Mobile learning and teacher quality: Assessing the impact of a mobile application on the positive psychology and professional practice of Panamanian teachers

This dissertation is submitted for the degree of Doctor of Education

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Personal Declaration

This dissertation is submitted for the degree of Doctor of Education.

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text. I further state that no substantial part of my thesis has already been submitted, or, is being concurrently submitted for any such degree, diploma, or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. It does not exceed the prescribed word limit for the relevant Degree Committee'

Abstract

Mobile learning and teacher quality: Assessing the impact of a mobile learning application on the positive psychology and professional practice of Panamanian teachers.

Adam Holden

In recent years, Latin America has experienced unprecedented growth in education coverage resulting in an acute strain on an already challenged infrastructure. Given the raft of research illustrating the strong relationship between teacher quality and student achievement the need to develop a proficient workforce to sustain the rapid change and improvement is critical. This study focuses on the improvement of teacher quality as a conduit to improving students' educational experiences.

The study incorporates a mixed methods design in two phases focusing on three key issues: (a) understanding teacher perception of self-efficacy and self-permission; (b) examining whether teacher performance can be improved by addressing teacher confidence; and (c) exploring whether teacher self-efficacy and professional practice can be improved using mobile learning.

Phase One investigates the relationship between teacher quality, positive psychology, and the importance of cultural norms in individuals' perceptions of their professional abilities. A small-scale pilot study (n=75) was used to test the validity of a five-level, Likert-style survey generated to explore teacher attitudes regarding perceptions of self-efficacy and self-permission. The resulting survey was then administered to more than 500 Panamanian teachers and a comprehensive quantitative statistical analysis of data collected was used to gain understanding of the relationships between teacher experience and qualification and levels of self-efficacy and self-permission. These findings ultimately informed the content, and structure of a mobile learning application designed to positively impact teachers' positive psychology.

Using this newly created learning application, Phase Two of the main study determines whether professional development delivered using mobile technology can have a positive impact upon professional efficacy, and performance. Ultimately, the study utilizes the mobile application to deliver research-informed practical tips for professional practice. As with Phase One, a small-scale (n=20) pilot study was carried out to inform the design of the mobile

application and the way it might be delivered. Data collected over a three-month timeframe using Likert-style surveys and semi-structured interviews was then used to determine participants' interaction, perceived usefulness, and professional impact of the application.

The study finds that Panamanian teachers' perceptions of self-efficacy are closely aligned with their classroom experience, while their perceptions of self-permission tend to be associated with professional qualification. It also finds that when professional development is effectively delivered using a mobile learning application it shows potential to have a useful impact on teacher positive psychology, self-efficacy, and professional practice.

Keywords: Mobile learning, Self-efficacy, Self-Permission, Positive Psychology, Teacher Quality, Professional Development, Panama.

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Finally, to my rock. *"You're the only reason I am… you're all my reasons"* – *John Nash.*

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Structural Overview

The following dissertation contains several independent yet highly related papers, organised into five distinct sections. While the dissertation exhibits the hallmarks of a formal research paper, a deliberate attempt has been made to integrate additional contextual information and researcher reflection on the process throughout the structure. It is hoped that this will add a depth perception for the reader as well as an increased understanding, not only of the research conducted in each phase of the main study, but also on the ongoing thought process of the researcher as the main study developed organically. This is of particular importance given that the findings of Phase One of the main study significantly shaped the underlying tenets of the methodology, design, and implementation of Phase Two of the main study. Particular attention has been paid to create headings that are self-explanatory and create a logical roadmap for ease of understanding.

Section one introduces the main study. In five papers, this section provides an academic framework and personal positionality that serves as a contextual primer. This includes discussion of the inspiration, purpose, theoretical framework, and ethical considerations for the study. The section has several elements that are reflective in nature, written both at the beginning and the end of the research journey.

Sections two and three outline the main study, a mixed-methods design presented in two phases. Each section is made up of six papers: an introduction, review of the literature, design, results, discussion, and implications. Section two outlines phase one of the main study and section three, phase two of the study. In both phases a pilot study was also conducted to shape the instruments used and to define the specific parameters of the research design. These sections are presented in a different format to avoid any confusion with the main study itself.

Section four serves as a postscript to the main study outlining, in one paper, how COVID19 transformed the educational practice in Panama and provided extended research opportunities within the country. This section while being informative is primarily reflective in nature.

Finally, section five, also in a single paper, concludes the project, reflecting on the process and the implications for future studies

<div align="center">**Section 1: Introduction**</div>

Paper 1: Personal positionality

Who am I?

Part 1: Considerations at the beginning of the research journey

My name is Adam Holden and when I started writing this dissertation, I was a 51-year-old professional educator.

My professional journey at that time had afforded me employment experiences as a practitioner in private and public education in both the United States and Europe. These experiences were formulated from the perspective of a teacher, coach, assistant professor, head of department, headmaster, and executive head. They were also formed while working in urban, rural, and international settings, ranging from primary schools to graduate degree programs. Each of these educational threads was distinct but woven into a single tapestry of educational understanding founded in professional practice.

For almost the entirety of this time, I had also been a student. This experience, though obviously more academic, was also predominantly viewed through a lens of professional practice. As such, my research agenda and academic portfolio was developed using an applied rather than a pure approach and perfectly illustrates the culture divide that is experienced by many doctoral students taking professional degrees (Andrews and Grogan 2005; Cowill 2012; Jarvis 1999; Gardner 2009; Nerad and Miller 1997; Willis, Inman, and Valenti 2010).

A decade earlier, my career moved to Higher Education, and with it the opportunity to view education and the process of learning from a theoretical standpoint. This academic perspective was difficult to embrace at first and I found myself resisting the epistemology as I moved from a normative, personal, and experiential understanding to a more analytical, intellectual, and theoretical one (Zambo et al. 2015). This was a paradigm shift that was as enlightening as it was challenging, revealing within me a narrow conceptual understanding derived from the need for application to a particular circumstance, rather than benefiting from a broader contextual understanding.

I found myself at a juncture where I was rethinking the nature (and role) that research should play for the reflective practitioner. At this early stage of my doctoral journey my thoughts remained a little messy in terms of how each role interacted with the others, and how these might orbit independently yet remain aligned to a core conceptual focus. While I had determined that theory and

practice must be seamlessly integrated if research was to be genuinely worthwhile, I had yet to establish which was the chicken and which the egg.

I entered into the educational journey at the very least committed to Wergin's (2011) EdD's signature pedagogy; namely, a commitment to the pedagogy of uncertainty by conducting rigorous and systematic inquiry into practice, the pedagogy of engagement undertaking inquiry by engaging in critical reflection through dialogue with others, and the pedagogy of formation conducting reflective practice in a way that models social action for the profession. (P.133).

Part 2: Reflections at the conclusion of the research journey

Now that I am coming to the conclusion of my research journey it is interesting to me how these initial thoughts have transformed over time and in some ways caused a fundamental change in my professional perspective. There is little doubt that I have come to affiliate more significantly with Wergin's (2011) categorization of the EdD dissertation as a capstone experience that is "ripe for creative thinking" and where the culminating written paper is 'a hybrid of scholarship and activism' (p.130). I have solidified my core belief that the educational process is best structured in a collaborative and active framework, where a student interacts with information in a dynamic manner, rather than in an abstract or solitary way. As such, this dissertation is presented as a series of papers, each representing a distinct and active undertaking with the content yet still connected by a series of common strands of learning. The journey has indeed involved the pedagogies of uncertainty, engagement, and formation where the model begins with a reflection of professional practice prior to the introduction of content knowledge to offer complex and sophisticated paradigm change (Wergin, 2011).

As I progressed through the process of developing a detailed methodology for my study, the desire to adopt a multi-phased, mixed-methods approach emerged as a defining characteristic. It surfaced that, as a student at least, it was necessary for me to categorize the various aspects of my scholarly and professional activities in order to maintain a structure that gave rise to the space for abstract and theoretical thought. While the concept of mixed-methods research appealed to my interpretation of aligning the academic and practical elements of the professional degree, the separation of the two phases allowed specifically for the qualitative and quantitative natures of the study to be presented under a single research umbrella and yet still maintain a separate independence and integrity. I remain unclear why this paradigm of study was easier for me to grasp as discrete

academic progressions, but it may speak to the fact that I have come to identify with the notion that there remains a substantial divide between the worlds and languages of the academic and the practitioner. In recognizing this, I made the conscious decision not to allow either identity to manipulate or eclipse the other. Rather, it has been my intent to recognize and respect each design while abutting the two together rather than fully integrating them. In this sense, it is my hope that this study serves to illustrate how these two realms might be used to inform and even shape each domain without the need to diminish the importance or credibility of either.

Interestingly, it has been during, and perhaps as a result, of this learning process that I have come to re-classify my understanding of what it is to be a student and a practitioner. Even though I remain challenged by the fact that I have often needed to find personal separation between the functions of the two identities (I still find academic writing a pursuit that is tremendously difficult to achieve in my "workspace"), I have found that my reflective thoughts have merged without the same difficulty. Indeed, this has caused me to consider elements of my academic research while working through a practical operation of my daily duties. Even if primarily in an informal way, I have developed the inclination of referring to the research literature on a given concept before formulating a definitive opinion. This habit has reshaped my reflection on professional practice perhaps merging and certainly overlapping with academic study.

Lastly, and perhaps most significant of all, I have come to understand just how narrow the scope of my cultural awareness from both a personal and professional perspective was and is. While I would not describe myself as being devoid of cultural sensitivity, the past four years have highlighted the fact that I continuously underappreciated the role that my occidental culture has played in the way that I view education and specifically, the roles played by individuals in the learning process. This has resulted in a professional identity founded entirely upon western norms and values, which while understandable is nevertheless, meaningfully limiting. The benefit of this realization is that recognition of such genuine ignorance allows for a re-examination of fundamental tenets from a non-threatened perspective. This, in turn, encourages a broadening of possibility when considering the characterization of concepts that might otherwise be narrowly culturally defined. The resulting conceptual flexibility has increased both my own cultural awareness and my willingness to conceive solutions from a cultural perspective other than my own. While this awakening is bound to take consistent effort over time, it does mark noteworthy professional (and personal) growth.

In the same way that I have grown as an individual over the past five years, so too have my motivations for completing the study. While the broad inspiration has remained unchanged, the nuances of the stimuli have resulted in a similar evolution of my curiosity and to some extent purpose. What follows is a brief discussion of why this study was and is important to me.

Why is this important to me?

Part 1: Considerations at the beginning of the research journey
Prior to beginning my study, I was of a mindset that all too often successful schools are measured in terms of student performance on standardized tests, budget balance sheets, parent contentment, and even a lack of controversy or negative press. Though many educators enter the profession wanting to make a difference or impact lives, these hopes are often quickly overtaken by the practical realities of a totally overwhelming daily routine. Such sentiments are supported by research, where school leadership is accepted to be increasingly challenging, overwhelmingly time consuming, and an unattractive position to aspire to (Court 2003; Thomson and Blackmore 2006; NCLS 2006). These are not new concerns and have been closely associated as having a disheartening effect on education leaders for decades (Bacharach and Mitchell, 1983), but have been exacerbated in recent years resulting in school leaders being legitimately distracted from the very reasons that they elect to go into the profession in the first place.

Simultaneously, disillusionment in leadership has long been linked with performance, and the concept of rekindling a positive approach to leadership had grown in importance to me as my career had progressed. Youssef-Morgan and Luthans (2015) discuss the power of having positive psychological capital as an educational leader where a positive cognitive mindset "predicts higher positive outcomes such as performance, satisfaction, commitment, wellbeing, and organizational citizenship behaviours, and lower negative outcomes such as cynicism, stress, anxiety, turnover intentions and counterproductive behaviours" (p.199). More specifically, the critical impact of the underlying tenets of hope, efficacy, resilience, and optimism outlined in this research, were increasingly missing in my own professional comportment, as well as in the attitudes of many of my professional colleagues. Unlike some other professional characteristics, I found the ability to develop and consistently maintain a positive psychological outlook within leadership teams to be extremely difficult to master. The desire to understand and counter what I perceived to be a wide-ranging negative disposition was a powerful source of motivation prompting my professional reading.

In the summer of 2009, I visited Central America for the first time, a trip that led to several more over the coming years. These visits allowed me to witness both the private and public education systems in Ecuador, Mexico, Panama, and Venezuela. Each experience was impactful, each trip eye-opening – personally and professionally. It was the culmination of these experiences, however, that led to a powerful re-examination of priorities. I found myself uncomfortably embedded in the heart of Martin Broadwell's (1969) Four Stages of Learning. I was suddenly acutely aware of my level of ignorance regarding the reality of education in low-resource contexts. Given the sophistication of the education systems that I had previously experienced, the school system I was now being introduced to was not within my paradigm of understanding.

The education system in Central America was unlike anything that I had previously experienced in that the infrastructure of schools was lacking by just about every visible measure. Naturally, in all major cities it was possible to find good private schools for those who could afford them, but once outside of the main urban centres (and even within in many cases), large numbers of students rarely attended school on a regular basis, and when they did attend they were often taught in conditions that lacked even the most basic of resources, and by teachers who had little or no formal training in the field. According to an Inter-American Development Bank (IDB) Report (2000), "learning in schools, by all accounts, remains strikingly deficient in all but a few elite institutions" (p.6) and this is compounded by the fact that "the region exhibits the largest income inequality in the world, which at the same time reflects and perpetuates disparities in educational opportunities for different population groups" (p.6). Even the most fundamental elements of the learning process were often absent from classrooms that regularly utilized educational practices long since absent from western schools. One of the primary findings of the IDB report, that "all available international comparisons show severe problems of quality in education across the region" (p.10), was evident for all to witness.

While the magnitude of the challenges faced in Central America was by no means less daunting than those present in more sophisticated education systems, the nature of the difficulties was far more fundamental. As such, I was encountering education systems where the potential for significant transformation was readily evident, at least at the local level. An educational leader who could help bring management structures to a school, develop working curriculum, or support and mentor underprepared teachers, clearly had the potential to have a genuine impact, especially in some of the most impoverished and under-supported communities. I believe that my initial hope was to be

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able to have such an impact, even if that was on a small scale, as long as the concept had potential relevance to a broader sphere of influence.

Part 2: Reflections at the conclusion of the research journey

In retrospect, while I was acutely aware that change was most probably best accomplished through systemic change, the real reason that such a project was important to me was far more fundamental. In its simplest terms, my real impulse was nothing more than a desire to help students and teachers working in a system that was clearly lacking. The classrooms that I had witnessed were so significantly deficient in materials and modern methodologies that I felt a fierce compulsion to help. Upon reflection, the first of several errors made was to approach this problem from the perspective of an educational leader, rather than to understand that it is not the quality of a school's leadership that most extensively improves the learning process but the quality of its teachers and teaching practices. To some extent I was reacting to my own emotional response to what I had witnessed, by placing myself at the centre of why and how I might be a support. Probably due to ego, it was important *for* me rather than *to* me. This journey has shifted my focus from wanting to understand and support education from an administrative perspective to seeking to genuinely understand how to empower and sustain the learning process from a teaching perspective.

As I reflect, I would have been wise to spend more time contemplating the nuances of Broadwell's model (1969) and the implications that it might have for this particular study. More precisely, I would have benefitted from closer consideration of the manner in which an individual might be able to move from conscious incompetence to conscious competence. The crux of the study that follows is established by the movement of teachers from a state of being aware that they might need to improve their practice but not knowing how this might be accomplished to teachers developing their practical abilities through the use of effective practices in the classroom. The idea that this directly mirrors my own journey moving from uninformed to cognizant is not lost on me as I conclude my study. Interestingly, my increased awareness of how best to impact the process of learning has paralleled my cultural growth outlined in the previous section.

As I have progressed through the practical journey of my professional degree, I have been consistently reminded of the fact that making a sustainable difference in education is a highly complicated process, constantly presenting a tangled myriad of potential levers for improvement. Even determining a commonly agreed definition of what success might look like, let alone how it might be

achieved is a challenge in itself. Without such 'common' understanding of terms, the development of a unified grasp of the problem can overwhelm the process itself, and constantly delay the development of a single vision for progress. As previously discussed, this complexity is further intensified when distinct cultural legacies are evident.

Regardless of original intent (or lack thereof), as I assess the design and progression of the study, it is apparent to me that, at least subconsciously, I was always mindful of the fact that teacher quality lies at the very heart of effective learning. Certainly, I now find myself viewing effective educational leadership through a different lens; one that is founded on the belief that making a difference begins with the quality of those who teach. This notion is further supported as I reflect upon the research projects that served as the inspiration for my thinking prior to embarking on my own examination of the concepts. A discussion of these and the way that they informed and shaped my own study follows.

Paper 2: Reflecting on the inspiration for the study

As might be expected the inspiration underlying the final iteration of the developed study also evolved over time, influenced by my deliberations as I began to research the concepts involved. These stimuli ranged widely from less formal podcasts, blogs, or TED talks to peer reviewed and academically credible studies. While each of these shaped my thoughts in different ways and with varying impact, the core conceptual framework remained consistent, and very much aligned with the previous discussion of why the project was important to me. Over time, however, three significant sources of motivation served as the primary encouragement for my own creative thoughts. Each of these served as sources that I returned to frequently as I fashioned my thinking around the role of teacher quality and our ability to design authentic sustenance to meet the need of those teachers working in under-supported environments.

Self-Organised Learning Environments

The first and most intriguing prompt for my study was found in the work of Sugata Mitra. Over the past two decades, Mitra has made strides in popularizing the benefit of the use of technology to address access to quality education programs in areas of high poverty with his "Hole in the Wall" research, for which he was awarded the 2013 TED Award. Additionally, Mitra's School in the Cloud concept has now expanded to seven global locations, with more than 16,000 sessions completed to date. A Professor of Education Technology at Newcastle University, Mitra's work was centred in the attempt to use computer technology to create self-learning groups of students in marginalized Indian communities. At the heart of Mitra's work is the suggestion that the whole concept of school, and certainly the definition of a teacher (or teaching) needs to be reimagined given that it is so widely inaccessible for many students and ineffective for others.

It is not surprising, therefore, that Mitra's work remains highly controversial in many educational circles. Critics of the project (De Bruyckere, Kirshner & Hulshof, 2015) point to the fact that the concept is founded upon the absence of supervision or formal teaching, which is contrary to much of the research on the importance of a teacher in the learning process. Others (Arora, 2010) argue that the sustainability of such learning structures is problematic over time, that oftentimes using stations is dominated by just a few students (especially boys and stronger students), and that there is a reliance on the need to access the internet for the station to be operative. Perhaps the greatest criticism, however, is the fact that Mitra's work appears to lack supportive research evidence, and that the claims

made, while heart-warming and emotionally compelling, do not stand up to rigorous academic scrutiny.

For me, it was not necessarily the somewhat exaggerated claims made by Mitra's supporters, nor the captivating nature of the possibility that his projects declared, but some of the assumptions made within his work that held promise. Chia Suan Chong (2014), in her English Teaching Professional blog frames Mitra's core tenets as follows:

- that the teacher solely as knowledge-transmitter is a model that is no longer viable,
- that learners can learn a lot more in groups than they could individually,
- that it is important that teachers learn to let go of the control they have over how lessons should take place and allow their students more autonomy,
- that increased learner autonomy leads to motivation,
- that encouragement can go a long way.

(Chia Suan Chong, 2014, p.10)

Such a model could not really be described as innovative, as much of the conceptual framework was already well-researched and established. Nevertheless, as essential features, these elements were very much in line with my own thinking at the time. More importantly, they also spoke to several of the barriers faced when attempting to develop an effective learning process in communities where high-quality teachers are scarce. Chong also notes that Mitra often highlights the fact that he enjoys playing the role of an ignorant professor claiming not to know the answers and so challenging students to have to move from a dependent to independent status in the learning process. This affiliation with the notion of students being active learners was also one that resonated with my own convictions.

The other factor that was instrumental in my assessment that Mitra's model had potential was the fact that my own work was already forming into a study where teachers were to be central and therefore the project would be conducted with a participant pool that already had some awareness of the learning process itself and who might be more acquainted (and hopefully more comfortable) with the skills required in problems solving, collaborative and active learning. In this sense, the ability to take on a more independent and active role in learning might be easier with this group than with the students involved in Mitra's work. Given this fact, the concept of self-organised learning environments (SOLEs) was intriguing to me and held good potential for a study designed to help teachers help

themselves. I felt that this was especially true if the conveyance of material and interaction of these environments could be delivered virtually therefore removing any challenges presented by geographical location.

The Best Foot Forward Project

Consistent with this thinking, the second source of motivation for me was directly linked to the role that video technology might play in the transfer of information. Recent years have seen an unprecedented growth of video media consumption where it is now estimated that close to 5 billion videos are viewed daily on YouTube with more than half of those being viewed on mobile devices (Cvety, 2021). My initial thinking embraced the consideration of attempting to harness the intrinsic motivation of individuals to self-learn through the use of video media on a convenient and informal platform. Seeking examples of this direct link, I became aware of The Best Foot forward Project (https://cepr.harvard.edu/best-foot-forward-project) which was an investigative study into whether or not video technology can be used to improve the observation process for teachers.

Originating within the Center for Education Policy and Research at Harvard University, the project was first piloted in 2013, in more than 100 classrooms, 347 teachers, and 108 administrators in New York City, Georgia, and North Carolina, and has subsequently grown to include over 400 teachers in six states (Best Foot forward Project, 2018). In a randomized, controlled trial, the project focused upon teachers collecting videos of their own teaching in order to submit them for observational purposes, rather than being observed by a peer or supervisor (Kane et al., 2015). The teachers were given control over how many videos they created, and which ones they submitted for their formal observation (Kane et al., 2015). The trial found that teachers reported that while watching the videos they noticed previously unnoticed student and personal behaviours (Quinn et al., 2015). Additionally, less experienced teachers experienced an increase of instructional support, and an increased recognition of their instructional strengths from more experienced peers when videos of their teaching were voluntarily shared (Quinn et al., 2015).

As a result of the trial, the Best Foot Forward Project then went on to develop a comprehensive practitioner toolkit providing guidance and resources for professional educators who wish to use video technology in classroom observations. The toolkit is divided into four groups of resources including:

1. Leveraging Video for Learning: Strategies for Using Video Observations for Professional Growth
2. Cultivating Trust in Video Observations: Considerations for Teacher and Student Privacy
3. Turnkey Technology: Recommendations for Setting up Schools for Effective Technology Implementation
4. Measuring Readiness and Success: A Guide to Piloting and Large-Scale Implementation

Each of these collections of resources provided a comprehensive set of tools and step-by-step instructions of how to create and implement such a program. These include direction and support for teachers and administrators, as well as the theoretical foundation of the pedagogy involved. Perhaps one of the most interesting elements of these resources was that each had the ability to be modified to meet the needs of individual circumstance, and each is research-based (Best Foot forward Project, 2018). This is where I saw the most immediate potential. If such resources could be used to deliver information and guidance regarding video technology and classroom observations, why could the same format not be used to deliver any pedagogical content or research-informed practice?

