.55 (mean entrepreneurial intention control beliefs) -.02 (mean entrepreneurial intention behavioral beliefs) -.07 (mean entrepreneurial intention normative beliefs), where entrepreneurial characteristics is measured as 1-5, entrepreneurial intention control beliefs is measured as 1-5, entrepreneurial intention behavioral beliefs is measured 1-5, and entrepreneurial intent normative beliefs is measured as 1-5. Two of the predictor variables used had a significant relationship to Technology Integration levels at the .05 level of significance: entrepreneurial characteristics (B=.55, p = <.01) and entrepreneurial intention control beliefs (B=.14, p = .01).

The other predictor variables did not show a significant relationship: entrepreneurial intention behavioral beliefs (B=-.02, p = .67) and entrepreneurial normative beliefs (B=-.07, p = .19).

Table 5. Summary of Multiple Regression Analysis for Overall Entrepreneurial Characteristics and Intention Predicting Overall Levels of Technology Integration

Overall Technology Integration including subscales of Levels[a]					
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	1.53	.45		3.44	.00
Entrepreneurial Characteristics	.55	.12	.36	4.67	<.01*
Entrepreneurial Intention: Control Beliefs	.14	.05	.22	2.66	.01*
Entrepreneurial Intention: Behavioral Beliefs	-.02	.05	-.04	-.42	.67
Entrepreneurial Intention: Normative Beliefs	-.07	..05	-.09	-.33	.19
Overall					
R^2_{adj}					.21
F					14.86
Sig.					<.01*

Note. [a]*T3 Framework Technology Integration Levels as subscales of Criterion Variable: Translational, Transformative, Transcendent*

**Significant at the p ≤ .05 level*

When we consider the unstandardized Beta weights of each of the variables involved in the analysis of this hypothesis, we find that with the finding of a significant relationship at p<.01, over half of the change in the criterion variable of total technology integration provided by an individual predictor variable is that of entrepreneurial characteristics at .55 which is four times the weight of any of the other variables involved. Entrepreneurial characteristics is significant at $p<.01$ and is joined by Entrepreneurial Control beliefs as a predictor significance at $p=.01$ at the $p\leq .05$ level of significance.

Hypothesis Three. A multiple linear regression was conducted using SPSS statistical software for hypothesis three to predict the relationship to overall entrepreneurial characteristics and entrepreneurial intention with sub-scales control beliefs, behavioral beliefs, and normative beliefs and demographics of teaching Level, years of Teaching, gender, and age. Hypothesis three was not supported. Table 6 presents data to indicate the relation of the individual predictors. A regression equation was found ($F (5,204)=0.11$, $p=.99$), resulting in an R^2 not significant at .00 and an adjusted R^2 at -.02 which reflected no variance in the criterion variable of entrepreneurial characteristics and intention accounted for by the demographics of level of teaching, years of experience, gender, and age. The teacher participants' predicted overall entrepreneurial score including entrepreneurial characteristics and entrepreneurial intention sub-scales of control beliefs, behavioral beliefs, and normative beliefs is equal to 3.83 -.03 (secondary teaching level) -.04 (elementary teaching level) -.03 (years of teaching experience) +.02 (gender) +.00 (age), where Teaching Level is measured as Elementary 0, Secondary 1; Years of Teaching is measured as 0 (1-10), 1 (11 or more); Gender is measured as 0 (Male), 1(Female); and Age is numerically measured as years. None of the predictor variables used had a significant relationship to overall entrepreneurial characteristics and entrepreneurial intention with sub-scales of control beliefs, behavioral beliefs, and normative

Table 6. Summary of Multiple Regression Analysis Demographics Predicting Overall Entrepreneurial Characteristics and Intention

	Overall Entrepreneurial Characteristics and Intention including subscales of Intention[a]				
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	3.83	.28		13.52	.00
Years of Teaching Experience	-.03	.10	-.02	-.27	.79
Gender	.02	.09	.02	.23	.82
Age	.00	.00	.05	.58	.56
Secondary Teaching Level	-.03	.10	-.03	-.26	.80
Elementary Teaching Level	-.04	.10	-.04	-.39	.70
Overall					
R^2_{adj}					-.02
F					.11
Sig.					.99

Note. [a]*Entrepreneurial Intention Subscales: Control Beliefs, Behavioral Beliefs, and Normative Beliefs.*

beliefs at the .05 level of significance: secondary teaching Level (B=-.03, p =.80), elementary teaching level (B=-.04, p =.70), Years of Teaching (B=-.03, p =.79), Gender (B=.02, p =.82), and Age (B=.00, p =.56).

Hypothesis Four. A multiple linear regression was conducted using SPSS statistical software for hypothesis four to predict the relationship to K-12 teachers' translational level of technology integration as measured by the T3 Technology Integration Framework, with sub-categories automation and consumption, and overall entrepreneurial characteristics and entrepreneurial intention with sub-scales control beliefs, behavioral beliefs, and normative beliefs. Hypothesis four was supported. Table 7 presents data to indicate the relation of the individual predictors. A regression equation was found (F (4,202) =3.63, p=.01), resulting in a significant R^2 at .07 and an adjusted R^2 at .05 meaning that entrepreneurial characteristics and intent accounted for 5% of the variance in the criterion variable of translational technology integration. The teacher participants' predicted translational technology integration Level is equal to 3.18 +.23 (mean entrepreneurial characteristics) +.09 (mean entrepreneurial intention control beliefs) +.01 (mean entrepreneurial intention behavioral beliefs) -.06 (mean entrepreneurial intention normative beliefs), where entrepreneurial characteristics is measured as 1-5, entrepreneurial intention control beliefs is measured as 1-5. Entrepreneurial intention behavioral beliefs is measured 1-5, and entrepreneurial intent normative beliefs is measured as 1-5. None of the predictor variables used had a significant relationship to the translational technology integration level at the .05 level of significance: entrepreneurial characteristics (B=.23, p = .07) and entrepreneurial intention control beliefs (B=.09, p = .11), entrepreneurial intention behavioral beliefs (B=.01, p = .84) and entrepreneurial normative beliefs (B=-.06, p = .22).

Table 7. Summary of Multiple Regression Analysis for Overall Entrepreneurial Characteristics and Intention Predicting Translational Level of Technology Integration

	Translational Technology Integration Level[a]				
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	3.18	.47		6.73	.00
Entrepreneurial Characteristics	.23	.13	.15	1.80	.07
Entrepreneurial Intention: Control Beliefs	.09	.06	.15	1.61	.11
Entrepreneurial Intention: Behavioral Beliefs	.01	.05	.02	.20	.84
Entrepreneurial Intention: Normative Beliefs	-.06	.05	-.09	-1.22	.22
Overall					
R^2_{adj}					.05
F					3.63
Sig.					.01*

Note. [a]*The Translational Technology Integration Level includes automation and consumption.*

**Significant at the p ≤ .05 level*

Hypothesis Five. A multiple linear regression was conducted using SPSS statistical software for hypothesis five to predict the relationship to K-12 teachers' transformational level of technology integration as measured by the T3 Technology Integration Framework, with sub-categories production and contribution, and overall entrepreneurial characteristics and entrepreneurial intention with sub-scales control beliefs, behavioral beliefs, and normative beliefs. Hypothesis five was supported. Table 8 presents data to indicate the relation of the individual predictors. A regression equation was found (F (4,202) =15.73, p=<.01), resulting in a significant R^2 at .24 and an adjusted R^2 at .022 meaning that 22% of the variance in the criterion variable of transformational technology integration can be accounted for by entrepreneurial characteristics and intention. The teacher participants' predicted transformational technology integration level is equal to .99 +.70 (mean entrepreneurial characteristics) +.17 (mean entrepreneurial intention control beliefs) -.08 (mean entrepreneurial intention behavioral beliefs) -.06 (mean entrepreneurial intention normative beliefs), where entrepreneurial characteristics is measured as 1-5, entrepreneurial

intention control beliefs is measured as 1-5, entrepreneurial intention behavioral beliefs is measured 1-5, and entrepreneurial intent normative beliefs is measured as 1-5. Two of the predictor variables used had a significant relationship to transformational integration levels at the .05 level of significance: entrepreneurial characteristics (B=.70, p = <.01) and entrepreneurial intention control beliefs (B=.17, p = .01). The other predictor variables did not have a significant relationship: entrepreneurial intention behavioral beliefs (B=-.08, p = .14) and entrepreneurial normative beliefs (B=-.06, p = .27).