The more that I interacted with the materials the more convinced I became that they had the potential to be a valuable resource for teachers, but also the capacity to be replicated and developed further in other areas of the developing world using mobile technologies. I was confident that teachers professionally interacting with and learning using video and smartphone technology merited further exploration, especially in the case of teachers receiving instructional support and guidance from educational experts outside of their immediate geographical location. When coupled with the concept of developing interactive SOLEs, the use of video as a conduit to distribute information using mobile technology was an attractive option given the scope of the emerging project.

OER4Schools

The third, and perhaps pivotal stimulus came from the OER4Schools resource. The OER4Schools Professional Learning Resource (www.oer4schools.org) for pre-service or in-service teachers was developed through research initially conducted in Zambia. The multimedia resource was developed over four phases from 2009-13 (as documented by Haßler, Hennessy & Hofmann, 2020; Hennessy, Haßler & Hofmann, 2018; Haßler, Hennessy, Cross, Chileshe & Machiko, 2015), and is focused on interactive pedagogy for classroom teaching (with or without technology),

using a blended and flexible approach to teacher learning. The resource was initiated at the Centre for Commonwealth Education, collaboratively authored by a team from the University of Cambridge Faculty of Education in partnership with local stakeholders including staff at the central research site, Chalimbana Basic School (Chongwe, Zambia). The project held particular appeal not simply because of these specific criteria, but also the fact that the programme was specifically shaped to support professional development of teachers and that the research was conducted in Sub Saharan Africa, a geographical location that had several similarities to the regions of Central America that I was considering for my own study.

As I reviewed the available material, several elements surfaced as being directly suitable for my potential study. Firstly, it was available for use free of charge, accessible under a Creative Commons license so that it could be freely distributed, copied or adapted. The tool was designed not only to highlight the benefits of interactive and collaborative learning but for this to be introduced through modelling the same approach. Secondly, the programme focused on the benefits of using mobile technologies (tablets, netbooks, e-book readers etc.), digital open educational resources (OER) and open-source software – as appropriate for teachers' own purposes and settings. These technologies were also used in a collaborative and participatory manner, moving the process of learning from a teacher-centred and somewhat 'rote' style of learning, to a more active process. Lastly, the OER4Schools was specifically designed to be culturally adaptive, flexible, and delivered using multiple approaches. Each school site was able to utilize the resources in the way that best fits their individual needs. These elements were central in my thinking at the time and so were particularly apt in framing how I might approach such a study.

The content of the OER4School project was equally functional. The resource comprised six individual units, four of which were topic-based, including an introduction to interactive teaching, effective questioning, group work, assessment, and practical inquiry. Each unit was formatted to include a wide variety of activities and materials for teachers and so served as a valuable resource for teachers whatever their previous experience or qualification. Specifically appealing was that the program was developed to be used in both online and offline formats to meet the needs of those who did not have consistent access to the Internet. While the program was not developed into a working application that might be used with mobile technology, I was confident that, with some simple design modifications and translation services, these resources could be adapted for use with low-cost mobile

technology in my proposed region. There was little doubt that conceptually, the program held the potential to be replicated in other low-income countries where teachers might have a similar profile.

In combination, the insights gained from these projects scaffolded my planning as I considered how I might convert my well-meaning though somewhat abstract intentions into a concrete and focused purpose. The result, over time, was the development of a multi-phased study, designed to explore (a) the perceptions of Panamanian teachers regarding their own efficacy and (b) the possibility of improving professional practice, through the development of self-organised learning environments, and the use of video to deliver useful professional development. Focused on Latin America, specifically the country of Panama, the study materialized with the intention of improving classroom experiences for students by directly addressing teacher quality. The study also considers the potential of using mobile technologies to positively impact teacher self-efficacy and self-permission.

Paper 3: Purpose of the study

  Fundamentally the objective of this research was an attempt to improve the educational experience of Panamanian students. The study was especially focused on addressing the educational experiences of students (especially those from isolated and/or marginalized communities) being taught by teachers with little experience or formal training. It is hoped that any potential findings might have useful implications more widely across the region of Latin America where several countries share common educational and societal characteristics with Panama.

  Given the raft of research illustrating the strong relationship between teacher quality and student achievement (Darling-Hammond, 2000; Klassen and Tze, 2014; Tschannen-Moran and Hoy, 2001, 2007; Zee and Koomen, 2016), the study focused on improving teacher quality as a conduit to improving students' educational experiences more generally. It used a mobile learning platform to share evidence-informed practices with teachers in a convenient and easily accessed application that could be delivered easily and economically throughout the country of Panama. The rationale behind the design was that teachers who were given effective, convenient, and culturally relevant professional development support would modify (and improve) their practice as a result.

  In order to accomplish this objective, the study focused on three key issues:

(a) understanding how perception of self-efficacy and self-permission impacts teaching performance in Panama;

(b) examining whether Panamanian teacher performance can be improved by addressing identified issues of teacher confidence; and

(c) exploring whether teacher self-efficacy and self-permission (and therefore teacher quality) can be improved using mobile learning.

(d)

  The study was designed with a multi-phase, sequential explanatory, mixed methods design (Tashakkori, Johnson & Teddle, 2020). The objectives were sequential and independent of each other with separately defined research questions. Phase One of the study established the specific nature of self-reported perceptions surrounding self-efficacy and self-permission within teachers in Panama. Phase Two explored whether mobile technology could be successfully utilized to address areas of perceived need and to improve teachers' perceptions of self-efficacy and self-permission.

The following research questions guided each phase of the study:

Phase One

1. What are the perceptions of teachers in Panama on self-efficacy and self-permission?

    a. What is the relationship between self-efficacy beliefs and teaching experience in teachers in Panama?

    b. What is the relationship between self-permission beliefs and teaching experience in teachers in Panama?

    c. What is the relationship between self-efficacy beliefs and teaching qualification in teachers in Panama?

    d. What is the relationship between self-permission beliefs and teaching qualification in teachers in Panama?

Phase Two

1. Can professional development delivered to instructors using mobile learning improve the self-efficacy of teachers in Panama?

    a. How do teachers interact with professional development delivered through a mobile learning application?

    b. How useful is professional development delivered through a mobile learning application?

    c. What is the impact of professional development delivered through a mobile learning application?

The following two sections outline the theoretical framework that provided the seminal underpinning for the design of the study and a discussion of the ethical considerations that served to guide my practice.

Paper 4: Theoretical Framework

Introduction

The idea that the research design in some way mirrored the intent of the study itself was appealing to me as a researcher, particularly in that it intertwined innovation and tradition, theory and practice, quantitative and qualitative approaches. As previously outlined, the inspiration for the study evolved over time and therefore the need for the research design to be flexible and adaptive was always central to my thoughts. The use of a portfolio model allowed for a journey of discovery viewed from a variety of perspectives, and the use of a mixed methods design offered a "practical and outcome-oriented method of inquiry that is based on action and leads, iteratively, to further action" (Cameron, 2009, p.144). This fit very well with a foundation of pragmatism and realism.

As detailed in the previous section, in order to accomplish this objective, the research paradigm was designed to examine three areas of study: understanding (Panamanian) teacher perception of self-efficacy and, equally, perception of self-permission and how this impacts their teaching performance; exploring whether (Panamanian) teaching practices can be positively impacted through a supportive focus on identified issues surrounding teacher confidence; and investigating whether teacher perception of self-efficacy and self-permission can be shaped using mobile learning.

Rationale

Ensuring that every teacher is academically and professionally qualified and that teacher qualification, self-efficacy, pedagogical training, and effectiveness are strong is crucial for successful learning to occur consistently (Kola & Sunday, 2015). Maintaining these professional standards can be challenging, especially in low-income countries. In Panama, there have been traditional problems related to the quality of teachers and their preparation, with many teachers having an educational equivalence closer to middle school than university (Alvarez & Majmudar, 2001). In such a system, teachers with natural talent and substantial experience are highly valued, resulting in the gradual migration of a significant percentage of the best teachers to a small percentage of schools, leaving an overwhelmed, underpaid, and unmotivated teaching force serving a fast-growing student population (Behrman et al., 2013). Addressing this imbalance is critical for those seeking to improve the educational product of the country as a whole, and for meeting the needs of the majority of children who do not have access to elite schools or high-quality teaching.

According to the OECD, although more teachers are completing formal training programs than before, no teacher preparation programs in Latin America and the Caribbean are prepared or equipped to produce teachers that have all the required skills and knowledge to be entirely successful (OECD 2020). Those teachers that enter the workforce having been trained understand the basics of classroom management and curriculum development, but do not have the sophistication to cope efficiently with the demands of a 21st-century classroom. Students experience a very traditional instructional methodology and a very teacher-centred ideology. More challenging and complex instructional methods are often beyond the capability and work ethic of many teachers and so collaborative working environments, critical thinking, problem-solving, and engaging classroom activities are often missing from schools (Bruns & Luque, 2014). On average, Latin American teachers fail to keep the whole class actively engaged in learning more than 25% of instructional time, resulting in many schools losing the equivalent of one full day of instruction per week (Bruns & Luque, 2014). This loss of instructional time coupled with diluted teacher quality remains a significant barrier to widespread systemic improvement.

Of equal concern was the fact that in many schools, especially those in rural and impoverished areas, teachers remain unqualified as well as inexperienced. In Panama, teachers with less than five years' experience are significantly more likely to teach in rural areas, where schools often have fewer resources and where professional support networks are often missing (OECD, 2015). The students who face the greatest barriers to even get to school on a regular basis, therefore, are likely to be taught by inexperienced teachers with little or no formal training (UNESCO, 2014). Unqualified and inexperienced teachers also tend to be less confident and comfortable in their teaching, and so when presented with more challenging work environments often resort to tactics of survival in the classroom rather than developing effective practices. "Teachers' self-efficacy generally increases over time… experience takes time to accumulate, but confidence can be boosted through participation in professional development, such as induction programmes and mentoring" (OECD, 2015 p.2).

Programs designed to specifically target the improvement of teacher efficacy, therefore, have the potential to have a positive impact on teacher quality in Panama. Self- efficacy remains a broad concept, however, and before any focused professional development can be developed data must be collected regarding the cultural nuances of teacher self- efficacy as it presents in Panama. Social and cultural characteristics can have a powerful influence on levels of teacher efficacy (Jeon, Buettner, & Grant, 2018); consequently, a complete understanding of the specifics of regional teacher self-

confidence is essential for the reliability and validity of any prospective study. Phase One of the study was designed explicitly to collect this type of data, with Phase Two using the findings to create mobile learning modules designed to improve self-efficacy and self-permission.

Research Paradigm and Positionality

The research paradigm was founded upon a pragmatic worldview, and more specifically, on a belief that learning occurs through dynamic experiences and practical application. Given the role that social and cultural norms play there is a need to establish a research design that can be practically applied to real human experiences (Figure 1). The paradigm is closely aligned with Dewey's assertion that learning is a social and interactive process, and that those who are learning function best in an environment where they are allowed to experience and interact with the curriculum as active participants (Dewey, 1916).
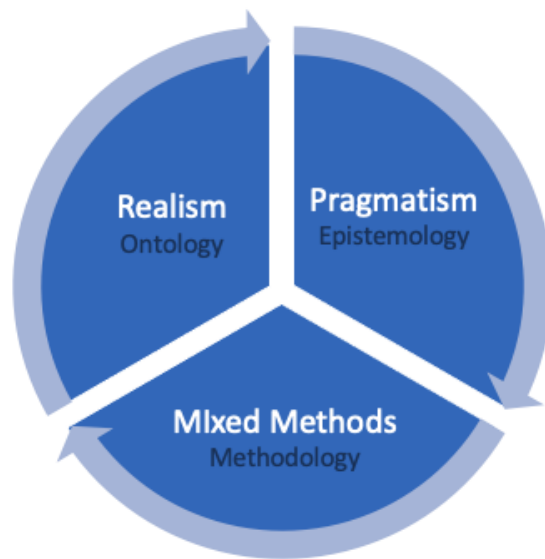
Figure 1: Research Paradigm

Ontology

The ontological foundation of the research design draws from the concept of realism. While a general premise of realism is the most pertinent underpinning, where the authenticity of an object or event is primarily accepted at face value, the practicality of common-sense realism is most closely aligned with the cultural influences within the study. This practical approach to life is particularly apt given the context of the study. In emerging societies, the fundamental premise that our perception of

life is 'really how things are' is even stronger than it might be in more advanced societies. In Latin cultures, while most people accept that individuals perceive the world through a specific lens and that perception is based as much on influences, emotions, and feelings, as they are a singular reality, most remain convinced that they have a realistic and unbiased interpretation of the world (UNESCO, 2009). Especially in economically challenged nations, life always has the potential to be unstable with most families being one significant event from legitimate difficulty, an existence which causes most individuals to interpret life in very real terms. The same is true of teachers in Panama, where many tend to navigate their professional lives with a sense of being in 'survival mode' and as such the experience of the classroom is accepted as reality at face value. Consequently, all professional development and personal growth is judged in terms of immediate value, often seeking short-term relief in place of longer-term gain. This results in a naïve realism in their approach and reaction to initial classroom experiences and to programs that might help them as they develop their career path.

Epistemology

The fundamental worldview of this study was a pragmatic one.

Recent years have brought a renewed interest in the practical aspects of pragmatism, primarily as they relate to an increasingly changing world (Sundström Sjödin & Wahlstrom, 2017). The professional reality for the participants in the study is one that continually must be interpreted and renegotiated as they become accustomed to the unpredictability of the modern classroom. Individuals experiencing new and rapidly changing realities, tend to adopt the customs, language, and beliefs of those around them and these formed habits are difficult to break once they are established (Sundström Sjödin & Wahlstrom, 2017). It is not surprising, therefore, that teachers are prone to develop habits that solve immediate problems and adopt practices that are more closely aligned to personal survival than research informed.

Any research study of this type must be designed with the practical realities of the participants in mind, and therefore a pragmatic approach to the sharing of pedagogical information or new practice was determined to be critical to the success of the design. It follows that the methodological approach should be mixed methods, in this case with Phase One having a quantitative focus (predominantly survey-based), and Phase Two a qualitative one (individual questionnaires and accompanying interviews). A mixed-methods approach is ideally suited to a professional degree design of this type as it employs an inductive-deductive research cycle (Tashakkori, Johnson, & Teddlie, 2020) where the

combination of observation and theory is outcome-oriented (Morgan, 2007), and specifically useful in invention-based studies as it focuses on the product of the research (Shannon-Baker, 2016). The pragmatic epistemology was founded on the assumptions within the concept of complementarity, that the combination of qualitative and quantitative approaches mitigates the disadvantages and enhances the advantages of both (Shannon-Baker, 2016). The mixed methods design also allowed for intersubjectivity, where there is a flexibility to the levels of objectivity and/or subjectivity, and where there is a context-specific transferability of results (Morgan, 2007), ideal given the importance of cultural sensitivity within the research paradigm.

While the methods were mixed the predominant foundation of the research was qualitative, with the essence of the study descriptive and interpretive. The rationale for the selection of such an approach lay in the ability to utilize a variety of data collection instruments and the triangulation of the evidence gained from wide-ranging sources. This construct gave a stable organizational structure and research credibility while maintaining a sense of authenticity and flexibility in the ultimate design.

Positionality

As in any study, it is "critical to pay attention to positionality, reflexivity, the production of knowledge and the power relations that are inherent in research processes in order to undertake ethical research" (Sultana, 2007, p.380). This was always an evident reality for me as a researcher and required an awareness that is essential in all aspects of this study. As a working professional, I was aware that I had a functional approach to learning and a practical approach to solving problems. I was mindful of the fact that the study would be designed with embedded assumptions mirroring my understanding of quality teaching, a schema that had been formed in complex and more sophisticated education systems. The research design was founded on a belief that learning is an active process and that good learning encourages students to be creative, to solve problems, to collaborate well in groups, and to think critically. It was also established with a premise that good teachers should possess professional dispositions and be reflective practitioners. Merging this philosophical approach with the cultural context of the setting was particularly important in this study, especially given the cultural gap between researcher and participant.

Within this reflexivity was the recognition that my own cultural identity is markedly different from the participants' and the context of the broader setting. Conceptual understanding of terms such as "professional disposition" or "think critically" were likely to differ significantly between the

participants and myself as a researcher. While awareness of these variances was important to the overall objectivity of the project, attempting to remove them completely had the potential to detract from the quality of the study. Goffman (1989) argues that the researcher's identity is as much part of fieldwork as the setting being investigated. As a result, throughout both phases of the study efforts were made to mitigate the influence my personal perspective might have on the findings. Data collection tools and processes were created that neutralized the impact of my own norms and values, but that sought to acknowledge my own reflexivity within the process rather than avoid it totally.

Throughout the study, extensive efforts were made to maintain the use of culturally appropriate language and to counter the potential of unintended culturally interpretive bias. Similarly, steps were taken to mitigate the impact of power relations given that I held a senior leadership position (Executive Head) in the institution where the participants work. Lastly, there was a focus on the ethical considerations of the study, details of which follow.

Paper 5: Ethical Considerations

All aspects of the designed study were conducted in accordance with the British Educational Research Association's (BERA) 2018 Ethical Guidelines for Educational Research (http://bit.ly/BERAethics2018). Careful attention was also paid to considering potential ethical issues. The Cambridge University, Faculty of Education's Research Ethics Review Checklist, was completed and no potential areas of concern were highlighted (see Appendix A). During each step of the design process ethical and cultural implications were factored into the methodological approach, with special attention paid to the cultural perspectives involved.

Specific attention was paid to ensure that all participants were protected throughout the research process. Studies have highlighted the fact that the concept and process of obtaining informed consent is closely linked to cultural influence and is certainly embedded within western values that are associated with freedoms which do not necessarily translate across all cultures (Macfarlane, 2009). Maintaining the central ethical principle of respect for all participants was a critical consideration in both phases of the study, despite the acceptance that the ethical guidelines being followed were originated with a western conceptual understanding. The three standard elements of consent were used as guiding tenets, namely, consent must be voluntarily given, consent must be informed, and consent must be given by an individual competent to do so (Durham, 2014). Accordingly, a systematic approach to ensuring that each criterion was meaningfully considered at all stages of data collection.

While the nature of this research was relatively benign, and the ethical issues involved low-level, the fact that the study touched upon professional performance and cultural beliefs required all stages of the research to be well-planned and transparent for the participants. Detailed information about the research was shared with all participants before the completion of the large-scale survey in phase one and participation was both voluntary and anonymised. This included the purpose of the study and how information will be collected and shared. Those that completed the survey remained anonymous (unless they choose to identify themselves) and each could complete the survey online or using a physical sheet where they could be assured those responses could not be attributed to them. All information and instructions were translated and presented to participants in Spanish and were shared with participants by a professional coach who was known to them but who played no supervisory role with them.

The participants selected for Phase Two of the study were met with in person to discuss the precise nature of the data collection and required to sign a more detailed and comprehensive informed

consent form, again outlining the details and purpose of the research (see Appendix B). Participants were also informed that participation was voluntary at all times throughout the data collection phase and that they had the option to decline any potential involvement at any time, without the need for any form of explanation or justification. In this phase, issues of confidentiality and anonymity were also guaranteed, unless otherwise waived by the participants themselves. Participant interviews were audio recorded, for purposes of translation and transcription, but any created documents were redacted to maintain the anonymity of those involved. Participants were made fully aware, however, that if digital video was collected as a part of the evidence dataset, it would be stored exclusively on a private, stand-alone, password-protected hard drive, and that parts or all of the dataset may be included in research appendices with the written consent of those recorded.

Protecting the welfare of participants in a study of this type clearly required culturally sensitive attention to be paid to the specific context of the study in order to be sure that appropriate solutions were found to ethical challenges (Benatar, 2002). Consequently, it is important to note that as Phase Two involved participants that were also employees of the same institution as me, and as I was in a senior leadership position, additional safeguards were needed to protect their privacy, autonomy, and interests. The selection of participants was carefully discussed with an understanding of the fact that the voluntary nature of participation must be authentic. Given the status of the researcher and the potential for cross-cultural misinterpretation, there was a reasonable likelihood that a sense of obligation had been created and that participants did not genuinely feel that they had a "de facto" right to decline joining or remaining in the data collection process. Whether it be wanting to participate as a sign of respect or out of deference to the institution or program, candidates needed to be selected only after the completion of a comprehensive informed consent process and reminded of the voluntary nature of the data collection prior to each interview. This process was designed in great detail and delivered by the individuals who would also lead the semi-structured interviews during the research study. At all times, attention was paid to ensure cultural norms were observed and to create an atmosphere that was culturally appropriate for participants. As such, the concept of power relations was continually observed throughout the selection of participants and collection of data. An independent point of contact was also established for all participants to serve as a 'gatekeeper' for this phase of the study with a specific focus of protecting their professional interests. No participants were ever under my direct supervision, and participants were assured that no identifying data would be

shared with me, colleagues, or supervisors. Participant confidentiality was prioritised and protected throughout the study.

Clearly, this specific context can have a negative impact on the objectivity of the dataset as well as the potential for participants to be anxious about the risk of being seen in a negative light. No participants were selected for this phase of the study who were under the direct supervision of the investigator, and employees were provided with written confirmation that their participation would in no way affect (favourably or unfavourably) their professional evaluation or any other career-related decisions made by peers or supervisors. Participant anonymity and confidentiality was protected at all times, although it is important to clarify that participants were also informed that the identity of those participating in the study may become known by peers given the nature of the institution. As workplace activities were a part of the topic of research, it was stressed that all participation was totally optional (including how and whether any or all resources were used) and distinct from normal workplace expectations and activities. A suitable, entirely independent point of contact was also established for all participants to serve as a 'gatekeeper' for this phase of the study. This individual served as the primary point of contact for all significant participant communication and was present for all significant points of data collection.

Merriam's (1998) six methods for ensuring internal validity underpinned the selection of data collection methods and instruments explicitly designed for triangulation of data, long-term observation, and collaborative modes of research. Steps to identify and eliminate researcher bias were also taken in the design and translation of the survey questions, the co-constructed nature of the interview questions, and self-selection format of the classroom observations design. Specific focus was placed upon the availability of independent and qualified interpretation and translation services at each stage of the data collection to ensure accuracy and authenticity of each participant's cultural voice. At the conclusion of the study, the findings were shared with each participant in a detailed debrief session with the intention of developing a plan for continued support and sharing of effective practices across the cohort.

Section 2: Phase One of the Main Study

Paper 1: Phase One: Introduction

Few would argue that access to a high-quality education is a critical component in the economic development and societal wellbeing of developing countries. The challenge, however, is that many of these countries face overwhelming levels of poverty, years of civil conflict, poor governmental structures, a lack of qualified teachers, and outdated and insufficient curricula. It is estimated that more than 61 million children worldwide do not attend formal schooling, with 100 million more required to work to support their families (UNESCO, 2021). In recent years, however, "Almost 80 million people have been lifted out of poverty, more than 50 million have entered the ranks of the middle class, primary school coverage has become almost universal, and average years of schooling has been converging towards that of countries in the Organization for Economic Co-operation and Development" (Bruns & Luque, 2015, P.xvii).

As a result of these gains, the rapid increase in access to formal education has strained an already challenged infrastructure. While education coverage in Latin American countries has expanded, this has not resulted in similar gains in student learning. "The troubling fact in this respect is that students in Latin American countries remain more than two years behind their OECD counterparts in math, reading and critical thinking skill - and even further behind East Asian countries, including Vietnam." (Bruns & Luque, 2015, P.xvii). It is evident that simply increasing the number of students who attend school on a regular basis is not enough to deliver the desired results in student achievement. If the region hopes to mirror recent economic gains within its education system, a deliberate and sustained effort to improve student achievement is required.

There are several factors that impact student learning, consequently any potential study designed to result in improved learning must consider the context of impediment to understanding in any given situation. Students' family background (parent education, socio-economic status, and conditions at home) is one of the most significant predictors of learning outcomes (Burns & Luque, 2015). Establishing a safe and structured environment for learning to take place is equally necessary. The importance of protecting children's nutrition, health, cognitive, and socio-emotional development in the earliest years of life is also of critical importance (Burns & Luque, 2015). In addition, perhaps more importantly, the past decade has also built new evidence that once children get to school, no single factor is as critical as the quality of teachers (Burns & Luque, 2015).

Ensuring that every teacher is academically and professionally qualified and that teacher qualification, self-efficacy, pedagogical training and effectiveness are strong is crucial for successful learning to occur consistently (Kola & Sunday, 2015). Teachers' qualification has been identified as a significant determinant of student performance, especially with the broadest definition of a special skill, experience or type of knowledge that makes someone suitable for a job (Akiri, 2013). In many underdeveloped regions of the world, finding qualified teachers of this type is a challenge but none more so that in Latin America, where there have been traditional problems related to the quality of teachers and their preparation, with many "school teachers prepared in normal schools that are closer in level to middle school education than to the training in a university major." (Alvarez & Majmudar, 2001 P.7).

In 2015, the World Bank Group published, "Great Teachers: How to Raise Student Learning in Latin America and the Caribbean", a report constructed from the largest globally comparable database on teacher practice in the classroom ever assembled, with observations of more than 15,000 different teachers in seven different Latin American countries. This research yielded critical data regarding the factors influencing the educational productivity in the region, most notably that:

- The low average quality of Latin American teachers is the binding constraint on the region's education progress, and consequently on the contribution of national education spending to poverty reduction and shared prosperity.
- Teacher quality in the region is compromised by weak mastery of academic content as well as ineffective classroom practice.
- Teachers in the countries studied spend 65% or less of class time on instruction (compared with a good practice benchmark of 85%), which implies the loss of one full day of instruction per week; they make limited use of available learning materials, especially information and communication technology (ICT); and they do a poor job of keeping students engaged.
- No teaching force in the region today can be considered of high quality against global comparators, but several countries have made progress over the past decade in raising teacher quality and student learning results.

- There are three fundamental steps to a high-quality teaching force—recruiting, grooming, and motivating better teachers—and substantial reform experience across and outside of LAC in all three areas can guide the design of better policies.
- Over the next decade, the declining size of the school-aged population in about half of the countries in the region, notably the southern cone, could make it substantially easier to raise teacher quality; in the other half of the region, especially Central America, the need for more teachers will complicate the challenge.
- The deepest challenge in raising teacher quality is not fiscal or technical, but political."

<div align="right">(Bruns & Luque, 2015 P. 2-3)</div>

Given this lack of quality within the professional teaching body, the need for comprehensive programs of professional development and support is apparent. This is especially true with teachers with less than five years' experience as they are significantly more likely than experienced teachers to teach in rural areas, where schools often have fewer resources (OECD, 2021b). Novice teachers also tend to be less confident and comfortable in their own teaching, and so when presented with more challenging work environments often resort to tactics of survival in the classroom rather than developing research-informed practices. Teachers' self-efficacy generally increases over time… experience takes time to accumulate, but confidence can be boosted through participation in professional development, support programmes, and mentoring (OECD, 2021b). Indeed, teacher confidence and belief in their own professional abilities are critical components in developing a positive mindset for teaching, an attitude that is also associated with the completion of effective professional development experiences for teachers (Darling-Hammond et al. 2009). Consequently, programs created to specifically address the identified barriers to educational productivity in the World Bank Report (2015) should not only focus on the quality of the training program itself, but also on the professional dispositions of those teachers participating.

The following papers outline the first phase of a two-part study that was designed to focus on seeking to understand the professional perceptions of teachers in Panama. It serves as a legitimate, independent investigation in its own right, the primary purpose of which was to determine teachers' perceptions of self-efficacy and self-permission in their approach to teaching. It should also be remembered, however, that this section of the research was also specifically designed to inform the creation of a mobile learning application for teachers and so needed to retain a consistency with the

practical nature of the theoretical framework of the research. Ultimately, this phase of the study strives to comprehend the present panorama of teachers in Panama, and then to establish common perceptions of teacher efficacy and permission as they relate to teacher attitude and quality.

It begins with a review of the literature that serves as a foundational understanding of the context and setting of the project, as well as the fundamental examinations of the concepts involved in understanding teacher quality and positive psychology.

Paper 2: Phase One: A Review of the Literature

This review of the literature is designed to serve as an academic underpinning of both the regional setting and the national context of the study that follows. It also serves as a considered analysis of the academic literature regarding the concepts inherent to the research. The review is structured into three distinct though connected sections: Education in Latin America, Understanding teacher quality, and the Importance of positive psychology. The discussion within each section served as the primary academic foundation and premise upon which this phase of the study was built.

Part 1: Education in Latin America

The right to education.

According to the United Nations Educational Scientific and Cultural Organization (UNESCO) education "is a fundamental human right that must be safeguarded, promoted and monitored to prevent discrimination or violation." (UNESCO 2016, p.7). This most basic of human rights has been internationally accepted as an essential entitlement for more than half a century, being asserted in a wide variety of legal documents and international treaties. Not only is education recognised as an individual human right itself, but also as a significant conduit to a range of other civil rights, without which basic personal freedoms are greatly diminished (Tomaševski, 2003).

Despite considerable efforts to secure the right to education across the globe, it is estimated that more than fifty-eight million primary-school-aged children are not in regular attendance at school (UNESCO 2019). The number of adolescents who are out of school, worldwide, are nearly twice as high as their primary-aged peers (UNESCO 2019). These numbers remain even more troubling when the constitutional protection of all students to access primary education is considered, where globally, "a minority of constitutions explicitly guarantee the equal right to primary school based on gender (38%), ethnicity (27%), religion (27%), language (26%), socioeconomic status (23%) and disability (14%)." (Heymann et al. 2014, p.138).

The factors influencing access to education are varied and are likely to be determined by the specific circumstance of the region, though the most significant barrier is to those students who live with a continuous threat of physical harm. UNESCO statistics indicate that more than 50% of the school-aged children who do not regularly attend school originate from societies that experience conflict on a consistent basis. In recent years, schools in politically unstable regions have become targets for attacks and kidnappings from those who have different ideological, political or religious

beliefs (GCPEA, 2014). These challenges are accentuated when schools are in remote locations where children, especially girls, face a long and potentially dangerous journey to and from school every day. Understandably, parents weighing the potential benefit of an education against the potential dangers of being able to access it safely, often err on the side of caution.

It is not just the fear of catastrophic violence that influences attendance rates, but also the general wellbeing and safety of children while at school. Millions of students must confront bullying, sexual intimidation and harassment, and corporal punishment while at school (Lundy, Orr, & Shier, 2017). School violence and bullying now impacts more than 246 million children and young people every year and occurs in all countries (UNESCO, 2017). Research shows that lesbian, gay, bisexual and transgender students (LGBT) are likely to experience school violence and bullying at rates up to five times higher than their non-LGBT peers and that up to 21% of LGBT students have experienced cyberbullying of some sort (UNESCO, 2017). The 2017 UNESCO Global Status Report on School Violence and Bullying also suggests that students living in non-industrialized countries are more likely to experience physical violence and corporal punishment, that girls are more likely to suffer sexual intimidation or abuse, and that "the most vulnerable children and adolescents, including those who are poor or from ethnic, linguistic or cultural minorities or migrant or refugee communities or have disabilities, are at higher risk of school violence and bullying." (UNESCO, 2017, P.9).

For those who live in poverty, the cost of access to education can also be a significant obstacle. Families may be required to pay directly for specific school fees, materials, uniform and other miscellaneous resources, but there are also indirect costs to the family in terms of lost income from a working child, transportation to and from school, and even the loss of cultural practices such as early marriage (Lundy, Orr, & Shier, 2017). While these issues are not universal, they remain a significant issue for millions of children across the world where more than 21 percent of girls are married before they reach the age of 18 (UNICEF, 2021). The exact cost of education is likely to vary depending on the culture and societal idiosyncrasies of the region, but what is not in doubt is the correlation between poverty and the poor educational attainment of children.

Children with disabilities also face significant disparity in access to education. According to the National Centre for Education Statistics (NCES) in 2019 the average graduation rate for students with disabilities was more than 17% lower than their non-disabled peers (Cohen, 2019). These statistics have shown little improvement over the past decade, where traditionally even greater differences are observed when factoring gender, with only 51% of boys and 42% of girls with disabilities successfully

completing primary school worldwide (World Health Organization, 2011). Students with disabilities have historically struggled to gain equal access to education, and despite decades of improved services and conditions, they still experience lower educational attainment and poorer employment rates (Cohen, 2019). Even in some of the most advanced education systems in the world, this 'achievement gap' persists for students who have disabilities at every level of schooling.

Given this data, the most alarming statistics concerning access to education is at the intersection of each of the aforementioned barriers. Those students who live in countries where conflict exists, who live in poverty, who are not safe in the available school settings, and whose parents are not aligned with the social, religious, or political influences of the society in which they live, have little possibility of receiving a reasonable educational chance in life. If the students happen to be female and/or disabled, their chances are reduced even further (Rueckert, 2019).

In May 2015, UNESCO together with The United Nations Children's Fund (UNICEF), the World Bank, the United Nations Populations Fund (UNFPA), the United Nations Development Programme (UNDP), the United Nations Entity for Gender Equality and the Empowerment of Women (UNwomen), and the United Nations High Commissioner for Refugees (UNHCR) met in Paris to ratify Education 2030; the Incheon Declaration and Framework for Action - a detailed vision for worldwide education. This renewed education agenda reset the commitment to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." (UNESCO, 2015a, p.iii). Recognizing the significant progress made over the past fifteen years, the Incheon Declaration established education as a central stand-alone goal, as well as one that greatly impacts the goals of "health, growth and employment, sustainable consumption and production, and climate change" (UNESCO, 2015a).

Education 2030 commits to providing access to inclusive and equitable education at all levels and for all students. This includes publicly funded and compulsory primary education and accessibility to secondary, technical, and vocational education (OECD, 2019). The declaration also ensures equity and inclusion for all, especially focused on all forms of marginalized societies and gender equality. Foundational literacy and numeracy skills, and higher order thinking skills, taught by well-qualified and motivated teachers using appropriate pedagogical approaches in safe and healthy environments are the defining characteristics of the educational programmes envisioned (UNESCO, 2015d). The framework affirms that education is a right that begins at birth and continuing beyond the formal classroom experience, with "flexible lifelong learning opportunities… provided through non-formal

pathways with adequate resources and mechanisms and through stimulating informal learning, including through the use of ICT" (UNESCO, 2015a, p.9).

Education in Latin America and the Caribbean

"Over the last 50 years, Latin America and Caribbean countries have achieved a mass expansion of education coverage that took a century or more to accomplish in many Organisations for Economic Co-operation and Development (OECD) countries." (Bruns & Luque, 2014, p.3) Such a rate of growth would cause even the most resource-rich of countries to struggle, but for a region of the world where most countries are still developing and face significant infrastructure and economic frailties this has strained human capital and economic resources to breaking point. More importantly, research is clear that economic growth is directly linked to the development of a skilled workforce, and that this is not primarily determined by the number of years of schooling students experience but by the quality of what they learn while in school (Hanushek & Woessmann, 2012). It is important, therefore, that Latin America – as in other regions of the world – invest in creating and sustaining qualified and capable teachers.

Nevertheless, the Latin America and Caribbean region of the world has made significant development gains over the past few decades from the consolidation of democracy in several countries to considerable advancements in health, education and the protection of the environment (UNDP, 2017). On the whole, countries in the region are experiencing stronger economies and continued growth in employment while at the same time making strides to combat widespread poverty and inequality. As a result of this development, more than 90 million people entered the middle class between the years of 2000-2012 and the region was the only one recognised by UNESCO as having reduced income inequality substantially (UNDP, 2017). Even with this progress, more than 220 million people remain socially and economically vulnerable in the region, and economic growth continues to divide the class structure in most countries; according to the latest UNESCO statistics, 10 of the top 15 most unequal countries in the world come from the region (UNDP, 2017).

Paralleling this economic and developmental growth have been efforts to address the challenges laid out in UNESCO's 'Education for All' (EFA) initiative. Between the years of 2000 and 2019, a significant global effort was undertaken to make progress in providing access to quality education for all children. Within this, six specific goals were identified to guide educational progress including:

1. The expansion of early childhood care and education,
2. Achieving universal primary education, especially for marginalised groups
3. Ensuring equal access to learning for all youth and adults,
4. Achieving a 50% reduction in the levels of adult illiteracy,
5. Achieving gender equity, and,
6. Improving the quality of education with measurable outcomes

(UNESCO, 2015d, xxii).

Globally, although these goals were designed to be achieved by 2015, just one-third of countries achieved each of these six goals, and within the Latin American and Caribbean region, Cuba was the only country to meet the standard. Nevertheless, considerable progress has been made in many of the designated areas of growth, despite the fact that there remains considerable regional variance. Most notably, the region has seen impressive movement in lowering child mortality rates and in addressing issues of malnutrition. The infant mortality rates per 1000 live births have fallen in Panama from 22 in 2000, to just 13.9 in 2017 (OECD/The World Bank, 2020).

Early childhood education has seen impressive growth over the past decade, although this has not always extended to primary aged children, where numbers remain strong but have plateaued. The introduction of compulsory education policies in many countries has been identified as the most influential factor in this rise, along with a concerted effort to ensure that access to pre-primary education remains free of charge to families (UNESCO, 2020). In Panama, enrolment in public schools is relatively strong with 97% of students reported attending primary education of some sort on a regular basis. This number drops to 88% at the lower secondary level, and even further to 71% at the secondary level, one of the highest out-of-school rates in the region (OECD/The World Bank, 2020). In some cases, as many as 40% of 15-17 years old children are in full or part-time employment while still technically attending school, resulting in an educational experience that leaves many illiterate (UNDP, 2017). Approximately 38 million adults lack core competencies, and even though illiteracy rates fell by more than 25% from 2000 to 2015, the region still lags behind others both in overall literacy rates and speed of improvement (UNDP, 2017).

These numbers, while impressive, mask the reality that a significant variance still exists with students living in poverty, those who are marginalised, and especially those who live in rural areas, making up much larger percentages of the number of children who do not have reliable access to

schooling. These students are also more likely to drop out of school, and, when they do complete their schooling, are less liable to achieve at the same rate as their more privileged peers.

Across the region, there is a consistency of data highlighting the fact that one of the greatest challenges remains the need to create equity within the system. At all levels, clear evidence exists that gender and poverty are critical factors in both the availability and quality of instruction (UNESCO, 2020). Despite being a key area of focus, gender disparity is evident throughout primary and secondary schools, where girls are less likely to be initially enrolled in school, but once attending, are more apt to survive to graduation than boys (UNESCO, 2020). Living in poverty exacerbates this fact specifically at the expense of males, a phenomenon that is unique to the Latin American region (UNESCO, 2020). As might be expected, gender disparities rise as children increase in age, and these gaps have widened even further over the past decade, once again having a more negative impact on boys more than girls. Adolescent boys in Latin America are specifically susceptible to a series of conflicting forces that make regular attendance at school difficult. Economic hardship, a lack of strong male role models, and unstable home lives push many into getting jobs at an early age, gang membership, or more frequently, just a negative perception of academic pursuits (UNESCO, 2020).

Considerable work remains to be done to improve the quality of education in Latin America and the Caribbean. Few countries in the region regularly use national assessments to monitor the progress made by students objectively, and even when these evaluations are in place, they are often used to measure a localised, subject-based curriculum, rather than measure an independent international standard (UNESCO, 2020).

Teachers in Panama

The country of Panama serves as a solid microcosm of the Latin American region as it has enjoyed significant positive transformation over the past decade, and yet remains one of the most unbalanced societies regarding economic stability, access to resources, and quality of education. A comprehensive curriculum of structured learning outcomes is missing within the country, as is a formal review of progress made. Such disorganisation has resulted in a significant underperformance of some students; most recently, Panama ranked 71 out of 77 countries on the 2018 Program for International Student Assessment (PISA) test, where 64% of 15-year-old students do not demonstrate good understanding of what they read, and 81% of students cannot answer simple calculations (Newsroom Panama, 2019). Given these statistics, it is not surprising that there has been an urgency to the call for

improved teacher quality believed to be across the fundamental to achieving sustained improvement in the Panamanian education system (UNESCO, 2020).

Approximately 75% of teachers in Panama are female, have a low socio-economic status, are ageing, and are academically weaker than other professionals (UNESCO, 2015b). While observable characteristics (age, gender, level of education, years of experience) do not necessarily have an impact on student learning (Goldhaber, 2002; Kane, Rockoff, & Staiger, 2008), practical ability in teaching can make a difference. Teachers of all ability tend to show solid improvement in their first few years of teaching as they become acclimated to the classroom and school environment, although this improvement is not apparent beyond the first five years in the job (Bruns & Luque, 2014). Additionally, knowledge has been directly connected to student achievement (Hill, & Chin, 2018). Furthermore, "the importance of teacher knowledge appears to be even stronger in developing countries…teachers' knowledge of the subjects they teach is one of the few variables consistently correlated with student learning" (Bruns and Luque, 2014, p.73). This presents a challenge for the country, as while teacher's formal education levels have consistently risen over the past decade, this evidence is weakened by the fact that students electing to study education at university are considerably academically weaker than the pool of students entering higher education as a whole (Bruns and Luque, 2014). Research on how well classroom teachers in Panama know their subjects mirrors that of Latin America generally where in some regions, 84 percent of sixth-grade teachers do not demonstrate mastery in math skills and less than 3 percent of teachers in other regions score in the excellent range on content mastery tests (Bruns & Luque, 2014).

Of equal concern is that in many countries, and especially in rural and impoverished areas, many teachers remain unqualified. This situation has improved over the past decade but finding well-qualified teachers to work in challenging environments remains a problem across the region. The median percentage of fully trained teachers at the primary level was 85% in 2012, but this dips as low as 58% in some areas (UNESCO, 2015c). More importantly, teachers who work in these communities that demonstrate capability often leave to work in schools where they will have better resources and earn higher salaries. Given the sharp increase in students attending school and a fast-ageing workforce, a conveyor belt of competent teachers moves from school to school seeking to maximise an economic advantage for themselves. As in any competitive marketplace, the least attractive schools suffer the most losing their best teachers to more competitive options. The possibility, therefore, that the students who face the greatest barriers to even get to school on a regular basis, will be met by a professional that

is qualified and experienced is very low (UNESCO, 2014b). These students are likely to be taught by inexperienced teachers with little or no formal training. As a result, the teaching force in Panama cannot be determined to be of high quality when compared to global comparators (Bruns & Luque, 2014).

The number of teachers in Panama has steadily increased since 2000, which has resulted in a slight decrease in class size where the average primary class size has reduced from 26:1 in 1999 to 23:1 in 2012 (UNESCO, 2015c). Again, these figures are subject to significant variance across the region, and teachers working in rural or poor schools often find themselves with far higher student-teacher ratios. Naturally, this places more emphasis on the need for teachers to maintain classroom management rather than focus on teaching. Ineffective instructional practice is a pervasive problem, where teachers regularly spend less than 65% of class time on instruction rather than the suggested 85% – "a loss of one full day of instruction per week" (Bruns & Luque, 2014, p.2).

Perhaps even more important than this loss of instructional time is the level of teacher motivation to improve classroom practice, as without it systemic improvement is impossible. Teachers in Panama receive relatively low salaries when compared to other professions. According to the World Bank, teachers' wages throughout the 2000s were between 10 and 50 percent lower than other equivalent workers (OECD, 2017). When coupled with a career earnings trajectory that also does not match other professional options, this serves as a deterrent for some of the region's most promising students entering the field of teaching. The challenge is not unique to the region, research over the past decade has indicated a decline in the number of candidates entering the profession, and a compression of teacher salary scales, globally (Fredriksen & Ockert, 2007).

The fact that International Schools are prevalent in the urban centres of Panama further exacerbates the problem as private entities charging tuition have the ability to maintain a competitive salary scale far more than the level possible in the education system as a whole. The result has been the gradual migration of a significant percentage of the best teachers to a small percentage of schools, leaving an overwhelmed, underpaid and unmotivated teaching force serving a fast-growing student population (Behrman et al., 2013). Overcoming these challenges is in no way a small undertaking. Teacher salaries account for 15% of total public spending in Latin America, and therefore any serious adjustment in core wage structure or significant investment in new workforce is likely to bear a considerable burden on economies that are already frail (Bruns & Luque, 2014). Additionally, teaching

remains a highly unionised profession across the region and therefore any significant alterations of the status quo involves a considerable political and complex process (Bruns & Luque, 2014).