Table 8. Summary of Multiple Regression Analysis for Overall Entrepreneurial Characteristics and Intention Predicting Transformational Level of Technology Integration

	Transformational Technology Integration Level[a]				
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	.99	.51		1.97	.05*
Entrepreneurial Characteristics	.70	.13	.39	5.21	<.01*
Entrepreneurial Intention: Control Beliefs	.17	.06	.24	2.80	.01*
Entrepreneurial Intention: Behavioral Beliefs	-.08	.06	-.12	-1.47	.14
Entrepreneurial Intention: Normative Beliefs	-.06	.06	-.07	-1.10	.27
Overall					
R^2_{adj}					.22
F					15.73
Sig.					<.01*

Note. [a]*The Transformational Technology Integration Level includes production and contribution.*

**Significant at the p ≤ .05 level*

Hypothesis Six. A multiple linear regression was conducted using SPSS statistical software for hypothesis six to predict the relationship to K-12 teachers' transcendent level of technology integration as measured by the T3 Technology Integration Framework, with sub-categories inquiry design and social entrepreneurism, and overall entrepreneurial characteristics and entrepreneurial intention with sub-scales control beliefs, behavioral beliefs, and normative beliefs. Hypothesis six was supported. Table 9 presents data to indicate the relation of the individual predictors. A regression equation was found (F (4,202) =23.68, p=<.01), resulting in a significant R^2 at .32 and an adjusted R^2 at .31 meaning that 31%, a high amount, of the variance in the criterion variable of overall technology integration can be accounted for by entrepreneurial characteristics and intention. The teacher participants' predicted transcendent technology integration level is equal to -.28 +.85 (mean entrepreneurial characteristics) +.18 (mean entrepreneurial intention control beliefs) +.02 (mean entrepreneurial intention behavioral beliefs) -.07 (mean entrepreneurial intention normative beliefs), where entrepreneurial characteristics is measured as 1-5, entrepreneurial intention control beliefs is measured as 1-5, entrepreneurial intention behavioral beliefs is measured 1-5, and entrepreneurial intent normative beliefs is measured as 1-5. Two of the predictor variables used had a significant relationship to transcendent level of technology integration at the .05 level of significance: entrepreneurial characteristics (B=.85, p = <.01) and entrepreneurial intention control beliefs (B=.18, p = .01). The other predictor variables did not have a significant relationship: entrepreneurial intention behavioral beliefs (B=.02, p = .74) and entrepreneurial normative beliefs (B=-.07, p = .23).

Table 9. Summary of Multiple Regression Analysis for Overall Entrepreneurial Characteristics and Intention Predicting Transcendent Level of Technology Integration

	Transcendent Technology Integration Level[a]				
Variable	*B*	*SE B*	*β*	t	Sig.
Constant	-.28	.55		-.52	.61
Entrepreneurial Characteristics	.85	.15	.42	5.87	<.01*
Entrepreneurial Intention: Control Beliefs	.18	.07	.22	2.75	.01*
Entrepreneurial Intention: Behavioral Beliefs	.02	.06	.03	.33	.74
Entrepreneurial Intention: Normative Beliefs	-.07	.06	-.08	-1.22	.23
Overall					
R^2_{adj}					.31
F					23.68
Sig.					<.01*

Note. [a]*The Transcendent Technology Integration Level includes inquiry design and social entrepreneurism.*

**Significant at the p ≤ .05 level*

Besides the single model analyses that were run for each hypothesis, two two-model analyses were run combining variables. The first was a multiple regression analysis for demographics and Entrepreneurial Characteristics and Entrepreneurial Control Intention, Behavior Intention, and Normative Intention predicting Overall Level of Technology Integration.

Two of the multiple regression analyses already conducted, one using demographics as predictor variables (hypothesis one), and one using overall means of entrepreneurial characteristics and entrepreneurial intent, including sub-scales of control beliefs, behavioral beliefs, and normative beliefs as predictor variables (hypothesis two) were conducted to predict the means of the overall levels of technology integration including sub-scales of translational, transformational, and transcendent levels. One analysis included the demographics as predictors (teaching level, years of teaching experience, gender, and age), while the second analysis included the means of entrepreneurial characteristics and entrepreneurial intentions including sub-scales of control beliefs, behavioral beliefs, and normative beliefs as predictors. The regression equation with the demographics was not significant with $R^2 = .03$, adjusted $R^2 = .00$, $F(5,203) = 1.11$, $p = .36$. However, the regression equation with the entrepreneurial characteristics and entrepreneurial intention added was significant, $R^2 = .23$, adjusted $R^2 = .21$, $F (4,202) = 14.86$, $p = <.01$. Based on these results, the entrepreneurial characteristics and entrepreneurial intentions, including sub-scales of control beliefs, behavioral beliefs, and normative beliefs appear to be better predictors of the overall levels of technology integration.

Next, a multiple regression analysis was conducted with all demographics and entrepreneurial characteristics and intent, including sub-scales of control beliefs, behavioral beliefs, and normative beliefs (See Table 10). The linear combination of the nine predictors was significantly related to the overall levels of technology integration, $R^2 = .25$, adjusted $R^2 = .22$, $F(9,195) = 7.27$, $p =<.01$. The entrepreneurial characteristics and entrepreneurial intent predicted significantly over and above the demographics, R^2change = .23, $F(9,195) = 7.27$, $p = <.01$, but the demographics did not predict significantly over and above the entrepreneurial characteristics and intention, R^2 change = .02, $F(5,199) = .81$, $p = .55$. Based on these results, the entrepreneurial characteristics and entrepreneurial intention measures appear to offer additional predictive power beyond that contributed by the demographics. Of the entrepreneurial characteristics and intention measures, the variables for entrepreneurial characteristics ($p = <.01$) and entrepreneurial sub-scale of control beliefs ($p = <.01$) most strongly related to the means for overall levels of technology integration.

The second was a multiple regression analysis of demographics and translational, transformational, and transcendent levels of technology integration together in a model predicting overall entrepreneurial characteristics and intent. This analysis was run after multiple regression analyses were already conducted, one using demographics to predict overall means of entrepreneurial characteristics and entrepreneurial intention including sub-scales of control beliefs, behavioral beliefs, and normative beliefs (hypothesis three), and the other using overall levels of technology integration including sub-scales of translational, transformative, and transcending levels of technology integration to predict overall means of entrepreneurial characteristics and entrepreneurial intention including sub-scales of control beliefs, behavioral beliefs, and normative beliefs (hypothesis two).