Even though education struggles to attract the best candidates to the profession, there is not a teacher shortage in Panama (UNESCO, 2015c). Employment in teaching has several unique elements which serve as attractions for many workers. However, this is not necessarily a benefit for students, as the perceived advantages attract a workforce that does not prioritise the preferred values. In Panama, teaching positions are a part of the public sector of jobs and therefore receive a status similar to a civil servant including protection against redundancy, generous health benefits, and strong pensions (Bruns & Luque, 2014). Alongside these advantages, there is a strong general perception that teachers enjoy stability of work (there will always be students to teach regardless of fluctuations in business or economic markets), fewer weekly working hours and considerably more vacation time than other positions (Bruns & Luque, 2014). As a result, there is a ready pool of applicants for teaching positions in the region, but they tend to include individuals who are attracted to teaching positions for the wrong reasons.

According to the OECD, no teacher preparation programs in Latin America and the Caribbean are prepared or equipped to produce teachers that have all the required skills and knowledge to be fully successful. Teachers enter the workforce having been trained in the basics of classroom management and curriculum development, but do not have the sophistication to cope easily with the pressures of a 21st-century classroom. Students experience a very traditional instructional methodology and a very teacher-centred ideology. More challenging and complex instructional methods are often beyond the capability and work ethic of many teachers and so collaborative working environments, critical thinking, problem-solving, and engaging classroom activities are often missing from schools (Bruns & Luque, 2014). Several research studies indicate that, on average, teachers fail to keep the whole class actively engaged in learning more than 25 percent of the time, and that in many classroom observations classes were out of the control of the teachers (Bruns & Luque, 2014).

This risk aversion on the part of teachers is also readily apparent in their approach to the use of ICT. More than 90% of schools in Panama now have access to ICT, yet few teachers have the skill, motivation, or confidence to regularly use it in the learning process (OECD, 2020). Research conducted by the World Bank suggests that while teachers spend approximately 33 percent of class time using their blackboard, and 20 percent using no teaching materials at all, just 2 percent of class time involves the use of readily available ICT (Bruns & Luque, 2014). Given the rising importance of

digital literacy and competence in the modern world, this is a critical component of learning that is missing from many classrooms in the region. Moreover, due to the potential of innovative technologies to assist teachers in critical elements of teaching and learning, it also provides the possibility to address teacher training issues at the same time.

Part 2: Teacher Quality

There has been a bright spotlight on "teacher quality" over the past two decades. (Bird, 2017). As a result, the concepts of instructional quality and student learning have become a focus of global discussion (LeTendre & Wiseman, 2015; Paine & Zeichner, 2012) as high-quality teachers have been directly associated with successful national education systems and economic buoyance (Hanushek, 2015). Evidence of stark inequities in access to effective teachers (Goldhaber et al., 2015; Isenberg et al., 2013; Sass et al., 2012) has motivated international efforts to improve teacher effectiveness as a means of reducing educational and economic inequality.

Despite this increased attention "the concept of teacher quality in a global context continues to be splintered among abstract dimensions such as "teacher pedagogical content knowledge," "teacher self-efficacy," or "teacher identity." (Akiba & LeTendre, 2017, p.3). While there is agreement that more effective teachers can significantly improve both short and long-term life success for students (Aaronson, Barrow, & Sander, 2003; Chetty et al., 2014; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004), teacher quality is often poorly defined and measured in a variety of ways, with little consensus as to what specific characteristics are most important. More clarification is required in determining whether teacher quality is the same as teacher effectiveness, or if student achievement is improved by the quality of the teacher or the quality of the learning experience (Adnot, Dee, Katz & Wyckoff, 2018). According to the National Comprehensive Center for Teacher Quality,

> "Teacher quality implies that there is a set of inputs (such as certification,
> teacher test scores, and college degrees) that serves as indicators of who will
> be successful in the classroom. On the other hand, teaching quality implies
> that it is not what the teachers have in terms of training and certification, it
> is what they do in the classroom that indicates quality… there is an
> assumption that teacher quality ensures teaching quality, or that teaching
> quality is an outcome of teacher quality." (Goe, 2007, p.8)

Clarity around the concept obviously serves as the foundation for all efforts to improve teacher quality and is clearly subject to cultural and political influence. Given the range of definition, it is not surprising that there is equal confusion surrounding how and what to measure. What is not in doubt, however, is the fact that a variety of teacher characteristics including educational background, experience, certificate status, perseverance, work ethic, and even teacher evaluation score, are the teacher dispositions associated with improved student achievement (Darling-Hammond, 2000; Rivkin, Hanushek, & Kain, 2005; Kane, Rockoff & Staiger, 2008; Sirait, 2016). For the purpose of this study therefore, teacher quality is best defined as a dynamic process rather than a single data point, that involves the inputs of teachers' characteristics and qualification and the process of teacher practice (see Figure 1).

Teacher quality and student achievement

Few would argue that quality teachers and teaching should result in successful learning (Fenstermacher & Richardson, 2005). The importance of teacher quality in the learning process, and ultimately student achievement, has been the focus of considerable research over the past decade. While this impact is likely to vary by classroom and school, good teachers can regularly advance student achievement by 1.5 years in a single academic year, while students taught by their weaker peers often master only 50% of the curriculum in the same timeframe (Hanushek & Rivkin, 2012). Children who are exposed to just a single "highly effective" teacher during their time in primary school are more likely to go on to study at university, earn better incomes and live in better neighbourhoods (Chetty, Friedman, & Rockoff, 2104). It would require an average reduction of students in a class of 10 or more (from 25 to 15 in a class), for the same benefit to be realised with a sub-standard teacher (Hanushek & Rivkin, 2010).

The advantages of having "highly effective" teaching, while tending to fade over time, do continue into later life. "The current evidence suggests that great teachers not only raise student learning… but also develop students' human capital in broader and deeper dimensions that have a lifelong payoff." (Bruns & Luque, 2014, p.71). Such benefits are critical in a region that is seeking to develop a skilled workforce to sustain and manage rapid expansion. A comprehensive study of kindergarten students in Ecuador indicated that these benefits are not limited to a specific discipline, but that student gain in all dimensions and discipline measured, ultimately producing better student achievement in mathematics, language, and other academic functions (Araujo et al., forthcoming). Also

evident was the fact that while the quality of the teacher did not have a positive impact on student attendance in school, parents were able to recognise good teachers. This did not, however, cause them to consider requesting a change of teacher or school; a phenomenon regularly witnessed when dealing with parents of means (Araujo et al., forthcoming). These positive gains are further magnified when students face additional hardships, and therefore any concerted effort to provide universal and equitable education across all parts of the region will require significant investment in the creation of a professional teaching force capable of changing the present learning paradigm.

Over the past decade there has been a global movement focused upon teachers' knowledge base and pedagogical practice and their 'added value' upon student learning (Gore, et al., 2017). Influential international organizations including the World Bank, the Organization for Economic Cooperation and Development (OECD) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) have lobbied vigorously for increased understanding of teacher quality as it relates to student achievement and how this can be leveraged to move countries towards improved human capital (Schleichter, 2015). Traditionally, this learning has been measured using the OECD's Programme for International Student Assessment (PISA), administered to over half a million students from more than 70 countries every three years (OECD, 2021a). While this premise is logically sound and certainly understandable given the increased accountability on global education systems, it remains a somewhat simplistic response to a highly complex paradigm and one that does little to take into account powerful cultural influence.

Using any single measurement of teacher quality does not fully appreciate the complex range and depth of skills and social foundation that successful teachers typically infuse (Shulman & Shulman, 2004). From an Anglo-American perspective, effective teachers improve a broad range of student outcomes (Goddard, Goddard & Tschannan-Moran, 2007) - critical thinking, problem solving, perseverance, collaboration, trust, respect, and creativity. While these targets may not all be wholly applicable in developing countries what is apparent from the breadth of aspiration is that any attempt to measure teacher quality is best designed combining multiple measures of performance rather than focusing on one single indicator (Mihaly, McCaffrey, Staiger, & Lockwood, 2013). The specific importance of each contributing factor is likely to differ significantly based on cultural variation. Quantifiable data on student achievement lie at the heart of these measures, but emerging evidence would seem to indicate that these statistics only have value as a part of broader contextual factors.

Teacher quality and global context

Education is at the heart of a country's economic growth with increased student learning linked to a longer working career, gaining more skills and creating a stronger workforce (Hanushek, Ruhose, & Woessmann, 2016). It is not surprising therefore, that recent years have witnessed an unprecedented effort to understand the common factors leading to improved student performance (Schleichter, 2015). A substantial voice in the recent research narrative from a global perspective is Pearson's Global Survey of Educator Effectiveness (2016). The survey collected data from more than 13,000 participants from over 23 countries on 5 continents and included participants from a variety of stakeholders including students, teachers, principals, parents, educational researchers, and policymakers. As one of the largest surveys of its type, this research served as an unscripted insight into global beliefs about teacher qualities. Interestingly, while the qualities of understanding learners, subject matter knowledge and professionalism were common themes it was the teacher dispositions of having a patient, caring, and kind personality, and the ability to develop trusting, productive, relationships that were the most valued qualities in teachers (McKnight et al., 2016).
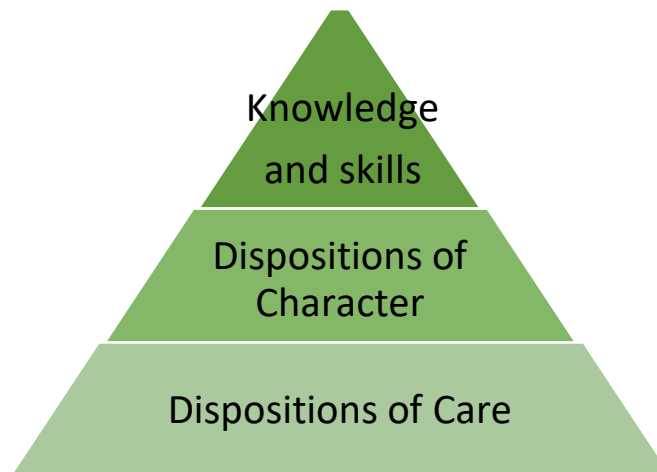
Figure 2: Pyramid of teacher competencies. From: McKnight, K., Graybeal, J., Yarbro, J., & Graybeal, L. (2016). The Heart of Great Teaching. Pearson Global Survey of Educator Effectiveness. Pearson Education.

While less developed countries valued teacher professionalism more strongly than their developed peers, even after taking into account grade level, gender, public or private schooling, and cultural variation, all stakeholders prioritised dispositions of care more than any other competency

(McKnight et al., 2016). These findings suggest that dispositions of care and character serve as the foundation for teaching-specific knowledge and skills (Figure 2).

Contrary to these findings, however, many developing countries, including Panama, have focused on teacher qualification and certification to improve teacher quality (Akiba & LeTendre, 2018). While research has shown that uncertified teachers have negative effects on student gains (Cavalluzo, 2004; Darling-Hammond et al., 2005; Goldhaber & Anthony, 2005), several other studies claim that teacher academic qualification has little or no positive influence on student achievement (Azam and Kingdon 2015; Chingos and Peterson 2011; Buddin and Zamarro 2009; Rivkin, Hanushek, and Kain 2005). Such ambiguity suggests that more contextual data is required before any definitive commitment can be made regarding the best approach to improve teacher quality in the region. It is a reasonable assumption, therefore, that adding a focus on teacher disposition and confidence has the capability to yield a stronger positive impact on student learning than merely seeking to improve teacher qualification alone.

Teacher quality and self-efficacy & self-permission

Given this importance, the development of 'positive psychological capital' (Luthans & Youssef-Morgan, 2017) in an attempt to improve teacher quality holds significant potential. Drawing from Bandura's theory of self-efficacy (Bandura, 1997), positive psychological capital (PsyCap) associates a combination of the resources of hope, optimism, efficacy and resilience with improved employee attitudes, behaviours, and performance (Avey et al., 2011). An individual's positive psychological state of development is characterized by having confidence (self-efficacy), having positive feelings about succeeding (optimism), persevering toward goals, and when necessary, changing direction in order to succeed (hope), and recovering from problems and adversity (resilience) to attain success (Avey, Luthans, Smith & Palmer, 2010). As social cognitive theory also highlights the connection between individual competence and the surrounding environment (Jeon, Buettner, & Grant, 2018), the theory is especially apt in Panama where according to a 2015 PREAL Policy Brief, teacher confidence is often low, both individually and in the profession more generally where the majority of teachers are female, ageing, academically weak, and have a low socio-economic status (UNESCO, 2015). As such, a strong argument can be made that teacher self-efficacy lies at the very core of improving McKnight et al's dispositions of care and character in the country.

This conceptual framework is not complete however, as it does not readily account for the strong social and cultural influence of the region, and the impact this has on developing a culture of teacher respect, which is associated with higher levels of teacher efficacy (Jeon, Buettner, & Grant, 2018). In order for an accurate assessment to be made regarding Panama the concept of self-permission must also be addressed. Nico Rose's theory of self-permission (Rose, 2014) refers to the beliefs that a person has regarding whether they are socially and politically permitted to realize long-term goals. Closely linked to efficacy, self-permission integrates social norms and expectations as a form of stereotype threat to performance. In other words, even if an individual has the self-confidence to believe that they can be a successful teacher, they are unlikely to realize their full potential if they do not believe that they have the right. This has added importance if we accept the premise that building a strong relationship (care and character) with students is the fundamental key to teacher quality. In a country such as Panama, where societal roles are often based on a strong sense of cultural hierarchy, respect for teachers is often low and as a result does not cultivate an environment where professional student/teacher relationships are easily developed.

Part 3: Positive Psychology

In recent years, the rapidly increasing body of research into positive psychology has worked to define the emerging factors that increase individual happiness and satisfaction (Sin & Lyubomirsky, 2009). Traditionally, empirical research has tended to focus upon potentially negative phenomena (aggression, anxiety, depression etc.), but most recently this has created an amplified focus on positive psychological factors such as character, achievement, well-being, etc. (Seligman, 2011). These studies have expanded the exiting understanding of concepts such as self-efficacy, autonomy, and optimism, while also highlighting interest in the emerging concepts of grit and growth mindset (Duckworth, Peterson, Matthews & Kelly, 2007; Dweck, 2000; Beyhan & Bas, 2017). While each of these maintains conceptual independence they often are seen to overlap and, more generally, represent an increasing recognition of the importance of how individuals perceive themselves and how this perception can impact personal emotion and professional performance (Dörnyei, 2009). Research also indicates that self-belief lies at the core of how individuals construct self-understanding and whether they develop assured or helpless responses to given situations (Möller, Pohlmann, Köller, & Marsh, 2009).

Self-Efficacy

These findings, however, do not paint the entire picture. Research centred on a broader comprehension of self-concept, while important in developing a foundation of understanding regarding the nature and organization of "self", has limited application when viewed through a goal-oriented lens. Insight into the psychological impact of having general feelings of self-worth or self-value is not necessarily relevant to a multi-dimensional theory where there may be separate beliefs about the different aspects of self. This is where the more narrowly focused concept of self-efficacy is beneficial. A defining aspect of self-efficacy, distinguishing it from a more generalized notion of academic self-concept, is its domain specific nature. The individual's perception of self-efficacy will differ from domain to domain, and within a domain, from context to context (Bong & Clark, 1999). The concept of self-efficacy "refers to belief in one's agentive capabilities, that one can produce given levels of attainment. A self-efficacy assessment, therefore, includes both an affirmation of a capability level and the strength of that belief." (Bandura, 1997, p.382)

Founded alongside Bandura's Social Learning Theory (1982), of late self-efficacy belief has become one of the most current discussions in scientific research (Wilde & Hsu, 2019). Related to

general competence and specifically the successful accomplishment of tasks, self-efficacy theory includes a multi-faceted productive capacity including social, cognitive and behavioural abilities (Bandura, 1982). In simple terms, self-efficacy speaks to how effectively an individual responds to adversity – how well they cope with professional difficulties based upon self-confidence in their own capacity (Bandura, 1982).

According to Bandura (1997) self-efficacy belief depends on four interrelated sources (Mastery experiences, Vicarious experiences, Verbal persuasion, and Emotional arousal) that, in combination, determine whether or not a person believes they are capable of completing specific tasks. Each of these sources has the ability to positively impact a person's self-efficacy, and when combined, the sources can have a significant influence of performance (Bandura, 1997). Mastery experiences are the most influential source of self-efficacy. A person can raise the accuracy of self-efficacy judgement based on the established knowledge of a causal association between behaviour and results (Cavanagh & King, 2020). When a task is performed successfully it has the potential to positively impact an individual's belief in their own ability to perform similar tasks in the future. Similarly, when someone witnesses another person successfully accomplish a task (vicarious experience) they also are encouraged to believe that they might be able to accomplish the same result. Verbal persuasion also works as a widely used means of influencing a person's personal self-efficacy. People can alter their self-efficacy by listening to others whom they regard as credible who persuade them to believe that they can achieve certain goals if they are willing and able to exert the required effort (Kang & Cavanagh, 2018). This third-party encouragement can boost performance levels and is especially true when the individual is emotionally motivated (emotional arousal) to succeed (Zonoubi, Rasekh, & Tavakoli, 2017).

Given this theoretical foundation, it is not surprising therefore that self-efficacy has been consistently linked to the teaching profession. The process of learning, and by extension, teaching, is closely linked to the formation of trusting relationships and mastering a complex and dynamic environment (Oberski, Ford, Higgins, & Fisher, 2010). Teachers who display a positive attitude and strong commitment towards the teaching profession consistently demonstrate higher levels of performance and greater productivity (Hussain et al., 2011). The importance of a positive professional approach to the learning process has also been clearly established as a critical factor in successful teaching (Karadağ, 2012). Teacher self-efficacy has been directly associated with a willingness to implement innovative teaching practices (Kavanoz, Yüksel, & Özcan, 2015), and the improved learning achievement of students (Caprara, Barbaranelli, Steca, & Malone, 2006). The need to ensure

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that teachers develop a positive psychology towards teaching, therefore, is of critical importance to their continued success in the profession.

Once established, teacher self-efficacy has been shown to be particularly difficult to modify (Akdemir, 2018). Consequently, it is essential that early experiences be affirmative for mastery and vicarious benefits to be maximized, and to ensure that potential negative influence on self-efficacy is minimized. This can be challenging in a classroom setting where authentic classrooms may not be ideal learning environments for new teachers to improve their teaching skills and increase levels of self-efficacy (Kang & Cavanagh, 2018). While continued professional development has a positive impact in maintaining self-efficacy, teachers should develop a positive attitude towards the teaching profession and belief in their own capacity before starting their professional career (Karadağ, 2012).

Prospective teachers' professional knowledge, skills, and experiences play a significant role in equipping them to deal with the pedagogical difficulties they will face in their professional lives (Akdemir, 2018). It is important to create learning environments that combine and enhance the acquisition of theoretical knowledge with practical activities, for pre-service teachers to gain the experiences required to increase their self-efficacy and to improve their teaching skills (Skaalvik & Skaalvik, 2016). Such activities allow for pre-service teachers to profit from mastery and vicarious experiences. While program activities that prioritise the formation and development of these skills remain central to the creation of teacher flexibility and resilience, one-to-one guidance has also been shown to be an essential factor (Ozan & Odabasi, 2016). Tapping into the power of verbal persuasion to increase self-efficacy, research indicates that instructor and peer feedback, especially when delivered through strong social networks, are particularly effective (Okumus & Yurdakal, 2016; Ozan & Odabasi, 2016).

Grit

Current challenges related to teaching in a high-stakes and potentially stressful professional environment, have prompted an increased discussion surrounding the concept of teacher grit (Bashant, 2014; Christensen et al., 2014). Also founded on Bandura's Social Cognitive Theory (Dobbins, 2016), recent studies have consistently established the importance of teacher grit as a central disposition of successful teachers (Atapattu, 2015; Dobbins, 2016: Eskreis-Winkler, Gross & Duckworth, 2016; Silvia, Eddington, Beaty, Nusbaum & Kwapil, 2013). Given that the role of the modern teacher increasingly requires intense relationships with a variety of constituent groups and the handling of a

dynamic and complex school environment, understanding the non-cognitive factors that are likely to improve teacher performance has rarely been more important (Argon & Kaya, 2018). Madden (2015) suggests that for teachers to positively influence the performance of their students over time, the continuity of their grit, perseverance, and endeavour, in addition to their qualifications and professional qualities is also very important. For teachers to be able to endure the often lengthy and complex process of improving student performance depends on their own long-lasting perseverance and passion (Argon & Kaya, 2018).

Recent research supports the fact that there is an intersecting relationship between teacher self-efficacy and teacher grit (Robertson-Kraft & Duckworth, 2014Specifically, there is a significant overlap in the conceptual language used to define the terms of each. Studies have illustrated a powerful connection between teacher efficacy and the development of the characteristics of teacher persistence (Tschannen-Moran et al., 2007), enthusiasm (Lararides, Buchholz & Rubacj, 2018), resilience (Tschannen-Moran et al., 2007), commitment, (Coladarci, 1992) and a determination to stay in teaching (Barni, Danioni, & Beneveve, 2019)). Similarly, the concept of grit is best elucidated by teacher durability, fortitude, perseverance, and determination (Argon & Kaya, 2018). Given this definition of the concept, teacher grit can also be directly associated with the determination, enthusiasm, and perseverance levels of teachers to reach their long-term goals (Robertson-Kraft & Duckworth, 2014). Individuals who possess good qualities of professional grit approach personal achievement with determination and demonstrate a sustained level of stamina despite obstacles that seem to hinder student learning (Duckworth, et al., 2007; Robertson et al., 2014). These individuals cultivate high levels of resilience and endurance resulting in increased career success and contentment (Rimfeld, Kovas, Dale, & Plomin, 2016)

In addition to the role that grit might play in developing a "staying power" within teachers, studies also indicate a positive correlation with personal motivation (Muenks, Yang, & Wigfield, 2018). In the same way that efficacious teachers see difficult tasks as challenges rather than threats (Bandura, 1997), teachers with grit are more willing to persevere and invest in the learning process, choosing to engage with the professional struggle and to take pride in learning accomplishments when they have not been easily achieved (Argon & Kaya, 2018). What is important for these teachers is whether if they endure the process there is a likelihood of longer-term success. Provided that there is a belief that a successful outcome is possible there is a greater potential that teachers will not be distracted or become skeptical of the worth of the endeavour. (Yerdelen-Aydın, Boz, & Aydın-

Günbatar, 2017). In this sense, teachers' psychological grit does not only improve teacher motivation but also general mood and outlook in school environments which may be stressful and where human interactions can be intense (Argon & Kaya, 2018). Indeed, educators with higher grit demonstrate a greater commitment to their goals, even more so than other factors such as additional qualification, age or experience (Hill, Burrow and Bronk, 2014). Employees with higher psychological well-being have been shown to be more effective in the execution of their professional duties and revealed less anxiety and higher self-esteem (Argon & Kaya, 2018).

Research also indicates that the benefits of having grit are not limited to the individual teacher but can also impact the institution more generally (Argon & Kaya, 2018). Several studies addressing grit have shown it to contribute positively to the achievement of institutional goals and in creating an environment that induces lower levels of burnout and exhaustion (Shen, McCaughtry, Martin, Garn, Kulik, & Fahlman, 2015). Teachers with high levels of grit tend to be more muted in their responses to adversity, and so contribute to a more stable institutional environment (Robertson-Kraft & Duckworth, 2014). Greater individual resilience, particularly if it involves key influencers in a school, has the potential to positively impact the overall culture through vicarious experiences and verbal persuasion much in the same way that it might strengthen self-efficacy belief. Building a positive momentum within staff teams can have an accumulative effect on enhancing the professional climate as when individuals witness others being successful with their efforts, they too begin to believe that if they work hard enough, they can also succeed (Bandura 1997). If these teachers work in teams this will contribute positively to them to be open to new ideas and projects to increase the performance of students' programs, and the school as a whole (Argon & Kaya, 2018). The key for school leaders is to cultivate an environment where overcoming obstacles without giving up, focusing on mid and long-term objectives without losing interest, and seeing challenges as opportunities becomes the norm.

Interestingly, research has shown that the development of perseverance and fortitude within teachers is not dependent on other personable variables. Recent studies indicate that teachers' ages, career experience, educational qualification, school type, or the subjects taught have any significant influence over whether or not a teacher can successfully develop professional grit (Argon & Kaya, 2018). These findings are somewhat counter-intuitive as it might easily be assumed that levels of tenacity would be expected to increase with age, professional seniority or level of education (Argon & Kaya, 2018). That being said, female teachers have been shown to be grittier than their male counterparts in some cases. Limited studies have determined that female teachers are more enthusiastic

and determined than the male teachers, possibly because they develop a more personal desire to achieve both personal and institutional goals (Von Culin, Tsukayama & Duckworth, 2014).

Growth Mindset

Tangentially a concurrent discussion around growth and fixed mindsets has also soared in prominence. Based on the work of Carol Dweck, this research is founded upon the notion of brain plasticity, defining intelligence as having an inherent malleability (Kuusisto, Laine, & Tirri, 2017). According to Dweck, people with a growth mindset (incremental theory) believe that intellect and natural ability have the potential to be enhanced and increased incrementally over time; people with a fixed mindset (entity theory) see these qualities as predetermined, static, and unalterable (Dweck, 2006). Such a concept has the capacity to significantly impact levels of grit, and by association, self-efficacy. If, as Dweck asserts, personal intelligence is not always attributed to a fixed individual talent or ability (Dweck, 2008), but can be developed and improved over time through effort and instruction (Dweck, 2010), then grit and self-efficacy should also be able to be increased in the same manner. Indeed, some research suggests that the very definition of growth mindset is based upon the premise that intelligence level is not a fixed number and can be enhanced given the right encouragement and support (Hochanadel et al., 2015). If this is the case, then the importance of grit as "…passions and persistence for long-term goals" (Duckworth & Quinn, 2009, p.166) is further magnified.

Dweck's theory, therefore, holds promise both in the personal performance level of teachers and in the way that this models successful learning to students (Hochanadel & Finamore, 2015). This promise is especially compelling in communities where teachers do not enter the profession with a depth of academic schooling or professional career training. In these cases, it is natural for teachers to lack the theoretical foundation of how learning occurs often resulting in a lack of clarity as to the technical steps required to promote learning. This is essential as studies have shown that teachers' beliefs about intelligence are predictive of their sense of responsibility for student performance (Patterson, Kravchenko, Chen-Bouk, & Kelley, 2016). Teachers with a fixed mindset view student ability as predetermined and static therefore regardless of the quality of the teaching experience are unlikely to develop significant gains in ability. As a result, teachers with this viewpoint often consider themselves to have less influence over student academic performance (Patterson, Kravchenko, Chen-Bouk, & Kelley, 2016) and may even be less open to pedagogical professional development (Rissanen, Kuusisto, Tuominen, & Tirri, 2018).

At the same time, teacher's beliefs about intelligence can also shape their professional interactions with students (Massa, 2014). Teachers often unconsciously deliver messages to their students regarding their learning ability through the language they use and can shape students' views of their own abilities as well as influence their motivation, confidence levels, and achievement (Cimpian, Arce, Markman, & Dweck, 2007). They tend to praise a student's natural ability (Rissanen et al., 2018) or comfort students for their limited ability which has the potential to have a negative effect on student performance and motivation (Klehm, 2014). Fixed mindset teachers also seem to protect weaker students (for all the right reasons) from challenges and critical feedback, to preferring to give easier or more comforting feedback (Rissanen et al., 2018) They engage in more ability grouping and so when it comes to student achievement students who are low in intelligence do not perform strongly in the classroom (Rissanen et al., 2018) In such classrooms, students often perform to expected levels, interpreting their understanding of their own abilities through the lens of the communication that they witness and receive from their teacher.

In contrast, teachers with a growth mindset are less likely to make stereotypical judgments about students' abilities and firmly believe in a teacher's power to influence student accomplishments (Rissanen, Kuusisto, Tuominen, & Tirri, 2019). Learning is viewed as a dynamic continuum that can be positively impacted by the development of skills for learning as well as a classroom environment that encourages collaboration and teamwork (Argon & Kaya, 2018). These teachers also spend more time in individual interactions with students in order to get to know them and give them individualized support as well as praising effort, determination, and courage in learning over achievements and personal qualities (Ronkainen, Kuusisto, & Tirri, 2018). In this environment students learn to cope with mistakes and develop an understanding of how failures and challenges play roles as learning opportunities (Hochanadel et al., 2015). As a result, these students tend to be grittier and low-achieving students can make significant learning gains (Bashant, 2014). Classrooms that provide students with a learning environment where perseverance and determination are an expectation give guidance through honest and supportive feedback and consistently give hope for continued improvement (Malik & Rizvi, 2018). While such an approach is likely to be beneficial to all students, studies indicate that having a growth mindset is even more important for Black or Latino students and for girls in specific disciplines (Dweck, 2010). It might also be posited that this would also be the case with students who are educated in marginalized communities.

Central to the concept of growth mindset pedagogy is that such teaching also promotes a growth mindset. Students' growth mindset and appreciation of persistence and effort correlates with not being thrown by failure, but rather in seeing failures as opportunities for learning (Dweck, 2006, 2010; Blackwell, Trzesniewski, & Dweck, 2007). While research indicates that mindsets tend to be relatively stable, they can be altered by interventions from educators who establish learning experiences that do not merely emphasize performance targets but also learning goals and continuous improvement as a part of the learning process (Mangels, Butterfield, Lamb, Good, & Dweck, 2006). Classrooms that establish a growth mindset pedagogy have been found to have higher levels of student achievement when facing adversity in the educational process, as well as higher student completion rates in demanding school courses (Blackwell, Trzesniewski, & Dweck, 2007; Yeager & Dweck, 2012). As Dweck (2010) asserts this is "because they believed that their intellect could be developed, students with a growth mind-set focused on learning, believed in effort, and were resilient in the face of setbacks" (p. 26). The development of this optimism towards the learning process within students serves not only as a boost to their personal hardiness but also to their independence and autonomy (Koca, 2016). Mirroring the transference of a positive attitude to learning from teacher to student, this increased motivational belief in the learning and teaching process on the part of the student completes the circle of also enhancing confidence levels of both peers and the teacher (Koca, 2016).

Self-Permission

In the same way that student motivation levels increase optimism and autonomy towards learning, self-belief and self-determination also leads to more engaging and worthwhile learning experiences (Roth, Assor, Kanat-Maymon, & Kaplan, 2007). Whether or not an individual has the ability to establish themselves as they pursue their goals can have a significant impact on their ultimate success (Burrell, Allen, Gayle, & Preiss, 2014). The capacity to conquer situational adversity and challenge as well as to assert themselves when facing the influence of others are important elements for individuals maintaining a positive approach to realizing personal goals (Burrell, Allen, Gayle, & Preiss, 2014).

As essential as prevailing over these types of external conflicts is, it is equally important that individuals also be aware of the power of internal conflict. Ultimately, one of the most important foundations of the concepts within the umbrella of positive psychology is the notion of 'self'. While many issues of control are associated with regulation by circumstances or social pressures that

originate from outside of the self (Ryan & Deci, 2000), the process of self-actualization – the actual attainment of short and long-term goals – emanates from inside the individual (Maslow, 1954). In this sense, internal conflict has the potential to cause a heightened level of personal stress, lower levels of well-being, and an overall poorer performance (Baumann, Kaschel, & Kuhl, 2005). It is imperative, therefore, that if an individual is to develop high levels of self-efficacy, they must first overcome any sense of internal conflict regarding their abilities and opportunities (Burrell, Allen, Gayle, & Preiss, 2014). This is especially important in teaching where inexperienced teachers often enter the profession with conflicting opinions about their ability to be successful in the classroom (Ma & Cavanagh, 2018).

As discussed earlier, according to Bandera (1986), self-efficacy originates from the strength of an individual's belief in their ability to succeed in the completion of smaller tasks and larger goals. This is likely to also shape the type of task or goal an individual elects to take up as well as the way they approach accomplishing them (Bandura, 1997. Self-efficacy derives from a conviction that something is possible, and with the development of a positive disposition of optimism and determination (Maddux, 2009), and as such, often foreshadows future success as a self-fulfilling prophecy (Bandura & Locke, 2003). That being said, even if an individual has the required levels of self-belief, grit, and motivation, without an accompanying certainty that they have the permission and authority to accomplish the established goals, they are unlikely to maximize their success. It is with this notion in mind that Rose's theory of self-permission emerged.

Nico Rose first introduced his concept of Self-permission in his 2014 capstone project regarding the perceived allowance of individuals to reach long-term objectives in their life (Rose, 2014). Centred on the concepts of professional belonging, autonomous functioning, and cultural authority, self-permission addresses the authority and power behind decision-making (Rose, 2014). Simply put, while efficacy focuses on the belief of individuals in their ability to accomplish goals, self-permission targets the sense of authority (self or otherwise) required to make the involved decisions. Although self-permission and generalized self-efficacy beliefs capture different aspects of a person's self-concept, they are also interrelated in that they are moderately positively correlated with one another (Rose, 2014). While undoubtedly closely linked with the concepts of confidence and self-assurance, self-permission highlights the cultural nuances of decision-making in relation to the perceived appropriateness of roles and responsibilities. In this sense, the external conflict of "it is professionally appropriate for me to behave this way?" and the internal conflict of "am I actually allowed to do this?" are key drivers. Given the nature of this definition, teachers entering the

profession without a clear understanding of their role or responsibility often struggle with the internal conflict of self-permission.

In this vein, Rose proposes that self-permission exists in both a narrower and broader sense, and that these concepts are intertwined in many respects (Rose, 2014). In simple terms, self-permission can be applied at the institutional and the individual level. The feeling that one is not allowed to pursue and reach a specific goal is also likely to be of a dynamic nature and therefore develop or augment over time (Rose, 2014). The question as to whether or not a person is allowed to exhibit behaviours required to achieve established goals, or whether their intrinsic sense of value has been cultivated to allow them to believe they are worthy of fulfilment is subject to environmental influence (Rose, 2014). As such, it is also susceptible to both local (institutional) and regional sway. Similar to the notion of self-efficacy, self-permission is also likely to be constructed in an evolving fashion, by the countless interactions and experiences with primary and secondary caretakers and colleagues (Rose, 2014).

In view of this interpersonal nature of self-permission, the concept is as closely linked to self-esteem as it is self-autonomy or self-efficacy. Based on a foundation that is infused with the reaction of others to one's own actions, like self-esteem, the theory involves a self-evaluation of competencies, and self-liking (Bosson, & Swann, 1999). Although virtually no formal research has been completed regarding the benefits of self-permission, given its proximity to self-esteem, it is reasonable to suppose that even though some researchers question the beneficial outcomes (Baumeister, Campbell, Krueger, & Vohs, 2003), it is most often associated with high subjective well-being and psychological functioning (e.g., Judge, & Bono, 2001). It is also plausible, again as in the case of self-esteem, that a sense of self-permission can be impacted negatively including the possibility of social exclusion (Leary & Baumeister, 2000). Indeed, according to Rose (2014), systemic influences that affect an individual's self-permission can be very much concerned with the possibility of unfavourable outcomes in the future (Rose, 2014). At the same time, those who associate an optimistic structure, order or meaning in life often exhibit a sense of relatedness, self-acceptance and perceived personal growth (Steger, Kashdan, Sullivan, & Lorentz, 2008).

In an educational setting more specifically, self-permission addresses the sense of professional belonging a teacher has within the institution, and the understanding that they have regarding the key functions of teaching. For example, any preconceived impression of who has authority over the selection of the curriculum delivered in a given class, or the teaching methodologies used in the room is likely to modify the motivation of the teacher involved. Those who do not believe that a teacher has

the authority to modify their professional practice may be convinced that they have the ability to respond nimbly to a given professional situation but are still unlikely to do so due to a sense that such action would be inappropriate. Given this phenomenon, teachers in countries where there is a strong sense of social order and clearly defined societal expectations may understand their professional expectations vastly differently than their peers in more autonomous cultures.

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As mentioned at the beginning of this paper, the preceding review served as the scholarly footing for the following papers. In its simplest terms, this phase of the study was pursuing an understanding of the relationship between teacher quality and elements of positive psychology in Panamanian teachers. Although the goal of the study as a whole was related to the improvement of teacher practice, the specific focus of this phase was to determine perceptions of self-efficacy and self-permission within Panamanian teachers. The intent was that this, in turn, would help establish insights into teacher perception of these critical areas of positive psychology and therefore inform the development of useful professional development and support. The following Methodology details the approaches taken to collect such data.

Paper 3: Phase One: Design

Purpose

      While the study was originally designed to identify specific areas of need or concern for teachers who self-identify as unqualified and inexperienced, this intent was broadened over time to include a more comprehensive profile of teachers across the country. As a result, the survey was administered to three additional categories of participants to provide comparative data: experienced teachers who have a formal teaching qualification, experienced teachers who do not have a formal teaching qualification, and inexperienced teachers who have a formal teaching qualification. This phase was designed to identify broad patterns in levels of self-efficacy and self-permission within these teachers, with the hope that the data would inform the creation of a professional development tool using mobile technology in Phase Two.

Research Questions

1. What are the perceptions of teachers in Panama on self-efficacy and self-permission?
    a) What is the relationship between self-efficacy beliefs and teaching experience in teachers in Panama?
    b) What is the relationship between self-permission beliefs and teaching experience in teachers in Panama?
    c) What is the relationship between self-efficacy beliefs and teaching qualification in teachers in Panama?
    d) What is the relationship between self-permission beliefs and teaching qualification in teachers in Panama?

Theoretical Framework

      While adhering to the previously discussed theoretical framework of the study as a whole, the first phase of the research design was also focused on a narrower theoretical framework that blended the concepts of self-efficacy and self-permission.

      Despite being more than 25 years old, Albert Bandura's concept of self-efficacy remained a seminal foundation for our understanding of issues involving personal confidence. Bandura (1994) asserted that self-efficacy beliefs determine how people feel, think, are motivated, and behave. "People with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather

than as threats to be avoided… In contrast, people who doubt their capabilities shy away from difficult tasks which they view as personal threats." (Bandura, 1994 p.71-72) More recent studies have refined these characteristics somewhat, adding the complexity of societal and contextual influences on professional self-efficacy, but the descriptors still serve as useful today (Patterson-Hazley & Kiewra, 2013). In an educational context, this speaks to teachers' conviction in their own ability to teach students efficiently and effectively (Gavora, 2010). Building on Bandura's foundation, several iterations of efficacy instruments for teachers have been developed, most notably by Tschannen-Moran & Woolfolk Hoy (2001), and more recently by Gentry et al. (2014) who have developed an updated instrument to measure educator's self-efficacy for modelling 21st-Century skills. These evolutions served as founding principles for the instrumentation design of this study.

Teaching is a complex and challenging job especially for new teachers who often initially struggle with its demands (Aðalsteinsson, Frímannsdóttir & Konráðsson, 2014). This challenge is naturally magnified in situations where teachers have not received adequate training or preparation for the classroom. They are not always confident that they have the ability and character to be successful teachers and require considerable support and training (Tessier, Sarrazin, & Ntoumains, 2010). This lack of self-assurance can have a negative impact on both the experience and achievement of students as research indicates that students learn more from teachers with high self-efficacy than those same students would learn from those teachers whose self-efficacy is low (Ashton & Webb, 1986). The process of designing the study, therefore, remained faithfully cognizant of the fact that honouring specific cultural norms was critical to the validity of the research. Additionally, it was consistently noted that the data collected from this phase, though more conceptual in nature, was principally collected to inform a deeply practical application.

Despite the Panamanian economy experiencing positive momentum over the last two decades, the country still has a history of corruption and political instability (Thurston, Hackney, & Boggs, 2013). There remains a shortage of skilled labour, and professionals face significant government bureaucracy and the lack of an equitable and independent judicial system (Panama, 2013). As a result, levels of professional trust and confidence remain relatively low, especially for those living in low-income regions which remain challenged by the fact that there is a significant income disparity within the country (Porter & Schwab, 2009). At the same time, Panamanian society remains highly structured, with societal divisions based on wealth, occupation, education, family background, and culture, in addition to race (Meditz & Hanratty, 1989). Family loyalty is an inherent societal value, and

family ties are considered one's surest defence against a hostile and uncertain world (Meditz & Hanratty,1987).

The existence of such a powerful social stratification suggested that there was a critical cultural element missing from the idea of self-efficacy. Bandura's model needed enhancement to address these specific societal influences, and Rose's concept of self-permission served as a potential complement. Self-permission is a distinct construct to self-efficacy where efficacy refers to an individual's belief in their ability to accomplish established goals while permission addresses whether or not the individual feels that they have the authority or approval required to realize the goals (Rose, 2014). The two concepts are intertwined in many aspects and are developed in similar ways and over similar timeframes. Self-permission draws from the concepts of autonomous functioning and self-determination, though perhaps is most closely aligned with Maslow's self-actualization (Maslow, 1954). As such, the idea addresses professional self-perception from a perspective of belonging and cultural authority. In other words, am I 'allowed' to have the autonomy to be a good teacher, rather than do I have the required skill set?

Self-permission also focuses on the importance of belonging – a central component of Panamanian culture. The need to belong serves as powerful intrinsic motivation, especially when this is coupled with a lack of social acceptance (Leary & Baumeister, 2000). Professional belonging also impacts an individual's sense of neuroticism, anxiety, and sensitivity to rejection (Leary, Kelly, Cottrell & Schreindorfer, 2013). It is apparent, given the strength of the societal structure and the importance of the role of the family within Latin America culture, that being a good teacher is likely to be impacted by both a sense of belonging and sense of worth. This type of autonomous behaviour has been directly linked to offering more engaging learning experiences in the classroom (Roth, Assor, Kanat-Maymon, & Kaplam, 2007), as well as lower levels of anxiety and stress and higher levels of well- being (Weinstein & Ryan, 2011).

Given this paradigm, the work of Mercer and Kostoulas (2018) also served as a persuasive affirmation of the design thinking. While grounded in the world of language acquisition, their collection of thought-provoking theoretical frameworks in *Language Teacher Psychology* examines several of the established constructs that underpin this study, as well as justifying a call to action for further research in the area. In a well-designed series of chapters, the model posits the theory that a disproportionate focus on language learning through a lens of the learner, has resulted in an oversight of the importance of teacher psychological capitol (Mercer & Kostoulas, 2018). In making the case for

a more profound grasp of the role that positive psychology plays in effective teaching, the combined frameworks allowed for a more complete understanding of the cultural and motivational factors that shape teacher identity.

Specific to this construct, was the notion of self-determination theory. Hiver, Kim & Kim in Chapter 2 discuss the often-found presence of a mismatch between expectations and realities of the classroom for novice teachers (Mercer & Kostoulas, 2018). This premise is further expanded by the work of Sahakyan, Lamb & Chambers, in Chapter 4, where the opinion that new teacher's concept of ideal self gradually adjusts over time to reflect a more realistic professional self-construct (Mercer & Kostoulas, 2018). Such a theoretical framework regarding teacher motivation served as a strong cultural model for exploring the dynamic relationship between self-efficacy and self-permission. The concept that a teacher might be likely to have multiple 'selves' or visions of themselves as teachers, and that these might change over the duration of a career was central to this understanding (Wyatt, 2014).

Coupled with this conceptualisation of a teacher's sense of self, the framework also provided a detailed examination of the role of emotional intelligence and resilience as critical elements of positive psychological capitol. It stressed the importance of understanding resilience in changing contexts and advocated for an optimistic approach when addressing issues surrounding self-doubt, time management, and institutional limitations rather than the traditional practice of focusing on weaknesses in teacher performance (Mercer & Kostoulas, 2018). Due to the strong interconnection between the individual and contextual factors influencing any given psychological profile, there is a need to consider the perspective of novice, emergent, and veteran teachers to gain a comprehensive yet holistic conceptual understanding (Mercer & Kostoulas, 2018).

Consequently, the methodological design that follows was an attempt to not only gain an understanding of how teachers felt about their own competence and confidence, but also on the way that their perceptions of cultural and societal norms influenced their professional beliefs and, in turn, teaching practice.

Instrumentation

The study involved the development of a five-level, Likert-style survey administered to 500 teachers from six regions and one private school in Panama (see Appendix C). The survey was created using a blend of instruments for teacher self-efficacy and Rose's instrument for determining self-

permission (Rose, 2014). The original five-point Likert scale remains an efficient way to measure attitudes, character and personal traits (Boone & Boone, 2012), and was administered in Spanish for native speaking teachers. "The difficulty of measuring attitudes, character, and personality traits lies in the procedure for transferring these qualities into a quantitative measure for data analysis purposes" (Boone & Boone, 2012, P.1). Careful attention was taken to ensure that the translation considered the cultural nuances of the language. Both the instrumentation design and the way the survey was administered were followed by a small-scale pilot study used to determine the reliability and validity of the survey.

Table 1: Suggested Data Analysis Procedures for Likert-Type and Likert Scale Data.

	Likert-Type Data	**Likert Scale Data**
Central Tendency	Median or Mode	Mean
Variability	Frequencies	Standard deviation
Associations	Kendall tau B or C	Pearson's *r*
Other Statistics	Chi-square	ANOVA, t-test, regression

Note: From Boone, H. N., & Boone, D. A. (2012). Analysing Likert data. Journal of Extension, 50(2), 1-5.