Table 10. Summary of Two-Model Multiple Regression Analysis for Demographics and Entrepreneurial Characteristics and Entrepreneurial Control Intention, Behavior Intention, and Normative Intention Predicting Overall Level of Technology Integration

Overall Technology Integration Level[a]

	Model 1					Model 2				
Variable	*B*	*SE B*	*β*	t	Sig.	*B*	*SE B*	*β*	t	Sig.
Constant	3.82	.27		14.03	.00	1.67	.51		3.26	.00
Years of Teaching Experience	-.07	.12	-.04	-.53	.60	-.00	.11	-.00	-.03	.98
Gender	.21	.12	.13	1.77	.08	.22-	.11	.14	2.09	.04*
Age	.00	.01	.00	.03	.98	.00	.01	-.04	-.52	.61
Secondary Level of Teaching	.11	.15	.08	.73	.47	-.12	.14	-.09	-.89	.38
Elementary Level of Teaching	-.01	.15	-.01	-.08	.94	-.20	.13	-.15	-1.48	.14
Entrepreneurial Characteristics						.55	.12	.35	4.488	<.01*
Entrepreneurial Intention: Control Beliefs						.16	.06	.25	2.88	<.01*
Entrepreneurial Intention: Behavioral Beliefs						-.02	.05	-.03	-.37	.71
Entrepreneurial Intention: Normative Beliefs						-.08	.05	-.12	-1.64	.10
Overall										
R^2_{adj}					-.01					.22
F					.81					7.27
F change for R^2_{adj}										15.05
Sig.					.55					<.01*

Note. [a]*Overall Technology Integration Level includes sub-scales Translational (automation and consumption), Transformational (production and contribution), and Transcendent (inquiry design and social entrepreneurism)*
**Significant at the p ≤ .05 level*

The regression equation with the demographics was not significant with $R^2 = .00$, adjusted $R^2 = -.02$, $F(5,204) = .11$, $p = .99$. However, the regression equation with the overall means of levels of technology integration including subscales of translational, transformational, and transcendent levels of technology integration was significant, $R^2 = .07$, adjusted $R^2 = .05$, $F(4,202) = 3.63$, $p = .01$.

Next, a multiple regression analysis was conducted with all demographics and overall means of levels of technology integration including subscales of translational, transformational, and transcendent levels of technology integration (See Table 11). The linear combination of the nine predictors was significantly related to the overall entrepreneurial characteristics and intention, $R^2 = .32$, adjusted $R^2 = .29$, $F(8,200) = 11.53$, $p <.01$. The overall levels of technology integration predicted significantly over and above the demographics, R^2change = .04, $F(5,203) = 1.53$, $p = .18$, so the overall levels of technology integration did predict significantly over and above demographics, R^2 change = .28, $F(8,200) = .81$, $p = .55$. Based on these results, the overall technology integration measures appear to offer additional predictive power beyond that contributed by the demographics. Of the overall levels of technology integration measures, the variables for sub-scales translational level of technology integration ($p = .04$) and transcendent level of technology integration ($p = <.01$) most strongly related to the means for overall levels of entrepreneurial characteristics and intent. In addition, of the overall demographics, the variables for level of teaching (secondary level of teaching, ($p = .01$) and elementary level of teaching ($p = .02$)) most strongly related to the means for overall levels of entrepreneurial characteristics and intent.

Table 11. Summary of Two-Model Multiple Regression Analysis for Demographics and Translational, Transformational, and Transcendent Levels of Technology Integration Predicting Overall Entrepreneurial Characteristics and Intention

Overall Entrepreneurial Characteristics and Intention including subscales of Intention[a]										
	Model 1					Model				
Variable	*B*	*SE B*	*β*	t	Sig.	*B*	*SE B*	*β*	t	Sig.
Constant	3.52	.22		16.32	.00	2.57	.27		9.37	.00
Years of Teaching Experience	-.03	.10	-.02	-.28	.78	.09	.09	.07	1.11	.27
Gender	.02	.09	.01	.20	.85	-.02	.08	-.02	-.26	.80
Age	.00	.00	.02	.30	.76	.00	.00	.03	.52	.60
Secondary Level of Teaching	.32	.12	.30	2.41	.01*	.26	.10	.24	2.52	.01*
Elementary Level of Teaching	.28	.12	.28	2.63	.02*	.23	.10	.22	2.27	.02*
Translational Level of Technology Integration						-.16	.08	-.19	-2.09	.04*
Transformational Level of Technology Integration						.09	.08	.12	1.06	.30
Transcendent Level of Technology Integration						.34	.06	.54	5.65	<.01*
Overall										
R^2_{adj}					.01					.29
F					1.53					11.53
F change for R^2_{adj}										27.20
Sig.					.18					<.01*

Note. [a]*Overall Entrepreneurial Characteristics and Intention includes the sub-categories of Control Intention, Behavior Intention, and Normative Intention*
**Significant at the p ≤ .05 level*

Another multiple linear regression was conducted using SPSS statistical software to further predict the relationship to K-12 teachers' overall level of technology integration as measured by the T3 Technology Integration Framework, containing sub-scales translational level, transformational level, and transcendent level, grouping all variables as "technology total," and overall entrepreneurial characteristics and entrepreneurial intention with sub-scales control beliefs, behavioral beliefs, and normative beliefs, grouping all variables as "entrepreneurship total." Table 12 presents data to indicate the relation of the grouped predictors. A regression equation was found ($F (1,209) = 44.75$, $p < .01$), resulting in a significant R^2 at .18. The overall predicted total technology integration level is equal to 1.98 (mean total technology) +.52 (mean total entrepreneurship) where both are measured from 1-5.

To further the analyses and test the assumption that overall levels of technology integration and entrepreneurial characteristics and intention are related, a scatter plot indicates the distribution of variables within grouped variables "technology total" containing all means for sub-scale variables of translational, transformational, and transcendent levels, and "entrepreneurship total" containing means for all variables of entrepreneurial

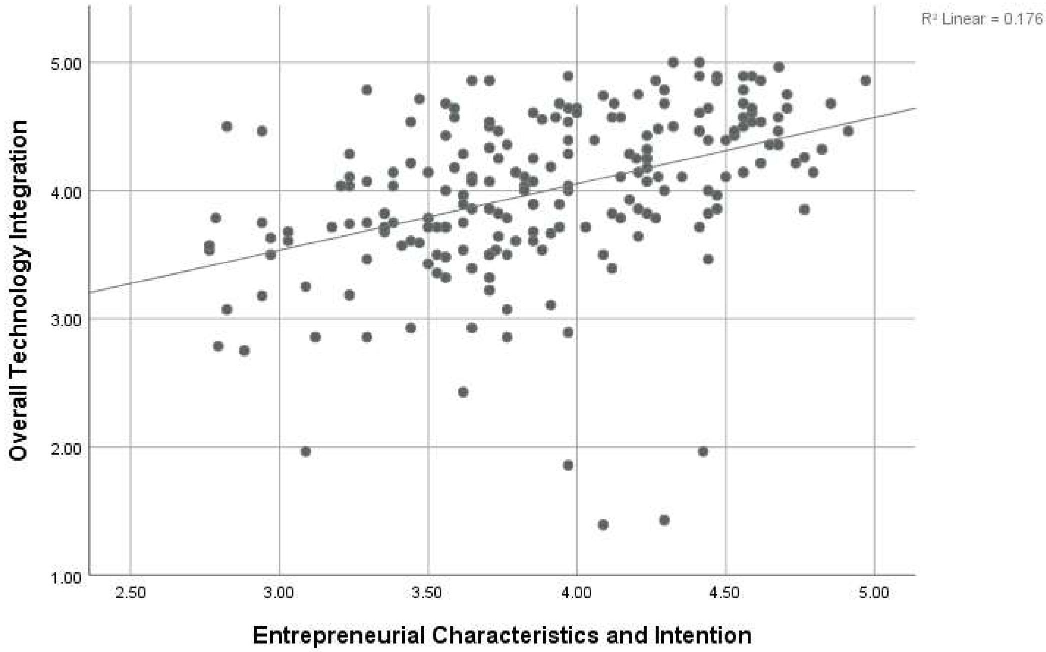
Table 12. Summary of Regression Analysis for Overall Levels of Technology Integration Predicting Overall Entrepreneurial Characteristics and Intention

Overall Levels of Technology[a]	Coefficients		
Variable	*B*	*SE B*	*β*
Constant	1.98	.31	
Total Entrepreneurial Characteristics and Intention	.52	.08	.42
R^2	.18		
F	44.75		
Sig.	<.01*		

Note. [a] Total Levels of Technology including sub-scales of translational level, transformational level, and transcendent level grouped as variable "tech total." Total entrepreneurial characteristics and intention including sub-scales of intention control beliefs, intention behavioral beliefs, and intention normative beliefs grouped as variable "entrepreneurship total."
*Significant at the p ≤ .05 level

characteristics, intention control beliefs, intention behavioral beliefs, and intention normative beliefs. Note the positive relationship, as an increase in entrepreneurial characteristics and intention (X) determines an increase in technology integration levels (Y). For the most part, variables follow a positive diagonal line. There are outliers, but there is still a positive relationship presented with a significance of $p < .01$ (See Figure 2).