Both Likert-type and Likert scale data analysis procedures were implemented. The study used Boone & Boone's suggested analysis procedures (Table 1) to construct a descriptive analysis using non-parametric procedures including the median for central tendency and frequencies for variability, as well as calculating a composite score using an interval measurement scale with the mean for the central tendency and standard variations for variability (Boone & Boone, 2012). The rationale for adopting this multi-analytical approach was to maximize the validity and reliability of the data collected in Phase One and to increase the flexibility of the potential design of the second phase of the study.

Piloting to test the validity of the survey instrument
An overview of the pilot study

A pilot study to test the validity of the survey instrument was carried out with a small sample of teachers (n=75). Specifically, the pilot was designed to test the research design and suitability in a Panamanian context of Bandura's Teacher Self-Efficacy Scale (TES), when translated into Spanish by bilingual professionals. Additionally, questions were asked about the participants' comfort with and

use of mobile technologies to complete the survey. The pilot was also used to collect data regarding the response rates to an online survey of this type, and the logistics of the process. There was no intent to analyse the data at this point.

Three bilingual professionals, experienced in translating documents, were asked to translate the TES individually and then together, combining their efforts to develop a single translation that all three translators were comfortable with. The survey was designed in Google Forms and shared with participants using an anonymous link in an email. Each participant was informed that completing the survey was voluntary, and that all feedback would be anonymous. The survey was administered over a 10-day period, with a reminder email sent after 5 days. Data were collected using Google Forms, and basic analytics within the program were applied to produce simple graphic representation of the collected responses, to depict those questions where participants had the lowest response rate (i.e., indicating a potential problem with the structure of the item). Following the administration of the survey, participants were invited to an informal feedback session where they could share unprompted opinions regarding the survey and the process generally.

Reflections on the pilot study

The following observations were apparent having reflected upon the process:

1. Google Forms does not have robust tools for initial data sorting and analysis, and so additional options for the survey tool should be considered. That being said, Google Forms is by far the most widely experienced platform for teachers given the fact that it is free and so teachers were clearly more comfortable and trusting of using a Google platform that was known to them. Embedding the survey into an email that can be accessed and completed via a smartphone was very well received. The ease of use with mobile technology is certainly a factor in response rate.

2. The response rate was predictably artificially high, given that the school selected was my place of work. I therefore anticipated a lower response rate once the survey was sent out to teachers from other regions. A well-designed implementation plan was obviously required for the survey to obtain a strong response rate. The manner in which the survey was shared, and by whom was also a cultural factor that needed to be considered in the ongoing design.

3. More work needed to be done on the translation. It was apparent on reflection, that the process of combined translation was dominated by the stronger personality of one of the translators. A

third voice might mitigate this influence on the final survey, as genuine consensus would then be required to gain agreement, which in turn was likely to cause a more thoughtful discussion over the precise vocabulary used.

4. The questions regarding technology did not fit seamlessly with the questions about self-efficacy. While the data collected was of use, it appeared to distract from the fundamental intent of the survey. The disparity between the concepts of self-efficacy and mobile technologies in the one survey seemed significant. We therefore considered, either having a separate section on the survey tool to collect data regarding mobile technologies or leaving this section until the pilot study to be completed prior to Phase Two.

The following is an abbreviated list of the main points of feedback from the teachers debrief session:

1. Definitions of the numbers and what they represent would be helpful. Several participants worried about what each number represented and the message that it sent about them as a professional. Clarity of direction, and even, perhaps, some examples might help alleviate anxiety. *"I worried about getting the right answer!"*

2. Nearly all participants felt that some questions were not reflective of self-efficacy as their answers did not speak to whether they believed in themselves, but rather whether or not they believed that they had the right or authority. *"I am not allowed to have an influence on the school, I am just a teacher!" "That's not my responsibility and so I am not supposed to think like that."*

3. The question about teacher qualification was problematic and might need to be worded differently. Teachers in Panama, even those that are not qualified, feel they should present themselves as professionals, and so do not feel comfortable being candid about their own deficiencies. Even though the survey was anonymous the distrust of giving candid responses remained an issue. *"I felt like I was letting IAE down by answering this question!"* Self-reflection is difficult within the profession, and so it may be necessary to add contextual data in some way (i.e., open questions on survey, random interviews in Phase One etc.), to add to the validity of the survey.

4. The precision of the vocabulary on the survey is very important. Participants did not necessarily understand what was meant by some questions and so tended to score a little higher than they might have done "just to be safe!". *"I thought that I knew what you were asking, but I wasn't entirely sure that I was right. That worried me."*

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How the Pilot modified the methodological design of Phase One

The findings of the pilot study had a direct influence on two significant elements of the research design, specifically, the composition of the survey, and the process used to translate the questions into Spanish. I also seriously considered changing the survey instrument from Google Forms to LimeSurvey to provide more robust and flexible options for representation of the data set. Ultimately, I decided against this, given the importance of teacher ease with the data collection process. While this resulted in a more restricted ability to represent the data, it was likely to be of more benefit that the study used a platform that teachers were aware of and might have some experience with. It was also essential that the Panama Bilingue coaches were equally confident in their ability to answer any potential questions that might arise to smooth the data collection process, which was far more likely using a simpler and more recognized 'Google' survey.

Feedback from the informal discussions with participants highlighted the fact that a strong cultural norm was influencing participants' responses to the self-efficacy questions. As a result, further research was completed seeking ways to modify the survey to increase the internal validity of the instrument. The survey was subsequently modified to exclude the questions regarding the participants' use of technology, and to integrate Rose's concept of self-permission. This alteration of the original survey design was intended to increase the consistency of question content, and to add depth of context to the data collected regarding self-efficacy. It was also hoped that modification of the questions might mitigate the potential of oversimplification of complex concepts, a common limitation in the use of survey research.

The process of translation was also modified significantly, with the addition of a third translator. This amendment was made to induce further debate over the exact vocabulary to be use, and therefore to create a more precise and authentic survey tool. The addition of a translator to make a group of three, created the need for an added discussion regarding the precise word use in order to develop consensus. Given the importance of ensuring clarity of meaning with the questions, this adjustment specifically addressed the imbalance of influence of the translation process. Moreover, the third participant of the translation process was deliberately selected for their understanding of informal Panamanian dialects and usage. This additional cultural nuance actually changed the structure of the way that the questions were asked, introducing a more informal or relaxed tone to the questions about self-efficacy. It is interesting to note that the translators found it considerably more difficult to find

common consensus on the wording of the questions on self-permission than they did self-efficacy.

Participants

The sample of participants included 500 teachers, from 6 regions of Panama including, Los Santos, Herrera, San Miguelito, Panama Norte, Panama Este, Veraguas and the Instituto Alberto Einstein (IAE), a private school in Panama City. All teachers worked in a bilingual program with the sample containing a diversity of teacher profile including teachers with a variety of experience and qualification levels.

For the study, experienced teachers were defined as professionals who have been teaching in a regular classroom for more than 5 years (Huberman, 1989). Formal teaching qualifications were defined as an accredited undergraduate degree in education, or an accredited degree and certified teaching program, resulting in a professional teaching license. Teaching licensure will not be limited to the country of Panama but could be obtained from any country. Hence, four categories of experience were identified: no teaching experience, 1-5 years, 5-10 years, and 10+ years of teaching experience. Five categories of teacher qualification were identified: no formal qualification, high school diploma, Bachelors degree, Masters degree, and other qualification.

Participants worked in an assortment of educational settings with schools ranging in size, type, age range, cultural demographic, and academic success. The size and diversity of the sample were loosely representative of the composition of the teaching profession in Panama, and the sample from IAE was designed to include participant profiles that were broadly representative of the profiles found in the larger population.

Data Collection

The survey was a specially designed hybrid of Bandura's Teacher Self-Efficacy Scale (TES), Gentry et al.'s instrument for modelling 21st-Century skills (ETS-ES), and a modified version of Rose's Self Permission Scale (SPS), adapted for an educational setting. Both scales were translated into Spanish by a panel of three bilingual professionals, individually and then as a team, to ensure agreement on the precision of vocabulary.

In the case of the TES and ETS-ES scales, questions were grouped into four sections:

1. planning and assessment self-efficacy

2. instructional self-efficacy

3. disciplinary self- efficacy

4. efficacy to create a positive learning environment.

For the Self-Permission Scale section of the survey, Rose's questions point towards 1. lack of self-permission and 2. positive self-permission were included (i.e., lack of self-permission questions were reverse-coded when calculating the composite score). The wording for each of these questions was altered as little as possible to make them more obviously refer to professional self-permission rather than personal. Questions were randomized once, before administering the survey to participants. This resulted in twenty-nine closed ended question survey divided into six distinct facets of efficacy and permission. Additional demographic data was also collected as a part of the survey (i.e., gender, age, birthplace, workplace) and the two main categories (i.e., experience and qualifications).

The survey was developed using Google Forms and was administered using a digital mobile link or with a physical copy depending upon the preference of the participant. The option to complete the survey was given in a regularly scheduled professional development training session with the professional development coach for the region involved. This method of dissemination was deliberately selected to increase levels of trust and to ensure that teachers were aware that participation in the survey was both voluntary and anonymous as the coach has built trusting relationships with these teachers over several years.

Data Analysis

The data were collected and inputted into the Statistical Package for the Social Sciences (SPSS) software to analyse. The data were analysed using a ratio scale of measurement and was represented solely numerically. No manipulation of the raw data took place prior to the importing into the SPSS.

Participant Demographics

A frequency analysis was performed to assess the number of participants who were represented within each category of teaching experience (i.e., never taught before, have taught for less than 5 years, have taught for 5 – 10 years, and have taught for more than 10 years) for each of the other covariates.

Descriptive Findings

The data was tabulated using descriptive statistics in order to calculate the number of participants within each level of experience and for each category of teaching qualification (i.e., No formal degree, high school diploma, other, bachelor's degree and master's degree). To the simple organization of these numbers, the datasets were analysed using mean and standard deviation for each question within the six categories (i.e., four for self-efficacy and two for self-permission) to describe them more fully.

Composites

Likert scale analysis procedures were implemented on the data. The study used Boone & Boone's suggested data analysis procedures to construct a descriptive analysis applying a composite score using an interval measurement scale with the mean for the central tendency and standard variations for variability. All missing data was treated as Missing at Random (MAT) (Boone & Boone, 2012).

Composite for Self-Efficacy

Self-Efficacy is measured in four main components:

1. E1: Planning and Assessment
2. E2: Instruction
3. E3: Disciplinary
4. E4: Positive School Climate

It was decided that each of these components deserved the same weight in building the composite. In order to do so, for each of these components, the mean was measured:

$$E_i = \sum_{j=1}^{n} x_j / n;$$

E_i represents each of the four components of Self Efficacy, x_j represents each of the subcomponents of E_i. To build the composite a weighted mean was calculated using the following algorithm:

$$SES = \sum_{i=1}^{n} 0.25 E_i ;$$

SES is the Self-Efficacy Score composite and E_i remains representing one of the Self-Efficacy components.

Composite for Self-Permission

Self-Permission is measured in two main components:

1. P1: Lack off Self-Permission

2. P2: Positive Self-Permission

Lack of Self-Permission was reverse-coded when calculating the composite score;

$$IF\ P_{1_a} = 1 \rightarrow P_{1_a}{}^- = 5, IF\ P_{1_a} = 2 \rightarrow P_{1_a}{}^- = 4, \dots, IF\ P_{1_a} = 5 \rightarrow P_{1_a}{}^- = 1$$

It was decided that each of these components deserved the same weight in building the composite. In order to do so, for each of these components, the mean was measured

$$P_i^{\pm} = \sum_{j=1}^{n} x_j / n;$$

$P_i^{\pm}$ represents either of the two components of Self Permission, and x_j represents each of the subcomponents of $P_i^{\pm}$. To build the composite a weighted mean was calculated using the following algorithm:

$$SPS = \sum_{i=1}^{n} 0.5 P_i^{\pm} ;$$

SPS is the Self Permission Score composite and $P_i^{\pm}$ remains representing one of the Self-Permission components.

Additional Analyses

Following the descriptive analysis for each of the two main categories (i.e., experience and qualifications), two main additional analyses were conducted: Pearson r correlational analyses and one-way between-subjects analysis of variance (ANOVA).

The Pearson r correlations were conducted to determine if there was a relationship between self-efficacy and self-permission within each category of teaching experience and qualification. The one-way between-subjects ANOVA was conducted to determine whether the difference in means (averages) on the self-efficacy and self-permission scales were statistically significant between different levels of teaching experience and teaching qualifications.

One-way between-subjects ANOVAs were also conducted for other covariates (i.e., gender, age, birthplace and workplace) to determine whether the difference in means (averages) on the self-efficacy and self-permission scales were statistically significant between different levels of those categories.

Upon a statistically significant finding, a LSD (i.e., if there were less than three categories in the independent variable) or Tukey's (i.e., if there were three or more categories in the independent variable) post hoc test was performed for those ANOVAs satisfying the homogeneity of variance, or a Dunnett's T3 post hoc test for those that rejected the null hypothesis in Levene's test. The level of statistical significance at which a result will be regarded as being statistically significant was .05, the conventional level used in education research.

Finally, a depiction of the means for self-efficacy and self-permission with 95% confidence interval was assessed for level within each covariate. The formulas for each of these statistical analyses can be found in Appendix D.

Paper 4: Phase One: Results

Participant Demographics

The data from this study came from a survey given to 500 teachers (see Appendix E). The response rate was 63% (i.e., 315 teachers participated in the survey). Most of the participants were female (78%), 31 years old or older (77%), born in Panama (81%), with at least a Bachelor's degree or a teaching license (74%) (Table 2).

Table 2: Participant Demographics for Phase 1 of the main study

Participants Demographics					
	Level of Teaching Experience				
Variable	1	2	3	4	Overall
	0 years	-5 years	5-10 years	10+ years	
N (%)**	6 (2)	90 (28)	78 (25)	141 (45)	315 (100)
Sex					
Female	4 (67)	57 (63)	65 (83)	119 (84)	245 (78)
Male	2 (33)	33 (37)	13 (17)	22 (16)	70 (22)
Age					
20-30	1 (17)	48 (53)	18 (23)	4 (3)	71 (23)
31-40	3 (50)	25 (28)	45 (58)	51 (36)	124 (39)
41-50	1 (17)	15 (17)	11 (14)	42 (30)	69 (22)
Over 50	1 (17)	2 (2)	4 (5)	44 (31)	51 (16)
Place of Birth					
Panama	4 (67)	85 (95)	59 (76)	107 (76)	255 (81)
Latin America	2 (33)	2 (2)	13 (17)	27 (19)	44 (14)
Europe	0 (0)	2 (2)	0 (0)	2 (1)	4 (1)
North America	0 (0)	1 (1)	4 (5)	0 (0)	5 (2)
Other Regions	0 (0)	0 (0)	2 (2)	5 (4)	7 (2)
Education Level					
No degree	0 (0)	11 (12)	4 (5)	11 (8)	26 (8)
High School	0 (0)	17 (19)	13 (17)	27 (19)	57 (18)
Bachelor's	3 (50)	31 (34)	35 (45)	53 (38)	122 (39)
Master's	1 (17)	23 (26)	22 (28)	41 (29)	87 (28)
Other	2 (33)	8 (9)	4 (5)	9 (6)	23 (7)
Work Region					
Herrera	0 (0)	12 (13)	7 (9)	3 (2)	22 (7)
Los Santos	0 (0)	5 (6)	3 (4)	5 (3)	13 (4)
Panama Este	1 (17)	29 (32)	19 (24)	30 (21)	79 (25)
Panama Norte	0 (0)	6 (7)	2 (3)	8 (6)	16 (5)
San Miguelito	0 (0)	21 (23)	9 (11)	15 (11)	45 (14)
IAE	5 (83)	7 (8)	31 (40)	79 (56)	122 (39)
Veraguas	0 (0)	10 (11)	7 (9)	1 (1)	18 (6)

** Percentages may not add to 100 due to rounding

When data was tabulated by levels of teaching experience, as teaching experience increases, females tend to dominate the teacher cohort even more, going from two thirds in the first two categories to over 80% in the other two (Table 2). As expected, as age increases, so does the experience. That is, the first age group dominates the second level of experience; whereas the last two age groups dominate (61%) the "teachers that have taught over 10 years" level of experience. Unlike national statistics, participants in the study were younger (i.e., 62% of teachers were less than 40 years old) (Table 2).

In terms of birthplace, in general and across all different levels of experience, most teacher were born in Panama. As levels of experience increases, other birthplaces are represented, with Latin America consistently increasing as experience increases (Table 2). Teachers with less experience (i.e., which is associated as a younger population) tend to possess at least a Bachelor's degree. It was expected that as experience increases, people with no formal education increases, perhaps due to reforms in teaching qualifications in Panama that allowed older and experienced teachers to remain in the profession, but required younger generations to be qualified; however, this group was steadily represented throughout all levels of experience. Although the percent may seem to decrease as experience increases, the number of individuals in this category do not (Table 2).

Finally, most of the participants were from three main regions: Panama Este, San Miguelito and the private school IAE (78%). Still, the other workplaces were represented across the different levels of experience (Table 2).

Descriptive Findings for Research Sub-Question 1a.

The first research sub-question for the study determined the relationship between self-efficacy beliefs and teaching experience in teachers in Panama. As stated previously, descriptive statistics were the first analysis to be conducted with the data.
For the first component of Self-Efficacy, Planning and Assessment, values in the Likert scale tended to increase as experience increased.

Overall, and across the four main components, teachers tended to score the lowest in this component (Table 3). For the second component, Instruction, teachers tend to score mid to high in the Likert Scale. An increase of score is observed as experience increases (Table 3).

Table 3: Self-Efficacy Scale for Teachers with Different Levels of Teaching Experience

Question	(Mean±SD)				
	Level of Teaching Experience*				
	1	2	3	4	Overall
	0 years	-5 years	5-10 years	10+ years	
	Planning and Assessment of Self-Efficacy				
How well can you get the instructional materials and the equipment you need?	3.17±1.33	3.45±0.90	3.45±0.96	3.67±0.78	3.54±0.88
How well can you use a variety of assessment strategies?	3.67±1.21	3.85±0.86	3.77±0.66	4.04±0.76	3.91±0.78
How well can you implement alternative strategies in your classroom?	2.50±1.22	3.72±0.82	3.76±0.58	3.90±0.78	3.79±0.78
How well can you collect, analyse and report data on your student's performance in order to improve instruction?	2.83±1.17	3.61±0.78	3.72±0.72	3.82±0.78	3.71±0.78
How well can you customize and personalize learning activities to address students' diverse learning styles?	3.50±1.05	3.63±1.00	3.72±0.80	3.74±0.76	3.70±0.85
How well can you provide students with multiple and varied assessments that are aligned with both the content standards?	2.50±1.38	3.42±1.06	3.62±0.76	3.88±0.82	3.66±0.92
How well can you teach students to use digital tools to solve real-world problems?	2.83±1.60	3.52±1.13	3.29±0.98	3.36±0.97	3.38±1.04
	Instruction of Self-Efficacy				
How well can you do to get through to the most difficult students?	4.00±1.26	3.36±0.90	3.53±0.72	3.82±0.78	3.62±0.83
How well can you do to keep students on the task of difficult assignments?	2.67±1.37	3.50±0.90	3.58±0.66	3.84±0.67	3.66±0.78
How well can you do to increase students' memory of what they have been taught in previous lessons?	2.67±1.51	3.89±0.78	3.87±0.69	3.80±0.65	3.82±0.74
How well can you do to motivate students who show low interest in schoolwork?	3.83±0.75	3.88±0.72	3.94±0.74	3.97±0.78	3.93±0.75
How well can you do to get students to work together?	3.17±1.33	3.84±0.92	3.85±0.82	4.09±0.71	3.94±0.83

* Levels of Teaching Experience: 1. No Experience, 2. Teachers that have taught for less than 5 years, 3. Teachers that have taught for 5-10 years, 4. Teachers that have taught for over 10 years.

Table 3   (Continued)

	(Mean±SD)				
	Level of Teaching Experience*				
Question	1	2	3	4	Overall
	0 years	-5 years	5-10 years	10+ years	
Disciplinary Self-Efficacy					
How well can you do to get children to follow classroom rules?	3.50±0.55	3.79±0.82	3.86±0.68	4.01±0.81	3.90±0.78
How well can you do to control disruptive behaviour in the classroom?	3.83±0.41	3.61±0.89	3.79±0.77	4.05±0.72	3.86±0.80
How well can you assist parents in helping their children do well in school?	3.50±1.22	3.36±0.94	3.65±0.81	3.69±0.92	3.58±0.92
How well can you establish a classroom management system with each group of students?	2.83±1.17	3.53±0.78	3.51±0.87	3.52±0.88	3.51±0.86
Positive School Climate of Self-Efficacy					
How well can you do to make the school a safe place?	3.50±1.05	3.61±0.90	3.83±0.76	3.80±0.83	3.75±0.84
How well can you do to make students enjoy coming to school?	3.50±1.38	3.96±0.69	4.05±0.68	4.07±0.77	4.02±0.74
How well can you help other teachers with their teaching skills?	3.67±1.03	3.72±0.95	3.91±0.71	3.91±0.79	3.85±0.82
How well can you do to reduce school absenteeism?	2.83±1.17	3.15±0.93	3.26±0.96	3.32±1.02	3.25±0.98
How well can you do to get students to believe they can do well in schoolwork?	3.83±0.75	4.05±0.73	3.91±0.65	4.03±0.64	4.00±0.67

* Levels of Teaching Experience: 1. No Experience, 2. Teachers that have taught for less than 5 years, 3. Teachers that have taught for 5-10 years, 4. Teachers that have taught for over 10 years.

The third component, Disciplinary, showed the highest scoring out of all four components. Although there is a tendency of increasing as experience increases, this increment over time is minimum (Table 3). The last component, Positive School Climate, also showed high scores for all the questions with a tendency to increase as experience increases (Table 3).

Overall, there seems to be a relationship between self-efficacy and levels of teaching experience. As years in experience increases, teachers score higher for self-efficacy.

Descriptive Findings for Research Sub-Question 1b

The second research sub-question for the study determined the relationship between self-permission beliefs and teaching experience in teachers in Panama. Descriptive statistics were the first analysis to be conducted with the data.

Table 4: Self-Permission Scale for Teachers with Different Levels of Teaching Experience

	(Mean±SD)				
	Self-Permission				
	Level of Teaching Experience*				
Question	1	2	3	4	Overall
	0 years	-5 years	5-10 years	10+ years	
	Lack of Self-Permission				
I do not have the permission to reach my professional goals.	1.33±0.82	2.26±1.40	2.12±1.26	2.15±1.24	2.15±1.28
I am not permitted to pursue those things in my professional life that I really want.	2.00±1.26	2.24±1.46	2.08±1.19	2.16±1.28	2.16±1.31
I am not allowed to live up to my full potential.	2.17±1.47	2.31±1.45	2.28±1.25	2.15±1.26	2.23±1.31
I am not allowed to reach my professional goals.	2.00±1.26	2.18±1.40	2.16±1.27	2.15±1.24	2.16±1.29
	Positive Self-Permission				
I can have a successful and fulfilling professional career.	4.67±0.52	4.46±0.78	4.26±0.89	4.46±0.88	4.41±0.85
I deserve to be everything that I can possibly be.	4.50±0.84	4.66±0.74	4.55±0.64	4.67±0.66	4.63±0.68
I have full consent to make the best out of myself as a professional.	4.00±1.10	4.65±0.66	4.38±0.76	4.59±0.78	4.55±0.76
I am free to live my professional life to the fullest.	4.00±1.10	4.64±0.68	4.40±0.83	4.42±0.95	4.47±0.86

* Levels of Teaching Experience: 1. No Experience, 2. Teachers that have taught for less than 5 years, 3. Teachers that have taught for 5-10 years, 4. Teachers that have taught for over 10 years.

For both components of Self-Permission, Lack of and Positive Self-Permission, there was not apparent change in scoring as experience increases. Lack of Self-Permission remained low across all levels of Teaching Experience and Positive Self-Permission scores were high across all levels of Teaching Experience (Table 4). There seems not to be a relationship between Self-Permission and levels of teaching experience.

Additional Analyses for Research Sub-Questions 1a and 1b

Pearson r Correlations

The first type of additional analysis conducted were several Pearson r correlational analyses to examine the overall relationship between the Self-Efficacy Score (SES) and the Self-Permission Score (SPS) and corrected for and within each of the four teaching categories. The two required assumptions were met before performing the Pearson r correlation analysis. The first assumption being the independence of observations between the participants; that is, the scores for each participant should be independent of all other participants. This assumption was met by having the teachers fill out their questionnaires independently. The second assumption being that the continuous variables are normally distributed in the population. The histogram and the standardized skewness for SES (0.20) and SPS (-1.04) indicate that SES data were fairly symmetrical, whereas SPS data were slightly negative skewed.

Table 5: Composite values for Self-Efficacy & Self Permission for Teaching Experience

	Level of Teaching Experience*				
	1	2	3	4	Overall
	(n=6)	(n=90)	(n=78)	(n=141)	(n=315)
Self-Efficacy	3.29±0.68	3.64±0.50	3.72±0.43	3.83±0.49	3.74±0.49
Self-Permission	4.21±0.80	4.19±0.73	4.12±0.71	4.20±0.67	4.18±0.70

* Levels of Teaching Experience: 1. No Experience, 2. Teachers that have taught for less than 5 years, 3. Teachers that have taught for 5-10 years, 4. Teachers that have taught for over 10 years.

Overall, the mean for SES was 3.74 (SD= 0.49) and for SPS was 4.18 (SD= 0.70) (Table 4). The relationship was positive, low in strength and statistically significant ($r(313)=0.21$, $p<0.05$). When such correlation was corrected for the levels of teaching experience, the relationship remained the same ($r(312)=0.21$, $p<0.05$).

For those teachers that have never taught, the mean for SES was 3.29 ($SD=0.68$) and for SPS was 4.21 ($SD=0.80$) (Table 5). The relationship was positive, moderate in strength but not statistically significant ($r(4)=0.60$, $p>0.05$). For those teachers that have teaching experience of less than 5 years, the mean for SES was 3.64 ($SD=0.50$) and for SPS was 4.19 ($SD=0.73$) (Table 5). In this group, the relationship was positive, low in strength and statistically significant ($r(88)=0.26$, $p<0.05$). Teachers that have been teaching between 5 and 10 years had a mean for SES of 3.72 ($SD=0.43$) and for SPS of 4.12 ($SD=0.71$) (Table 5). In this group, the correlation between SES and SPS was positive, low in

strength and not statistically significant ($r(76)=0.22$, $p>0.05$). Finally, for the fourth group (e.g., those teachers that have experience of over 10 years) the mean for SES was 3.83 ($SD= 0.49$) and for SPS was 4.20 ($SD= 0.67$) (Table 5). The relationship was positive, low in strength and not statistically significant ($r(139)=0.15$, $p>0.05$).

Overall, the SES increases as teaching experience increases; there is not apparent change in SPS as teaching experience increases. This may reflect the lack of statistical significance in the correlation analysis for those with higher levels of experience (Table 5).

One-way between-subjects analysis of variance (ANOVA).

The second additional analyses that were conducted were two one-way between-subjects ANOVAs to determine whether the difference in means (averages) on the self-efficacy and self-permission scales were statistically significant between different levels of teaching experience.

Self-Efficacy Score and Teaching Experience ANOVA

The descriptive statistics associated with self-efficacy scores for each of the levels of teaching experience are shown in Table 2. As previously stated, SES tends to increase as years of experience increases. To test the hypothesis that level of teacher experience had an effect on SES, the first ANOVA was performed. Prior to conducting the ANOVA, the assumption of normality was evaluated and determined to be satisfied where all levels of experience were associated with skew and kurtosis less than │2.0│ and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's F test, $F(3,311)=1.60$, $p=0.19$.

The independent between-groups ANOVA yielded a statistically significant effect, $F(3,311)=4.67$, $p=0.003$, $\eta^2=0.043$. Thus, the null hypothesis of no differences between the means was rejected, and 4.3% of the variance of SES was accounted for the levels of experience. To evaluate the nature of the differences between the fours means further, the statistically significant ANOVA was followed up with a Tukey's post-hoc test. The difference between the "Never" teaching experience group and the "Over 10 years" teaching experience group was statistically significant $p=0.038$, $d=-.54$. The difference between the "Under 5 years" of teaching experience and the "Over 10 years" of teaching experience was also statistically significant $p=0.021$, $d=-.19$. A visual depiction of the means and 95% confidence intervals is presented in Figure 3.
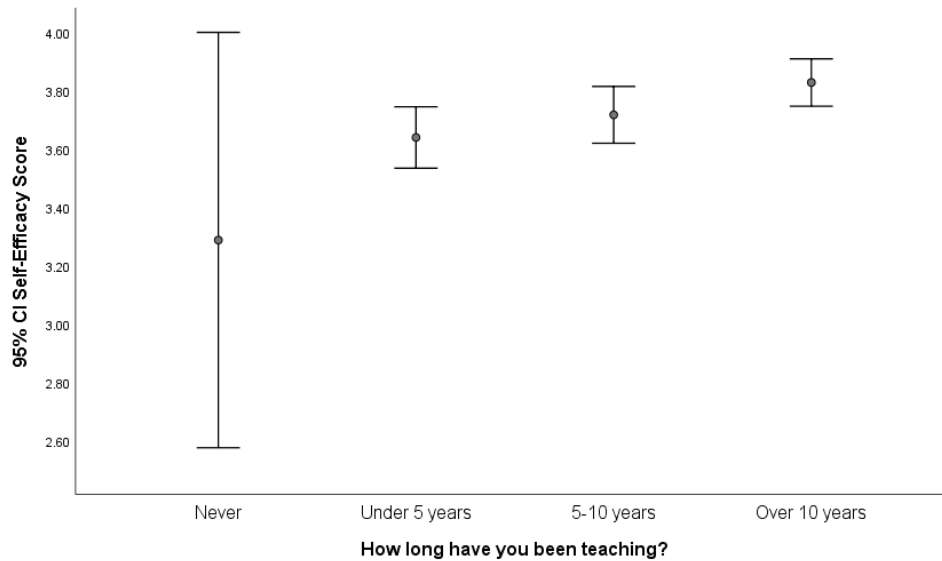
Figure 3 Self-Efficacy Score means and 95% confidence intervals across levels of teaching experience.

Self-Permission Score and Teaching Experience ANOVA

The descriptive statistics associated with self-permission scores for each of the levels of teaching experience are shown in Table 4. As previously stated, SPS does not tend to change as years of experience increases. To test the hypothesis that level of teacher experience had an effect on SPS, the second ANOVA was performed. Prior to performing the ANOVA, the assumption of normality was evaluated and determined to be satisfied with all levels of experience were associated with skew and kurtosis less than │2.0│and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's *F* test, $F(3,311)=1.17, p=0.32$.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(3,311)=0.21, p=0.889, \eta^2=0.002$. Thus, the null hypothesis of no differences between the means was not rejected, and 0.2% of the variance of SPS was accounted for the levels of experience. A visual depiction of the means and 95% confidence intervals is presented in Figure 4.
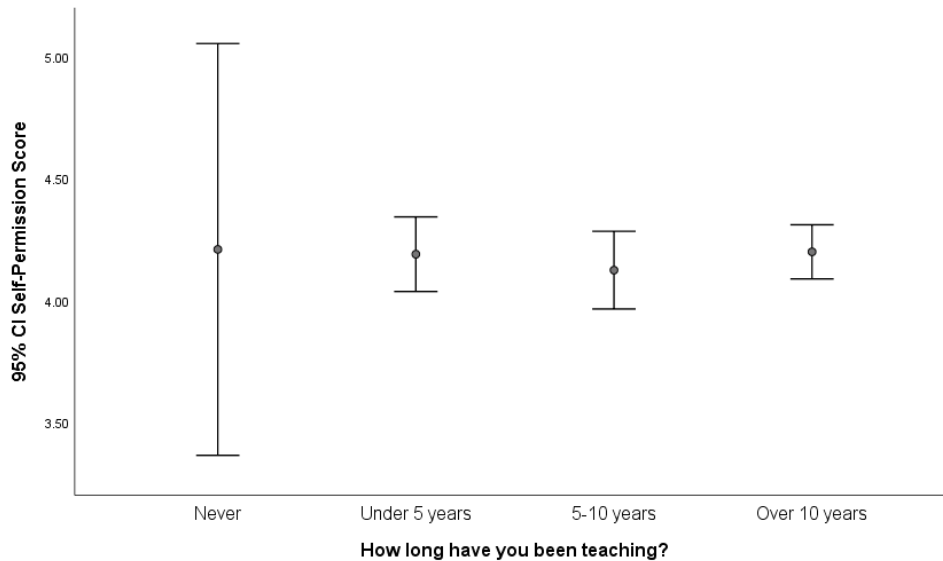
Figure 4 Self-Permission Score means and 95% confidence intervals across levels of teaching experience.

Descriptive Findings for Research Sub-Question 1c.

The third research sub-question for the study was to determine the relationship between self-efficacy beliefs and teaching qualifications in teachers in Panama. As stated previously, descriptive statistics were the first analysis to be conducted with the data. For the first component, Planning and Assessment, there was no apparent tendency to increase or decrease at different levels of qualifications, and the scores were high (Table 6).

For the second and third component of Self-Efficacy, as levels of qualifications increased, the scores tended to decrease. Moreover, these decrements were minimum across levels of qualifications (Table 6). Same tendency was observed for the last component of Self Efficacy with "Other" level of qualification showing the lowest values.

Overall, Self-Efficacy values change very little across different levels of qualifications. There seems not to be a relationship between Self-Efficacy and levels of Teaching Qualifications.

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Table 6: Self-Efficacy Scale for Teachers with Different Levels of Qualifications (Mean±SD)

Question	(Mean±SD)				
	Level of Qualification*				
	1	2	3	4	5
Planning and Assessment of Self-Efficacy					
How well can you get the instructional materials and the equipment you need?	3.63±0.88	3.42±0.88	3.30±0.93	3.58±0.83	3.61±0.92
How well can you use a variety of assessment strategies?	4.08±0.81	3.86±0.67	3.61±0.94	3.82±0.79	4.11±0.74
How well can you implement alternative strategies in your classroom?	4.04±0.68	3.72±0.84	3.43±0.95	3.75±0.70	3.90±0.79
How well can you collect, analyse and report data on your student's performance in order to improve instruction?	3.76±0.78	3.77±0.85	3.39±0.72	3.72±0.75	3.74±0.80
How well can you customize and personalize learning activities to address students' diverse learning styles?	3.76±0.83	3.54±0.89	3.43±0.73	3.75±0.89	3.79±0.79
How well can you provide students with multiple and varied assessments that are aligned with both the content standards?	3.84±0.94	3.49±1.04	3.43±1.12	3.70±0.81	3.71±0.93
How well can you teach students to use digital tools to solve real-world problems?	3.37±1.06	3.40±0.98	3.13±1.10	3.32±0.99	3.52±1.11
Instruction of Self-Efficacy					
How well can you do to get through to the most difficult students?	3.72±0.79	3.58±0.78	3.48±0.95	3.66±0.91	3.59±0.74
How well can you do to keep students on the task of difficult assignments?	3.96±0.61	3.77±0.78	3.13±0.92	3.60±0.76	3.71±0.76
How well can you do to increase students' memory of what they have been taught in previous lessons?	4.08±0.69	3.93±0.70	3.39±0.99	3.76±0.66	3.86±0.75
How well can you do to motivate students who show low interest in schoolwork?	4.04±0.82	3.98±0.74	3.83±0.65	3.92±0.73	3.92±0.80
How well can you do to get students to work together?	4.00±0.58	4.02±0.81	3.70±0.82	4.03±0.78	3.83±0.95

* Level of Qualification: 1. No Formal Degree, 2. High School Diploma, 3. Other, 4. Bachelor's Degree, 5: Master's Degree.

Table 6   (Continued)

Self-Efficacy Scale for Teachers with Different Levels of Qualifications (Mean±SD)

Question	Level of Qualification*				
	1	2	3	4	5
Disciplinary Self-Efficacy					
How well can you do to get children to follow classroom rules?	3.96±0.66	3.89±0.80	3.78±0.85	3.86±0.77	3.97±0.82
How well can you do to control disruptive behaviour in the classroom?	4.15±0.73	3.79±0.86	3.70±0.77	3.81±0.82	3.92±0.74
How well can you assist parents in helping their children do well in school?	3.69±1.09	3.44±0.98	3.57±0.66	3.61±0.88	3.61±0.93
How well can you establish a classroom management system with each group of students?	3.65±0.85	3.62±0.86	3.35±0.83	3.50±0.84	3.44±0.89
Positive School Climate of Self-Efficacy					
How well can you do to make the school a safe place?	3.84±0.85	3.70±0.91	3.70±0.93	3.79±0.82	3.71±0.82
How well can you do to make students enjoy coming to school?	4.25±0.61	4.07±0.75	3.74±0.81	4.02±0.75	4.01±0.72
How well can you help other teachers with their teaching skills?	4.08±0.64	3.82±0.91	3.83±0.65	3.82±0.83	3.86±0.86
How well can you do to reduce school absenteeism?	3.48±0.96	3.12±1.05	2.83±1.15	3.30±0.88	3.29±1.02
How well can you do to get students to believe they can do well in schoolwork?	4.04±0.61	3.96±0.76	3.91±0.67	3.99±0.63	4.05±0.69

* Level of Qualification: 1. No Formal Degree, 2. High School Diploma, 3. Other, 4. Bachelor's Degree, 5: Master's Degree.

Descriptive Findings for Research Sub-Question 1d

The last research sub-question for the study determined the relationship between self-permission beliefs and teaching qualifications in teachers in Panama. Descriptive statistics were the first analysis to be conducted with the data.

For the first component of Self-Permission, Lack of Self-Permission, there seems to be a slight decrease as levels of qualifications are higher, with High School showing the highest scoring for Lack of Self-Permission (Table 7). The second component showed no apparent decrease or increase throughout the different levels of qualifications (Table 7). Overall, there seems to be little fluctuations in levels of Self-Permission for the different levels of qualifications.

Table 7: Self-Permission Scale for Teachers with Different Levels of Qualification (Mean±SD)

	Self-Permission				
	Level of Qualification*				
Question	1	2	3	4	5
Lack off Self-Permission					
I do not have the permission to reach my professional goals.	2.50±1.47	2.55±1.29	1.74±0.96	2.02±1.18	2.11±1.38
I am not permitted to pursue those things in my professional life that I really want.	2.43±1.34	2.44±1.28	1.91±0.90	2.04±1.30	2.15±1.40
I am not allowed to live up to my full potential.	2.39±1.30	2.44±1.27	2.17±1.07	2.09±1.29	2.24±1.43
I am not allowed to reach my professional goals.	2.38±1.24	2.53±1.26	2.17±1.15	1.91±1.15	2.21±1.47
Positive Self-Permission					
I can have a successful and fulfilling professional career.	4.76±0.44	4.15±0.87	4.61±0.72	4.33±0.97	4.55±0.72
I deserve to be everything that I can possibly be.	4.72±0.46	4.44±0.81	4.61±0.89	4.63±0.70	4.74±0.54
I have full consent to make the best out of myself as a professional.	4.58±0.65	4.31±0.86	4.52±0.59	4.55±0.83	4.69±0.62
I am free to live my professional life to the fullest.	4.60±0.58	4.24±1.09	4.48±0.73	4.43±0.91	4.64±0.67

* Level of Qualification: 1. No Formal Degree, 2. High School Diploma, 3. Other, 4. Bachelor's Degree, 5: Master's Degree.

Additional Analyses for Research Sub-Questions 1c and 1d

Pearson r Correlations

The first type of additional analysis conducted were several Pearson r correlational analyses to examine the overall relationship between the Self-Efficacy Score (SES) and the Self-Permission Score (SPS) corrected for and within each of the five categories of teaching qualifications. Assumptions for the correlation analysis were previously determined.

As stated before, the mean for SES was 3.74 ($SD= 0.49$) and for SPS was 4.18 ($SD= 0.70$) (Table 5). The relationship was positive, low in strength and statistically significant ($r(313)=0.21$, $p<0.05$). When such correlation was corrected for the levels of teaching qualifications, the relationship remained the same ($r(312)=0.21$, $p<0.05$).

For those teachers with no formal degree, the mean for SES was 3.87 ($SD=0.41$) and for SPS was 4.15 ($SD=0.69$) (Table 8). The relationship between the two scores was positive, moderate in

strength and statistically significant ($r(24)=0.41$, $p<0.05$). Teachers with a High School Diploma reported a SES with a mean of 3.72 ($SD=0.53$) and a SPS with a mean of 3.92 ($SD=0.68$) (Table 8). For this group, the correlation was positive, low in strength and statistically significant ($r(55)=0.32$, $p<0.05$). Teachers with Other qualifications showed a SES mean of 3.52 ($SD=0.46$) and a SPS mean of 4.28 ($SD=0.60$) (Table 8). The correlation between the two scores for this group was also positive, moderate in strength and statistically significant ($r(21)=0.43$, $p<0.05$). Teachers with a Bachelor's degree reported a SES with a mean of 3.73 ($SD=0.49$) and a SPS with a mean of 4.24 ($SD=0.69$) (Table 8). When a correlation was assessed between these two scores within this group, the relationship was positive, low in strength and not statistically significant ($r(120)=0.15$, $p>0.05$). Finally, for those teachers with a Masters Degree, the mean for SES was 3.77 ($SD=0.49$) and the mean for SPS was 4.24 ($SD=0.72$). The relationship was positive, low in strength and not statistically significant ($r(85)=0.16$, $p>0.05$).

Overall, there is no apparent change in SES or SPS in the different levels of qualifications. The SES remains lower than the SPS (Table 8).

Table 8: Composite values for Self-Efficacy and Self Permission for Different Levels of Qualifications

	Level of Qualification*				
	1 (n=26)	2 (n=57)	3 (n=23)	4 (n=122)	5 (n=87)
Self-Efficacy	3.87±0.41	3.72±0.53	3.52±0.46	3.73±0.49	3.77±0.49
Self-Permission	4.15±0.69	3.92±0.68	4.28±0.60	4.24±0.69	4.24±0.72

* Level of Qualification: 1. No Formal Degree, 2. High School Diploma, 3. Other, 4. Bachelor's Degree, 5: Master's Degree.

One-way between-subjects analysis of variance (ANOVA)

The second additional set of analyses that were conducted were two one-way between-subjects ANOVAs to determine whether the difference in means (averages) on the self-efficacy and self-permission scales were statistically significant between different levels of teaching qualifications.

Self-Efficacy Score and Teaching Qualification ANOVA

The descriptive statistics associated with self-efficacy scores for each of the levels of teaching qualifications are shown in Table 6. As stated before SES does not tend to change for the different

levels of qualifications. To test the hypothesis that level of teacher qualification had an effect on SES, the first ANOVA was performed.

Prior to performing the ANOVA, the assumption of normality was evaluated and determined to be satisfied where all levels of experience were associated with skew and kurtosis less than │2.0│ and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's F test, $F(4,310)=0.98, p=0.42$.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(4,310)=1.71, p=0.147, \eta^2=0.022$. Thus, the null hypothesis of no differences between the means was not rejected, and 2.2% of the variance of SES was accounted for the different levels of qualifications. A visual depiction of the means and 95% confidence intervals is presented in Figure 5.
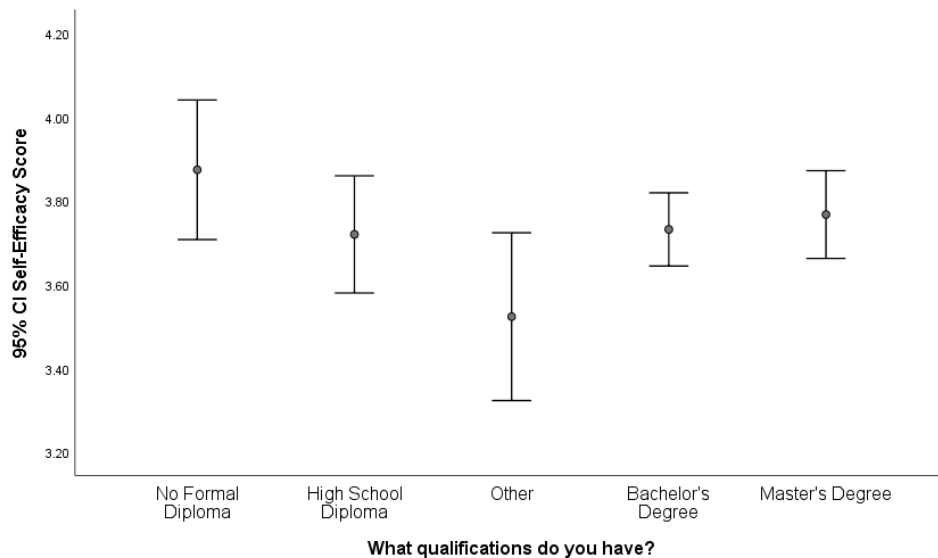
Figure 5: Self-Efficacy Score means and 95% confidence intervals across levels of teacher's qualifications.