Figure 2. Relationship of Data between Total Technology Integration and Entrepreneurial Characteristics and Intention



Note. SPSS generated Scatter Plot Entrepreneurial Characteristics and Intention regressed on Overall Levels of Technology Integration $R^2 = .18$, $F(1,209) = 44.75$, $p < .01^*$

Chapter V: Discussion

Summary

The significant relationship found between overall technology integration and entrepreneurial characteristics and intention confirms the necessity to include more professional development around higher-level use of technology to develop teaching practices that model entrepreneurial thinking for students. This is confirmed further by the significant relationship found between Entrepreneurial characteristics and intention and each of the translational, transformational, and transcendent levels of technology as defined by Magana's, (2017), T3 Technology Integration Framework.

Findings

<u>Study Participants</u>

The survey responses provided a good cross-section of educators as study participants. The ratio of elementary teachers (102) to secondary teachers (135) provided a balanced view of the technology integration practices of PreK-12 teachers The study had far more responses from experienced teachers with 170 teachers responding who had taught 11 or more years, and only 43 responding who had taught 1-10 years. I assumed that teachers who were new to the profession were probably younger and would have had more experience with technology on a personal basis, leading them to perhaps integrate technology into their teaching practices at a higher level. While measures of technology integration levels were somewhat even for the two categories of teaching levels, there was a higher tendency toward the transcendent level of integration for the 1-10 years of teaching experience group. This coincided with the above assumption. It was not surprising, then, to see that the more experienced group, assumed to be older, had a higher measure in the transitional level of technology integration.

Data Collection Process

The procedures used to collect and analyze data were effective and produced N=213 participants in a short period of time. Twitter and Google+ communities were key methods for capturing the attention of potential participants, and using email with a provided public domain listserv created a way to reach even those who might not use some of the collaborative online tools but still could provide some valuable information concerning technology integration and use of digital tools. If the study had stretched over a longer period, partnering with school districts to follow the process of approval for distributing mass communication messages would have been extremely effective in acquiring a larger number of participants. Another effective method of recruitment would have been to create business cards to distribute to conference attendees at various educational and educational technology conferences. With the conference administration's permission, a wider audience of technology users with varying levels of integration and demographic characteristics could be captured. In thinking of the regional and national conferences at which I present each year, this would have been a good audience to approach. For further studies, I would like to try this method to measure its effectiveness. The materials used were effective in measuring the variables as desired. Regardless of some of the demographic imbalances, the assumed hypotheses that set out to prove that there is a significant relationship between overall technology integration and entrepreneurial characteristics and intention were retained. It helped that even the portions of the survey measurement tool that dealt with entrepreneurism were written in understandable language to which all teachers could relate in terms relevant to their roles as teachers, not just those who were seen as entrepreneurial.

While sending out the link to prospective participants through social media might have been seen as creating bias in the results, recruiting those who are collaborative users of technology, the data collection was leveled through the use of email. Using the public domain listserv allowed the survey to be distributed to 10,000 random email accounts. Using Twitter with hashtags allowed recruitment of participants from national and international geographic demographics. Similarly, the use of Google+ communities allowed a strategic, while still random, method of recruiting a diverse set of PreK-12 teachers. The procedures worked, as the number of participants reached 213 within a matter of five days, forming an adequate data collection sample to allow analysis results in the study to be generalized to a larger population and also to allow opportunity of replication of the study by other researchers.

Technology Integration and Demographics

In analyzing the results of the data collection, there were some assumptions validated, and there were also some surprises. An assumption was made that the demographics of especially age, gender, and teaching experience would have an impact on a teacher's level of technology integration. The findings did not support this assumption. Females had a slightly higher measure of overall technology integration than did males. In fact, when the sub-scales of transitional level, transformative level, and transcendent level were broken down, females were measured higher at all three levels.

Neither males nor females measured at the top of the transcendent level supporting Magana's theory that most teachers never reach this level of technology integration (Magana

2017). The participant's age in relationship to overall technology integration was not significant and did not show any pattern.

In terms of years of experience, the transcendent level of technology integration measured higher with teachers who had taught 1-10 years, and teachers who had taught 11 or more years measured higher at the translational level. This fits an assumption that teachers with less experience might be younger and therefore be more familiar with technology and more willing to integrate it into teaching practice. In reviewing another demographic relationship of teaching level with the levels of technology integration measured, it was interesting to find that Pre-K, Elementary, and Middle School level teachers measured higher than high school. From my experience as a classroom teacher, I have often seen a difference in the type of technology professional development that is provided to different levels of teachers, so there was no surprise in seeing differences in how teachers use and integrate technology at various levels of teaching.

This coincides with what I have seen in terms of professional development and integration of new technologies in school districts. It seems that most districts will start technology initiatives first in the lower grades so that progress can be monitored and sustained as the students travel through the higher grades. It seemed logical, therefore, that other teaching levels might rank higher than high school for this reason. The information graphed is interesting and gives us a glimpse of the relationships even though none of the demographics were found to have a significant relationship with mean overall technology integration.

Technology Integration and Entrepreneurial Characteristics and Intention

In the analysis with mean entrepreneurial characteristics and intention regressed on mean overall technology integration, the relationship was found to be significant. This finding validated the overall concept that preK-12 teachers' levels of technology integration are related to entrepreneurial characteristics and entrepreneurial intention. In addition, two of the variables as part of that analysis were individually found to be significant with mean overall technology integration: entrepreneurial characteristics and intention control beliefs. These two examples of significance are not surprising since the entrepreneurial characteristics choices provided to participants included characteristics of "teacherpreneurs" as presented by Berry, (2013). Additionally, entrepreneurial intention control beliefs relate to individuals controlling their desires to act on an opportunity which is a trait that most teachers share as a part of daily making decisions for students and curriculum in their classrooms.

The significant relationship between overall levels of technology integration and entrepreneurial characteristics and intention is confirmed further when additional variables are added to analyses. In the analyses regressing a combination of demographics and entrepreneurial characteristics and intention on overall technology integration, the relationship is significant, even though the regression of demographics on overall technology integration did not confirm that overall entrepreneurial characteristics and intention are significantly related to overall technology integration while controlling for demographics. Likewise, in an analysis regressing a combination of variables for demographics and overall levels of technology integration on overall entrepreneurial characteristics and entrepreneurial intention, there is a significant relationship found, even though there was not a significant relationship measured when demographics were regressed on overall entrepreneurial characteristics and intention. Overall levels of technology integration related significantly to overall entrepreneurial characteristics and intention while controlling for demographics.

Technology Integration By Level and Entrepreneurial Characteristics and Intention

By breaking down the mean overall technology integration into the three levels of translational, transformational, and transcendent, I was able to better understand the significant relationships to mean overall entrepreneurial characteristics and intention. The mean translational level of technology integration, including sub-categories of automation and consumption, was found to be significantly related to entrepreneurial characteristics and entrepreneurial intent though no individual variables were significantly related.

The mean transformational level of technology integration was also found to be significantly related to overall entrepreneurial characteristics and intention. In addition, unlike in the analysis using the transitional level variables, two of the individual variables also showed a significant relationship: entrepreneurial characteristics and entrepreneurial intention control beliefs. It is understandable that with each higher level of technology integration, there would be individual variables that would show significance because those who do integrate technology at higher levels, it is assumed, would possibly be more entrepreneurial in both characteristics and intention. Similarly, the analysis conducted that regressed the mean transcendent level of technology on entrepreneurial characteristics and intention measured a significant relationship, and the same two individual variables, mean entrepreneurial characteristics and entrepreneurial intention, showed significant relationships as well.

Entrepreneurial Characteristics and Demographics

When regressed on mean entrepreneurial characteristics and intention, demographics did not show a significant relationship. This was surprising, as it was assumed that gender and age would show a relationship. Not only was there no significant relationship overall, but none of the predictor variables, including gender and age, related significantly. It was interesting, though, to break down the entrepreneurial characteristics and entrepreneurial intention beliefs for more information. In graphing age and the entrepreneurial characteristic of risk taking, for example, it was assumed that younger individuals would be more prone to risk taking; however, that was not the case in this analysis. For gender, males measured higher in the indicator of the entrepreneurial characteristic of risk taking.and also in the entrepreneurial intention control belief.

This was assumed and not surprising since literature recognizes the male bias in the area of entrepreneurship. Articles such as “Academic Entrepreneurship: Gendered Discourse and Ghettos,” conclude that men are seen as the norm in terms of entrepreneurship, and women are seen as a subgroup or a different “type” of entrepreneur (Fältholm, Abrahamsson, & Källhammer, 2010, p. 57). In addition, outsourcing of jobs may force more women into entrepreneurship (Fältholm, et al., p. 53).

This finding supports the research of Liñán, et al. (2010) who determined that researchers have identified variables that may explain entrepreneurial intention and behavior including the influence of gender (p. 199). Gender, as stated previously, had a significant relationship with overall entrepreneurial characteristics and intentions when holding for the other demographics included in the analysis. Also supported in the results is the idea that an individual's perception of acting entrepreneurially is a determination of entrepreneurial behavior influenced by personal attitude and social norms, following closely the constructs studied in the Theory of Planned Behavior. Based on the significance of behavioral control when regressed in the analysis with overall entrepreneurial characteristics and intention while holding for other variables.

Implications for Theory and Research

Wagner and Compton (2015) in *Creating Innovators: The Making of Young People Who Will Change the World,* wonders where we should start working with learners if we agree that there are certain capabilities that we need to develop and certain characteristics that are needed for youth to be successful in the world. One place to start is in creating role models of teachers. As the study indicates, encouraging teachers to integrate learning technologies at a higher level is certainly related to developing the characteristics and practices of being entrepreneurial.

Teachers will be challenged in the next five years to use technology in the classroom, but our student population demands it. School districts and teachers will have to look past filtering systems that do not allow them to teach students about how to use these resources in order to implement the technology to reach the higher levels of the T3 framework, (Magana, 2017), focusing on inquiry design and social entrepreneurism. Currently, we filter so many things from student use, but the students are doing their experimenting and learning at home, unsupervised, with no direction for discerning quality sources from those that are not. Then, we are surprised when students misuse technology and get into trouble.

One of the challenges with this is that teachers fear incorporating technology at higher levels because of their own fear of using technology. Teachers are so conditioned to think that they must be the knowledge provider for students that they fear that they do not have the knowledge to teach students about these tools. The traditional processes of professional development could be part of the problem.

A challenge for teachers is the concept of time. Teachers do not have the time to learn about ways to integrate technology. Most of their professional development and/or in-service, time is spent going over strategies for the same things that we spent time on many years ago, student data, classroom management, classroom engagement, innovating curriculum, making learning authentic, solving problems, managing projects, and more, without incorporating instruction about and practice of higher-level technology that could provide value in all of these areas of educational practice.

One such area, as example, would be measurement and data of their own, and their students' progress. The collection and analysis of student data is a driving force in learning and instruction. Magana (2017), provides guides within the T3 framework professional development for teachers and students to allow both student and teacher self-assessment and reporting of learning.

Another challenge is the control of a centralized technology system in many districts that bases technology purchases and operations on ease of control and monitoring. Many districts make purchases of devices without teacher input, and once purchases are made, items are standardized in classrooms and then are installed with little or no training for use. Teachers lack the buy-in of a system that is not personalized for them and their students' needs and are forced, if they want to integrate technology, to sink or swim. Added to this already frustrating system could be a lack of administrative support or prioritization necessary to make effective progression of technology integration to higher levels a critical need.

Another challenge that affects teachers and their integration of technology, and will continue to do so for the next five years, is the fast-moving changes that occur in the technology market. Without teachers who own the entrepreneurial intention mindset, there will be no pursuit of new strategies and digital tools that can be used at that transformational level of integration. School systems are slow to make decisions and even slower to make purchases of large quantities of resources, often due to funding. As a result, many classrooms struggle to do innovative things with older technology that sometimes does not work with new platforms and resources.

This brings up the idea of cost. Interesting research in the future might center on providing ways for teachers to acquire the training and digital tools necessary to practice higher levels of technology integration with less expense. Currently, even if a teacher wanted to use the most cutting-edge resources in his/her classroom, many of those tools are priced in ways that are limiting or even impossible. Take, for example, the Microsoft Holo Lens. While I see value in seeking out a tool such as this to use that with my students to promote critical thinking and creativity, it is pretty much out of our price range unless I can apply for a grant to fulfill our plan. More schools should try to pool with others in the same district or with other districts as consortiums and increase their purchasing power. Years ago, many districts had a centralized resource center that allowed teachers to "check out" resources to use. Still, providing the professional development could be key. When a teacher does not use a tool on a regular basis, he/she may lack the skills to get it up and running, and if integration specialists or other resource individuals are not available to assist the teacher, it may be tried unsuccessfully, never to be tried again.

Other challenges that could exist, according to the *2017 Horizon Report,* are trying to get teachers to provide authentic experiences for students while still stuck in a traditional system. Higher level technology experiences can play a key role in providing authentic experiences for students. Skype, Google Hangouts, Google +, Google Docs, Oovoo, ePals, and virtual field trips are just some of the tools that can be used in instruction to provide these opportunities and that can also be used as adaptive technologies in differentiating instruction.

In thinking about higher levels of technology integrations for learning, simulations can provide new ways to learn in accordance with Kolb's (1984) theories of experiential learning. Augmented and Virtual reality activities enhance the environment for students and help to teach concepts in an innovative and exciting way. Students and teachers can create their own artifacts of learning, categorized as part of the transformational level of the T3 Framework, (Magana, 2017).

In terms of entrepreneurial intention, teachers and students also need to develop a sense of who they are and what resources they have around them that can help to develop an entrepreneurial mindset. Project Wayfinder, (http://www.projectwayfinder.com), Project Indigo Project, (http://www.indigoproject.org), and Clifton Strengthsfinder, (https://www.gallupstrengthscenter.com), are tools that can be used to introduce students and teacher to themselves to begin this process, and the tools for measure are all based in higher level technology created to provide data to be used for this self-awareness. Much can be gained in collaboration, for example, if students and teachers consider the strengths and skill sets of their colleagues to map out a strategy for effective collaboration. Indigo goes a step further with information on career connections and areas of challenge for goal setting.

Some things that schools are doing currently to promote entrepreneurial thinking are setting up makerspaces in the school setting, introducing students to coding and robotics at any age and ability with tools like Tickle, (https://tickleapp.com/), Scratch, (https://scratch.mit.edu), and Lego-education resources. Also, schools are investing in analytics and data-driven instruction that are technology based. In addition, they are taking the simulation and experiential learning concept further with resources such as virtual museums.

Our students' world will also be presented with artificial intelligence used for teaching and learning, voice-activated devices such as the Amazon Alexa, Google Home, Microsoft's Cortana, in addition to wearable technology like Apple Watches, Fitbits, and other smartwatch and fitness watch options. With Apple's latest version of the apple watch which is free-standing and does not have to be near a phone for full functionality, we may find that Dick Tracy was truly a pioneer of a world to come.

Recommendations for Change in Practice

Professional Development

Effective and targeted professional development must be offered to teachers. Based on the analysis results that of all characteristics, gender seems to surface as having a higher part in determining the change in the criterion variable of technology integration, more professional development should be offered especially in the area of recruiting females for STEM activities and activities that offer opportunities to use technology for inquiry design and social entrepreneurship purposes. In addition, risk-taking, used in this study as an entrepreneurial characteristic, is developed through the concept of design thinking and entrepreneurial project planning and development. Professional development should target training in encouraging students to take risks with learning. Ignoring this would be to adversely stay with a traditional system in which students are not critical thinkers but rather responders to prompts placed before them to receive a right or wrong answer.

Teacher Role

Some teachers are restrained from being creative in the classroom. The challenge is that with wired technology options, usually those who install the ports and outlets necessary are not part of the daily classroom interactions and place them in areas that are convenient for discovery and repair. Every wired projector, for example, in my own experience, is in the exact same place in all of our classrooms dictating the space utilization for the teacher. This takes away the flexibility of a teacher to provide an iterative learning experience.

As with most endeavors, while we gained the standardization of equipment and workability, just as in the focus on standardized testing and learning, there is a loss of flexibility. Teachers must have a place in technology decision-making.

Teacher Training Programs

If any place emphasizes integration and using technology tools to enhance learning and instruction, it should be the teacher training programs. Technology tools, discussions, demonstrations, and workshops should be a part of EVERY course taken to prepare future teachers. University programs should model by design…and many do not. Most of the university programs that I have seen that truly have integration as a part of its process usually have that forced upon them by entering students who have used technology their entire lives and force the issue by demanding to use creative technologies for presentations and activities. Teachers need to l be given the task to develop more hands on, technology-enhanced learning opportunities and should be challenged to do so. Our Google and Pokemon Go generations of students are demanding more. There must be more efforts to provide mentoring and coaching for teachers to model technology integration and entrepreneurial thinking.

The future teacher preparation experience should encourage student teachers to realize the importance of the role technology in learning and instruction and their role in its development and execution. While they are taught about various learning theories, more time should be spent on the constructivist, social constructivist, and constructionist methods of learning. The candidates themselves should be participate in activities of problem solving involving the design thinking process and working collaboratively to achieve results.

They should also become well versed in SCL (student centered learning) activities and not only study but practice differentiating instruction on the same topic. Teacher candidates should also be versed in a technology integration framework such as the T3 Framework and should participate in regular self-reflection and feedback. Additionally, these future teachers should be analyzing digital content and applying what they know to develop their digital citizenship, just as they will promote their students to do.

Lastly, the teacher candidates should add to their reading and research for their teacher preparation documents which promote entrepreneurial and design thinking in classrooms. Teacher candidates should be reading books like *Launch, Drive, Don't Bother Me Mom I'm Learning,* and reading comments by Sir Ken Robinson, Will Richardson, Daniel Pink, Tony Wagner, Ted Dintersmith, etc. in addition to their texts on classroom management and learning theory, and they should also be involved in a credentialing system, such as Microsoft Innovative Educator or Apple Teacher programs.

Entrepreneurial Focus

In order to create an entrepreneurial education program for students, we have to realize that learning about entrepreneurship is much different than practicing entrepreneurship. When we think of a curriculum developed to teach these skills, it must incorporate authentic experiences for the students so that they not only learn about the concepts but find ways to apply them. Students should be put into a reflective view of themselves and what they have to offer in the educational process. Personality profile surveys and other self-awareness activities, as mentioned previously, should be established as the starting point for this type of instruction. What students learn about themselves is extremely important in the start of entrepreneurial thought The project INDIGO survey, as example, gives students charts of personal analytics in reference to their skill sets, their attitudes, and their interests and can relate them into ways for students to recognize the power they could have in collaborative settings and in their individual projects. Spending time to allow the students to ingest this information allows them to set goals for themselves.

One thing that is very important for students in using the data from any of these self-evaluative tools is that they should be encouraged to not only set goals for challenge areas in their learning process but also in areas of strength. In Herold's (2010) TED Talk, "Let's teach students to be Entrepreneurs," he discussed all of the opportunities he had to develop his entrepreneurial thinking while growing up. He talked about being bad at the subject of French, which resulted in his parents getting a tutor for him to help him with French. He made the statement that he is still bad at French. He was good at talking, though, and he said that he wished that his parents would have acquired a "speaking" tutor for him to make him even better. This is a mindset that we need to change in traditional education settings. We work harder at the challenges, but never at the strengths. We need to encourage students to find their strengths and passions and find ways to accelerate those things instead of just those things we feel we do not do well. Goal-setting for students, then, takes on a different focus in the entrepreneurship program, and it is already embedded in the language of the T3 Framework of Technology Integration (Magana, 2017).

Authentic Learning Opportunities

Teachers should be able to do the same inner reflection activities provided to the students so that they can work with the students as colleagues to understand what it truly means to think entrepreneurially in order to become role models for that type of learning and action.

To promote learning at the upper levels of the T3 Framework, students should be presented with authentic learning opportunities so that they can take what they learn about themselves and put it into action. Aside from just internships, students should have the opportunity to work with other professionals on a project geared toward solving an authentic problem. Students can participate in webinars, skypes with experts, community gatherings, etc. to give them a real audience for their work. Formative assessments along the way could be done with project management software like Basecamp or Trello to help them learn not only project development skills but to practice time management. These assessments should be allowed to be in multi-dimensional forms, and progress could look different for every student depending on his/her project or initiative. Connecting with a group such as Real World Scholars who will put up $1000 seed money for a classroom to start a business is a way to push students to the next step and for them and the teachers to reach the transcendent level of technology integration by developing technologies that work in ways never encountered before and by practicing entrepreneurism. Real World Scholars provides resources in economic development, conversations with experts, and branding assistance. Going through this process and others will truly take the student through the entrepreneurial thinking process in action, not theory.

Limitations and Suggestions for Future Research

There were limitations in the study. There was a gender imbalance with more than three times the female participants (168) as male participants (43). This could have provided some bias in responses considering the demographic gender variable. If I had collected responses for years of service as a numerical entry and not coded responses as 1-10 and 11 or more, I could have pulled more specific data from that area and perhaps made some more specific validations in terms of how technology was integrated at various stages in the participants' teaching careers. The collection of geographic data could have provided a more valid snapshot of applying results to a generalized population. Since the participants were randomly recruited, it was impossible to see if the location of the teachers' teaching positions might have had an impact on results. A more robust tool could be used as measurement. Various tools were considered for use in this study; however, most were highly priced and also catered to business practices. Instead, it was decided to use adaptations of other tools to assist in making the topic relevant and understandable for teachers. Terminology could have been an issue in the study. Most people associate the term entrepreneur only with the concept of starting a business, so the idea of entrepreneurship in relation to teaching might have been difficult for participants to grasp. Finally, the scale for levels of technology would have been more effective if survey questions for levels of technology integration, translational, transformation, and transcendent, had been given different weights so that responses would have been exponentially evaluated at a higher level.

Theoretically, there are other limitations that could have impacted this study; for example, teachers' lack of control over equipment and training. Without opportunity to work with digital tools and receive quality professional development, participants could be at a disadvantage when responding to questions on the survey. In addition, so many of these professionals think that they are pressed for time and see any technology as simply an add-on. Hoping for the transformative effects of proving the importance and the benefit of such integration, it is anticipated that there could have been some unintentional push back from teachers. Along the same lines, school districts have filtering systems that do not allow even teachers to access some social networking sites that could be used enhance levels of integration. The iterative and varied ways that some of the social networking tools can be used by teachers could cause some unpredicted bias and/or skewing of results.

Further study should be conducted connecting levels of technology integration to entrepreneurial characteristics and intention. Though there is a paucity of literature that approaches this topic from an education perspective, it is important to continue to find these connections for the sake of students. A broader study, including interviews with teachers, administrators, and students could perhaps create a better picture of technology's role in developing entrepreneurially thinking teachers and students.

Conclusion

This study was conducted to find a relationship between teachers' technology integration and entrepreneurial characteristics and intention. The Qualtrics survey measurement tool used questions adapted from Magana's T3 framework of technology integration to measure level of integration, questions on the characteristics of an entrepreneur or ""teacherpreneur"" (Barnett Berry) repeated throughout literature, and questions adapted from EIQ questions that were used to measure entrepreneurial intention adapted from Ajzen's (1991) Theory of Planned Behavior using skill sets identified as those characteristic of recognized entrepreneurs and "teacherpreneurs", and from parts of Ajzen's Theory of Planned Behavior that particularly addressed entrepreneurial intention. Multiple regressions were conducted to determine positive relationships of statistical significance between technology integration levels and entrepreneurial intention. Secondary relationships were determined through regressions including demographics of age, gender, years of experience, and grade level taught. Because of the random sample, there was no systematic bias, and it was realized that the data gained was dynamic and had the capacity to change as culture changed around teachers and their teaching environments. From the responses of study participants assumptions were presented and six hypotheses were tested. The findings confirm that digital technologies and the level of their integration are related to the entrepreneurial characteristics and entrepreneurial intention beliefs of PreK-12 teachers.

Results of this study demonstrate the need for providing quality professional development to create opportunities for more PreK-12 teachers and administrators to recognize and reap the benefits of technology integration at higher levels. The findings also provide insight for advancing teachers' integration skills, their entrepreneurial characteristics, and their entrepreneurial intentions. This insight is critical as we approach a future in which students must be entrepreneurial in their own thinking and learning. The targeted preparation and training of role models who can promote this use of technology and entrepreneurial practice are necessary steps to ensure future success for students.

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APPENDICES

APPENDIX A

Survey informational consent

Teacher Technology Integration and Entrepreneurship Survey

Teacher Technology Integration and Entrepreneurship Survey

This survey has been created to collect data for my at the University of Kansas. I appreciate your participation. Participation is voluntary, and participants will remain anonymous. Results will be used for publishing statistical outcomes only. The survey should only take 10 minutes to complete.

The Department of Educational Leadership and Policy Studies at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

This survey is designed to better understand the relationship between teachers' integration of technology and their entrepreneurial intentions. We believe that the information obtained from this study will help us gain a better understanding of how the various levels of teachers' technology integration can relate to their entrepreneurial intentions. Your participation is solicited, although strictly voluntary. Your name or other identifiable will not be associated in any way with the research findings. Your information will not be shared unless you give written permission. Survey results will remain anonymous, and will only be reported as a collectively. It is possible, with Internet communications, that intentionally or accidentally someone other than the intended recipient may see your response. If you would like additional information concerning this study before or after it is completed, please feel free to contact us by phone or mail.

Completion of the survey indicates your willingness to take part in this study and that you are at least 18 years old. If you have any additional questions about your rights as a research participant, you may call (785) 864-7429 or write the Human Research Protection Program (HRPP), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email irb@ku.edu.

Sincerely,

Tammy Estes Fry, Principal Investigator
Educational Leadership & Policy Studies
(785) 864-4458 |tammyfry@ku.edu

Ron Aust, Ph.D.
Educational Leadership & Policy Studies
(785) 864-4458, aust@ku.edu

APPENDIX B

Survey technology integration questions

T3 framework: translational level

T3 Framework: Translational Level

Translational Level Questions: T1.1 Automation

I use digital tools to save time.

I use digital tools so that I have fewer errors.

I use digital tools to increase the amount of work I can accomplish in a given time.

I use digital tools to create and share documents.

I use digital tools to communicate with other teachers, administrators, and parents.

I use digital tools to investigate and research.

I use digital tools to present new content information.

I use digital tools for testing and/or grading

Translational Level Questions: T1.2 Consumption

I use digital textbooks and/or ebooks

I read digital newspapers and magazines.

I access websites for information.

APPENDIX C

Survey technology integration questions

T3 framework: transformative level

T3 Framework: Transformational Level

Transformational Level Questions: T2.1 Production

I use digital tools to produce works that represent my learning/knowledge.

I use digital tools to accomplish things that I could not have done without the digital tools.

I use digital tools to track my progress in professional development, goal setting, or other.

I use digital tools to track student progress.

Transformational Level Questions: T2.2 Contribution

I use digital tools to create tutorials/learning guides for my students.

I use digital tools for brainstorming activities.

I use digital tools to solicit feedback.

I use digital tools to design presentations.

I use digital tools to blog and/or participate in online discussions.

I use digital tools to store and archive information.

APPENDIX D

Survey technology integration questions

T3 framework: transcendent level

T3 Framework: Transcendent Level

Transcendent Level Questions: T3.1 Inquiry Design

I use digital tools to seek out solutions that can help me in my life.

I use digital tools to become part of a network of individuals working toward a common goal.

I use digital tools to solve authentic problems.

Transcendent Level Questions: T3.2 Social Entrepreneurship

I use digital tools to improve my teaching and learning.

I use digital tools to imagine, design, and create new tools or platforms as solutions to authentic problems.

I use digital tools to beta test, iterate, and generate robust digital solutions to authentic problems.

I use digital tools to scale the implementation of a digital solution to an authentic problem.

APPENDIX E: SURVEY ENTREPRENEURIAL CHARACTERISTICS

Entrepreneurial Characteristics

Visionary

Passionate

Creative and Innovative

Design Thinker

Persistent in getting things done

Persistent in promoting ideas and change

Risk-taker

Willingness to Experiment

Problem Solver

Ability to prioritize and plan

Continuous learner

Solutions-focused

Outside the box thinker

Sees projects to the end

Develop ideas for personal advancement

Develop ideas for company advancement

Self-Reliant

Optimistic

Idea Generator

Change Agent

Digitally Connected

Appendix E: Survey Entrepreneurial Intent Questions

Entrepreneurial Intent

Control Beliefs

To start a firm and keep it working would be easy for me.

I am prepared to start a firm.

I can manage the creation process of a new firm.

I know the necessary practical details to start a firm.

I know how to develop an entrepreneurial project.

If I tried to start a firm, I would have a high probability of succeeding.

Behavioral Beliefs

Being an entrepreneur implies more advantages than disadvantages to me.

A career as an entrepreneur is attractive for me.

If I had the opportunity and the resources, I'd like to start a firm.

Being an entrepreneur would entail great satisfaction for me.

Among various options, I would rather be an entrepreneur.

Normative Beliefs

My close family would support my decision to start a firm.

My friends would support my decision to start a firm.

My colleagues would support my decision to start a firm.

Appendix F: Survey Demographics Questions

Demographics

Level of Teaching Practice (Click all that apply)

Early Childhood Elementary Middle School High School

Years of Teaching Experience

1-10 11or more

What is your gender?

Male Female Other Prefer not to answer

What is your age?

Appendix G: Human Subjects Approval

THE UNIVERSITY OF KANSAS
Research

APPROVAL OF PROTOCOL

February 26, 2018

Tammy Fry
tammyfry@ku.edu

Dear Tammy Fry:

On 2/26/2018, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Investigating the Relationship Between Teachers' Use of Digital Tools and Entrepreneurial Intentions
Investigator:	Tammy Fry
IRB ID:	STUDY00142069
Funding:	None
Grant ID:	None
Documents Reviewed:	• Email Invitation to Survey.pdf, • Information_Consent Form, • Tammy Estes Fry Information_Consent Form.pdf, • Tammy Estes Fry KU Human Research Protocol 8-17-1.pdf, • Tammy Estes Fry Survey.pdf, • Tammy Estes Fry Survey.pdf

The IRB approved the study on 2/26/2018.

1. Notify HRPP about any new investigators not named in original application. Note that new investigators must take the online tutorial at https://rcr.drupal.ku.edu/human_subjects_compliance_training.
2. Any injury to a subject because of the research procedure must be reported immediately.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.

Continuing review is not required for this project, however you are required to report any significant changes to the protocol prior to altering the project.

Please note university data security and handling requirements for your project:
https://documents.ku.edu/policies/IT/DataClassificationandHandlingProceduresGuide.htm

You must use the final, watermarked version of the consent form, available under the "Documents" tab in eCompliance.

Sincerely,

Jocelyn Isley, MS, CIP
IRB Administrator, KU Lawrence Campus

APPENDIX G: HUMAN SUBJECTS MODIFICATION APPROVAL

KU THE UNIVERSITY OF KANSAS
Research

APPROVAL OF PROTOCOL

March 15, 2018

Tammy Fry
tammyfry@ku.edu

Dear Tammy Fry:

On 3/15/2018, the IRB reviewed the following submission:

Type of Review:	Modification
Title of Study:	Investigating the Relationship Between Teachers' Use of Digital Tools and Entrepreneurial Intentions
Investigator:	Tammy Fry
IRB ID:	STUDY00142069
Funding:	None
Grant ID:	None
Documents Reviewed:	None

The IRB approved the study on 3/15/2018.

1. Notify HRPP about any new investigators not named in original application. Note that new investigators must take the online tutorial at https://rgs.drupal.ku.edu/human_subjects_compliance_training.
2. Any injury to a subject because of the research procedure must be reported immediately.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.

Continuing review is not required for this project, however you are required to report any significant changes to the protocol prior to altering the project.

Please note university data security and handling requirements for your project:
https://documents.ku.edu/policies/IT/DataClassificationandHandlingProceduresGuide.htm

You must use the final, watermarked version of the consent form, available under the "Documents" tab in eCompliance.

Sincerely,

Jocelyn Isley, MS, CIP
IRB Administrator, KU Lawrence Campus

APPENDIX H: EMAIL TO PARTICIPANTS

Dear Fellow Teacher:

The survey linked below has been created to collect data for my dissertation at the University of Kansas. I appreciate your participation. Participation is voluntary, and participants will remain anonymous. Results will be used for publishing statistical outcomes only. The survey should only take 10 minutes to complete.

The Department of Educational Leadership and Policy Studies at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

This survey is designed to better understand the relationship between teachers' integration of technology and their entrepreneurial intentions.

We believe that the information obtained from this study will help us gain a better understanding of how the various levels of teachers' technology integration can relate to their entrepreneurial intentions. Your participation is solicited, although strictly voluntary. Your name or other identifiable will not be associated in any way with the research findings. Your information will not be shared unless you give written permission. Survey results will remain anonymous, and will only be reported as a collective.

Thank you, in advance, for your help with my research!

SURVEY LINK: https://kusurvey.ca1.qualtrics.com/jfe/form/SV_em2T6wPc2jMNgQR

Sincerely,

Tammy Estes Fry, Principal Investigator
Ed. Leadership & Policy Studies
University of Kansas
tammyfry@ku.edu

APPENDIX I

Information form of consent

Teacher Technology Integration and Entrepreneurship Survey

This survey has been created to collect data for my dissertation at the University of Kansas. I appreciate your participation. Participation is voluntary, and participants will remain anonymous. Results will be used for publishing statistical outcomes only. The survey should only take 10 minutes to complete.

The Department of Educational Leadership and Policy Studies at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

This survey is designed to better understand the relationship between teachers' integration of technology and their entrepreneurial intentions.

We believe that the information obtained from this study will help us gain a better understanding of how the various levels of teachers' technology integration can relate to their entrepreneurial intentions. Your participation is solicited, although strictly voluntary. Your name or other identifiable will not be associated in any way with the research findings. Your information will not be shared unless you give written permission. Survey results will remain anonymous, and will only be reported as a collective. It is possible, with Internet communications, that intentionally or accidentally someone other than the intended recipient may see your response. If you would like additional information concerning this study before or after it is completed, please feel free to contact us by phone or mail.

Completion of the survey indicates your willingness to take part in this study and that you are at least 18 years old. If you have any additional questions about your rights as a research participant, you may call (785) 864-7429 or write the Human Research Protection Program (HRPP), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email irb@ku.edu.

Sincerely,

Tammy Estes Fry, Principal Investigator
Ed. Leadership & Policy Studies
(785) 864-4458, tammyfry@ku.edu

Ron Aust, Ph.D.
Ed. Leadership & Policy Studies
(785) 864-4458, aust@ku.edu

APPENDIX J

Definition of terms

21st century skills- skills anticipated as necessary for future work success and future citizenship

AACE-Association for the Advancement of Computing in Education

Aspen Youth Entrepreneurship Institute- conducts a year-long curriculum that incorporates economics, personal financial literacy, organizational leadership, and entrepreneurship for K-8 students.

Barefoot College, The- community of entrepreneurial thinkers solving world problems www.barefootcollege.org

Behavioral Beliefs-spending time learning, bad to good, pleasant to unpleasant

Bird 1989 (modified by Boyd and Vozikis) Entrepreneurial theory that concentrates on personal and social background

C21 Canada-framework for 21 century skills, including entrepreneurship and character

CAEP- Council for the Accreditation of Educator Preparation

Causation-starting with a goal and then finding resources to reach it

Control Beliefs-barriers to entrepreneurial thinking

Effectuation-using resources in place to create and work toward a goal

eMINTS-Enhancing Missouri's Instructional Networked Teaching Strategies

EIQ-Entrepreneurial Intention Questionnaire

Enterprise Education-application of creative ideas and innovations to practical situations

Entrepreneurial Mindset -"entrepreneurism is fundamentally about the desire to solve problems creatively." (Zhao 2012)

Entrepreneurial Mindset Attributes-culture, engagement, action, value creation, opportunity seeking, new methods, process for discovery, relevant curiosity, guided curiosity, logical curiosity, make a difference, measureable by level

Entrepreneurism Education-development and application of enterprising mindsets and skills in specific of setting up a new venture…to grow and existing business (O'Brien 70)

Future Friendly Schools Initiative- network of future-forward schools

GERM-Global Educational Reform Movement-race to produce better test scores

Grass roots initiative-development based on the people for which it is intended

Green School Bali- promotes using local, renewable materials for building and sustainability www.greenschool.org

Intrapreneur-someone who creates an innovation within an organization

ISTE-International Society of Technology in Education

Khan Academy-learning videos started as a means to provide a world class education for all www.khanacademy.org

Me to We- people empowering domestic and international change www.metowe.com

Necessity entrepreneur-someone who begins an innovation because of a need

Normative Beliefs-most people like me…unlikely to likely

OET-Office of Educational Technology

Opportunity entrepreneur-someone who sees and opportunity an acts on it

Opportunity Seeking- looking for better ways to solve a problem

P21-Partnership for 21st century learning

PISA-Programme for International Student Assessment

PLN-Professional Learning Network

Policy entrepreneur- someone who seeks out an innovation in order to change policy

Product-oriented Learning-Learning in the process of creating a product

Professional Development-learning intended to improve practice

QAA (United Kingdom)-Quality Assurance Agency for Higher Education

Real World Scholars-organization that works with youth in schools to develop startups with funding and resources

SAMR- Technology Integration Framework based on Substitute, Augment, Model, Replicate

Shapiro's Theory of Entrepreneurism (SEE)- Shapiro and Sokol 1982 Theory of Entrepreneurship in which action is based on an event that presents itself

Social Entrepreneurism-using connections to collaboratively make a difference

Social Networking- making meaningful connections to assist in attaining a goal or solving a problem

Student-centric-student-directed learning initiative

T3 Technology Integration Framework-Technology Integration framework based on translate (automation, consumption); transform (contribute, artifacts); transcend (identify & investigate a problem, social entrepreneurism)

Taking IT Global- networks of young people working toward solving global problems www.tigweb.org

TCI-Teacher Characteristics Index

Teacher-centric- teacher-directed learning initiative

Theory of Planned Behavior (TPB)- Theory of entrepreneurism that is based on what is believed as the planned action of the entrepreneur

Tool/aide- workable plan to solve a problem, enhancement to the current, method, assistant, helper

T-Pack-Technology Integration framework based on Technological, Pedagogical, and Content Knowledge

Twitter – Social networking tool used to connect people and ideas in a linear, real-time platform

Virtual Architecture- Judi Harris' framework which presents a foundation for designing and implementing powerful curriculum-based telecomputing projects