Self-Permission Score and Teaching Qualification ANOVA

The descriptive statistics associated with self-permission scores for each of the levels of teaching qualifications are shown in Figure 6. As previously stated, SES does not tend to change for the different levels of qualifications. To test the hypothesis that level of teacher qualification had an effect on SPS, the second ANOVA was performed. Prior to conducting the ANOVA, the assumption of normality was evaluated and determined to be satisfied with all levels of experience were associated

with skew and kurtosis less than │2.0│ and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's F test, $F(4,310)=0.98, p=0.42$.
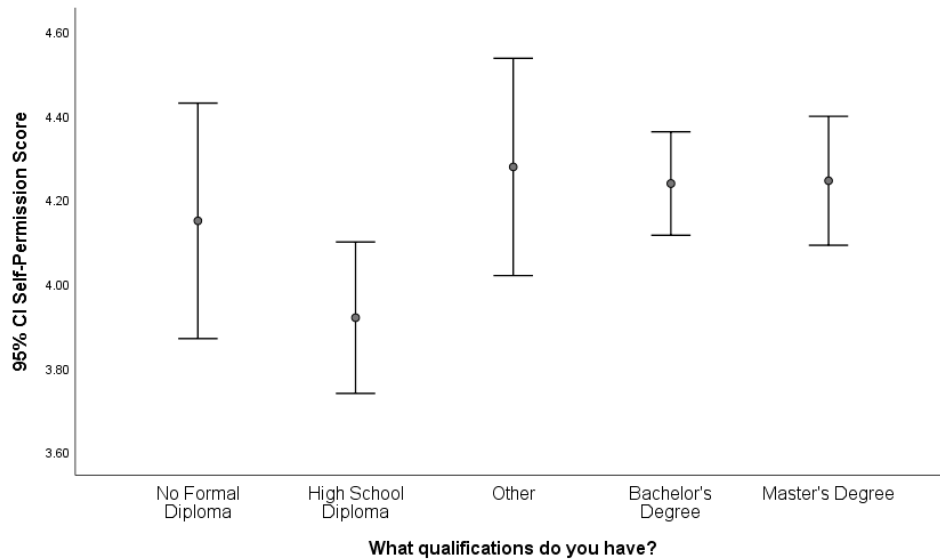
Figure 6: Self-Permission Score means and 95% confidence intervals across levels of teacher's qualifications.

The independent between-groups ANOVA yielded a statistically significant effect, $F(4,310)=2.58, p=0.037, \eta^2=0.032$. Thus, the null hypothesis of no differences between the means was rejected, and 3.2% of the variance of SPS was accounted for the different levels of qualifications. To evaluate the nature of the differences between the five means further, the statistically significant ANOVA was followed up with a Tukey's post-hoc test. The difference between the "High School Diploma" group and the "Bachelor's Degree" group was statistically significant $p=0.034, d=-.32$. The difference between the "High School Diploma" group and the "Master's Degree" group was also statistically significant $p=0.046, d=-.33$. A visual depiction of the means and 95% confidence intervals is presented in Figure 5.

Additional Analyses for covariates: Gender, Age, Birthplace, and Work Region

ANOVA Self-Efficacy and Self Permission for Gender

The descriptive statistics associated with self-efficacy and self-permission scores for both genders are shown in Table 9. Neither SES nor SPS showed changes for both genders. To test the hypothesis that gender had an effect on SES or SPS, an ANOVA was performed. Prior to conducting

the ANOVA, the assumption of normality was evaluated and determined to be satisfied with both genders associated with skew and kurtosis less than ⎪2.0⎪ and ⎪9.0⎪, respectively.

Table 9: Composite values for Self-Efficacy and Self Permission for both Genders

	Gender	
	Female (n=245)	Male (n=70)
Self-Efficacy	3.75±0.48	3.68±0.53
Self-Permission	4.18±0.70	4.16±0.68

Figure 7: Bar charts with Self-Efficacy Score means and 95% confidence intervals across Gender.

Figure 8: Bar charts with Self-Permission Score means and 95% confidence intervals across Gender.

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Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's *F* test, $F(1,313)=0.94,p=0.33$ for SES and $F(1,313)=0.12,p=0.72$ for SPS.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(1,313)=1.28,p=0.259,\eta^2=0.004$ for SES and $F(1,313)=0.03,p=0.859,\eta^2=0.000$ for SPS. Thus, the null hypothesis of no differences between the means was not rejected for both analyses, and 0.4% of the variance of SES and 0.0% of the variance of SPS was accounted for gender. A visual depiction of the means and 95% confidence intervals is presented in Figure 7 and Figure 8.

ANOVA Self-Efficacy and Self Permission for Age Group

The descriptive statistics associated with self-efficacy and self-permission scores for all age groups are shown in Table 10. SES showed a slight increase of SES as age increased and SPS showed a slight increase between the first two groups and then a slight steady decline from the second group to the last group (Table 10).

Table 10: Composite values for Self-Efficacy and Self Permission for Different Age Groups

	Age Group			
	20-30 (n=71)	31-40 (n=124)	41-50 (n=69)	Over 50 (n=51)
Self-Efficacy	3.64±0.50	3.73±0.49	3.80±0.46	3.79±0.51
Self-Permission	4.15±0.75	4.23±0.69	4.17±0.69	4.10±0.66

To test the hypothesis that Age had an effect on SES or SPS, an ANOVA was performed. Prior to conducting the ANOVA, the assumption of normality was evaluated and determined to be satisfied with all levels of age were associated with skew and kurtosis less than │2.0│and │9.0, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's *F* test, $F(3,311)=0.12,p=0.95$ for SES and $F(3,311)=1.03,p=0.38$ for SPS.

Figure 9: Bar charts with Self-Efficacy and 95% confidence intervals across Age Groups.
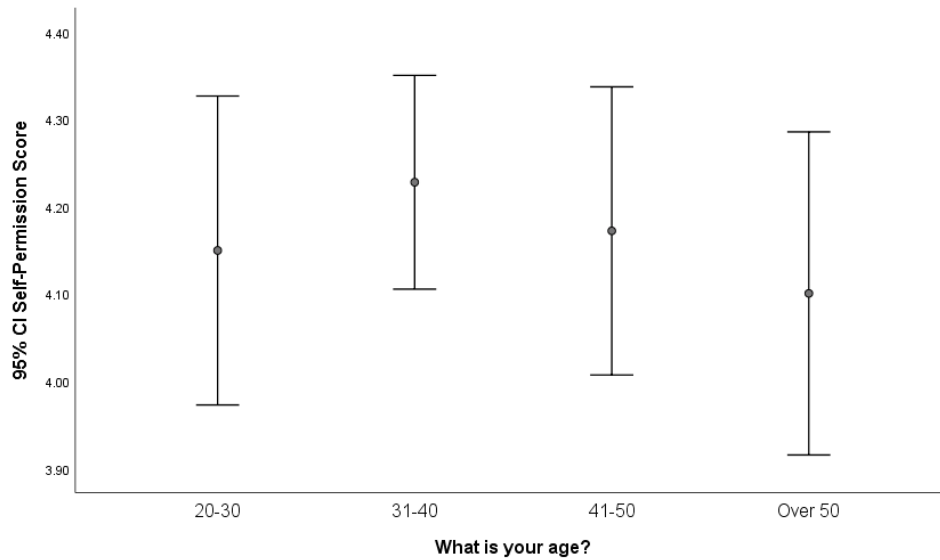
Figure 10: Bar charts with Self-Permission Score means and 95% confidence intervals across Age Groups.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(3,311)=1.49, p=0.217, \eta^2=0.014$ for SES and $F(3,311)=0.46, p=0.709, \eta^2=0.004$.

Thus, the null hypothesis of no differences between the means was not rejected, and 1.4% of the variance of SES was accounted for age group and 0.4% of the variance of SPS was accounted for age group. A visual depiction of the means and 95% confidence intervals is presented in Figure 9 and Figure 10.

ANOVA Self-Efficacy and Self Permission for Birthplace

The descriptive statistics associated with self-efficacy and self-permission scores for all birthplaces are shown in Table 11. There were slight differences of less than 0.5 of a point in a Likert scale for SES, showing people born in North America and Europe with the lowest scores.

Table 11: Composite values for Self-Efficacy and Self Permission for Different Birthplace

	Birthplace*				
	1 (n=255)	2 (n=44)	3 (n=5)	4 (n=4)	5 (n=7)
Self-Efficacy	3.76±0.50	3.68±0.43	3.40±0.22	3.44±0.54	3.61±0.24
Self-Permission	4.15±0.70	4.39±0.60	4.02±1.01	3.38±0.67	4.20±0.57

* Birthplace: 1. Panama, 2. Latin America, 3. North America, 4. Europe, 5: Other.

In terms of SPS, these scores were the lowest once again in North America and Europe with a range of over a point in the Likert scale difference between the lowest and highest mean of SPS for different birthplaces (Table 11). In order to test the hypothesis that Birthplace had an effect on SES or SPS, an ANOVA was performed. Prior to conduction the ANOVA, the assumption of normality was evaluated and determined to be satisfied with all birthplaces were associated with skew and kurtosis less than │2.0│and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied for SES on Levene's F test, $F(4,310)=1.94, p=0.10$ but not for SPS, $F(4,310)=2.87, p=0.02$. The latter was statistically significant and the null hypothesis of the variances being homogeneous was rejected.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(4,310)=1.35, p=0.252, \eta^2=0.017$ for SES and a statistically significant effect, $F(4,310)=2.58, p=0.037, \eta^2=0.014$ for SPS. Thus, the null hypothesis of no differences between the means was not rejected for SES, and 1.7% of the variance of SES was accounted for Birthplace. However, the null hypothesis of no differences between the means of SPS for the different Birthplaces was rejected, and 1.4% of the variance of SPS was accounted for birthplace.   To evaluate the nature of the differences between the five means further, the statistically significant ANOVA was followed up with a Dunnett T3 post-hoc test, since the homogeneity of variances assumption was not satisfied.
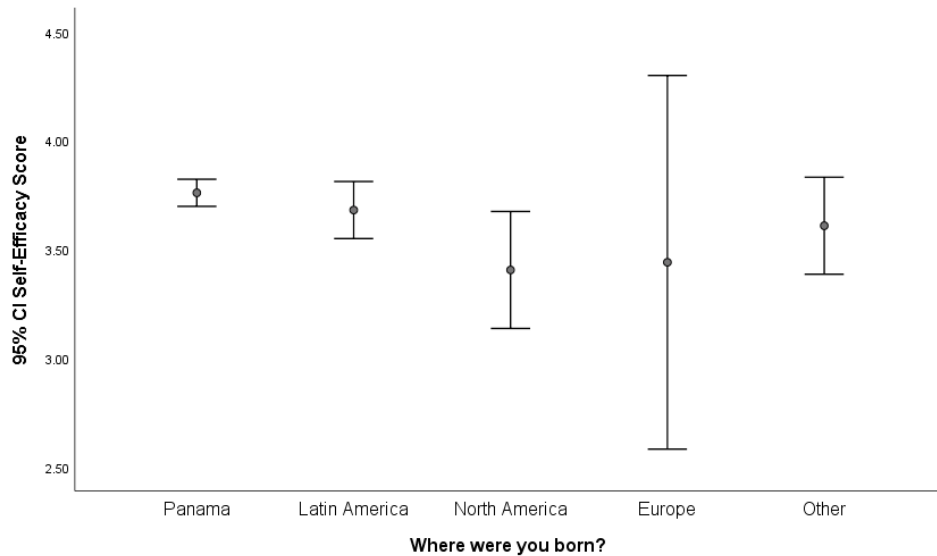
Figure 11: Bar charts with Self-Efficacy Score means and 95% confidence intervals across Birthplace.

Although, the ANOVA was statistically significant, the post-hoc analysis found no differences in means among birthplace groups for SPS. A visual depiction of the means and 95% confidence intervals is presented in Figure 11 and Figure 12.
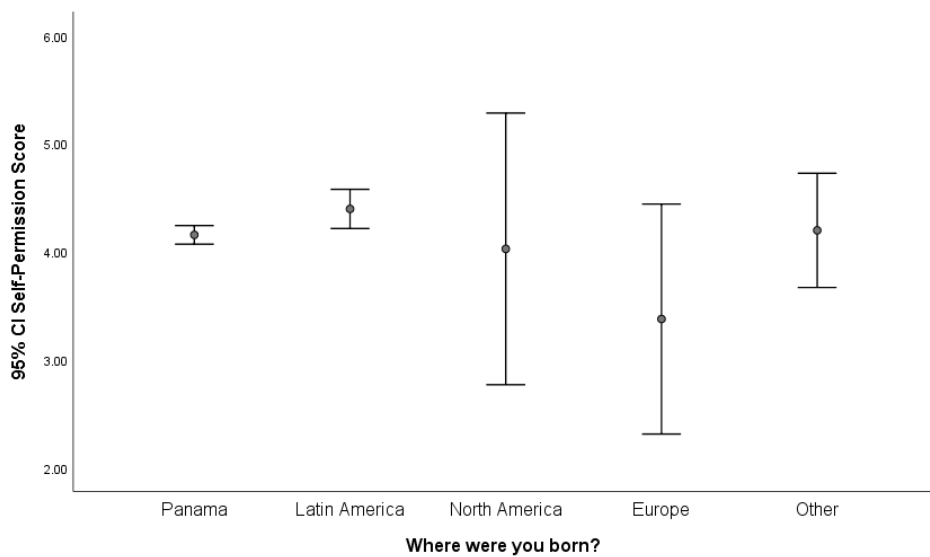
Figure 12: Bar charts with Self-Permission Score means and 95% confidence intervals across Birthplace.

ANOVA Self-Efficacy and Self Permission for Workplace

The descriptive statistics associated with self-efficacy and self-permission scores for all workplaces are shown in Table 12. SES and SPS showed no apparent changes among the different workplaces (Table 12)

Table 12: Composite values for Self-Efficacy and Self Permission for Different Workplace

	Workplace*						
	1 (n=122)	2 (n=79)	3 (n=16)	4 (n=45)	5 (n=22)	6 (n=18)	7 (n=13)
SES	3.69±0.46	3.69±0.52	3.79±0.56	3.88±0.53	3.88±0.44	3.71±0.40	3.63±0.53
SPS	4.26±0.70	4.17±0.68	4.06±0.56	4.09±0.70	4.00±0.70	4.17±0.80	4.20±0.75

* Workplace: 1. IAE, 2. Panama Este, 3. Panama Norte, 4. San Miguelito, 5: Herrera, 6: Veraguas, 7: Los Santos.

To test the hypothesis that Workplace had an effect on SES or SPS, an ANOVA was performed. Prior to the conduction of the ANOVA, the assumption of normality was evaluated and determined to be satisfied with all workplace groups were associated with skew and kurtosis less than │2.0│ and │9.0│, respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied on Levene's F test, $F(6,308)=1.32, p=0.24$ for SES and $F(6,308)=1.27, p=0.27$ for SPS.

The independent between-groups ANOVA yielded a not statistically significant effect, $F(6,308)=1.33, p=0.244, \eta^2=0.025$ for SES and $F(6,308)=0.72, p=0.64, \eta^2=0.014$. Thus, the null hypothesis of no differences between the means was not rejected, and 2.5% of the variance of SES was accounted for workplace and 1.4% of the variance of SPS was accounted for workplace. A visual depiction of the means and 95% confidence intervals is presented in Figure 13 and Figure 14.
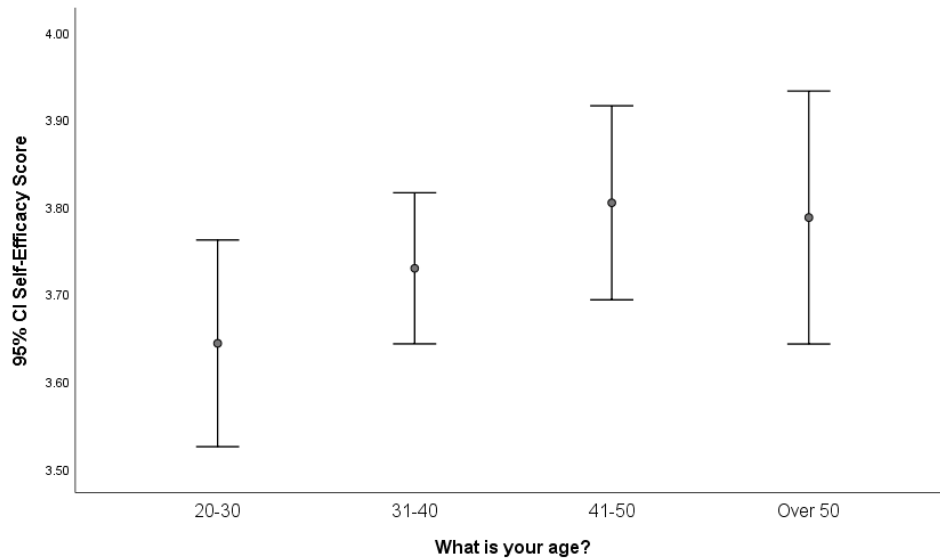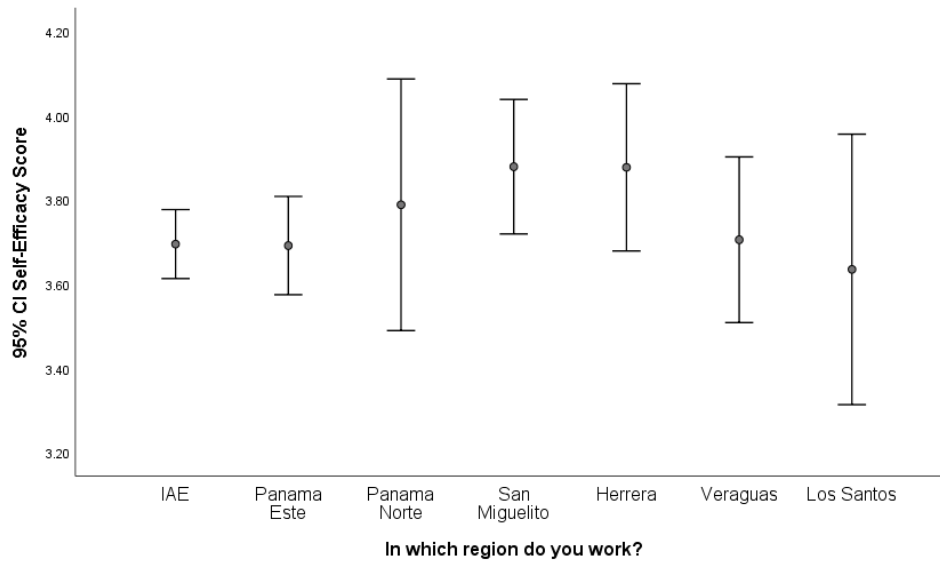
Figure 13: Bar charts with Self-Efficacy Score means and 95% confidence intervals across Workplace.
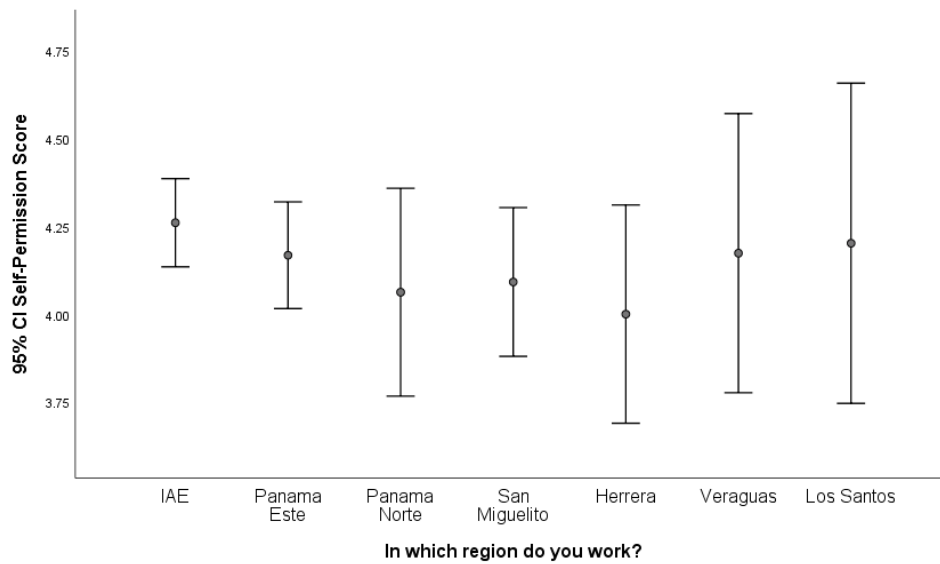
Figure 14: Bar charts with Self-Permission Score means and 95% confidence intervals across Workplace.

Paper 5: Phase One: Discussion

Phase One of the study investigated the perceptions of teachers in Panama concerning self-efficacy and self-permission to address the primary research question. The results indicate that overall, there is no strong linear relationship between teacher's perception of self-efficacy and self-permission.

The results in relation to the four sub-questions can be summarized as follows:

(1) As teacher experience increases so does teacher perception of self-efficacy.

(2) Teacher experience does not seem to affect the perception of self-permission in teachers.

(3) Teacher qualification does not seem to affect the perception of self-efficacy

(4) Teachers with higher levels of formal qualification indicate a higher perception of self-permission.

The following section discusses these findings in more detail, considering the research literature.

The nature of self-efficacy and self-permission

Any critique of findings from the present study must begin with a discussion of the fact that the results clearly indicate no linear relationship between teacher perception of self-efficacy and self-permission. Indeed, very much in line with Rose's (2014) observations, our results would suggest that self-efficacy and self-permission operate as distinct and separate entities. While the concepts may overlap in descriptive characteristics, they clearly are perceived as independent conceptions that are distinct in the way they evolve over time and how they are perceived by teachers. Accordingly, the findings of this study suggest that the development of teacher quality need not focus on attempting to address both self-efficacy and self-permission in combination, but by focusing on one or the other. It is reasonable to conclude, therefore, that this might be achieved by seeking to expand positive psychology from a perspective of the professional characteristics of the individual involved rather than the system in which they work.

Given this presumption, an understanding of the career cycle of teachers and how this is related to positive psychology is helpful. For years, research has highlighted distinct phases in the career of teachers (Gray, Lowe, Prout, & Jefferson, 2018). According to Huberman, teachers go through developmental stages within their career, often labelled differently in different national, cultural, or contextual variations (Keller-Schneider, Zhong, & Yeung, 2020). Similar to the participant groups within Phase One of the study, Huberman (1989) identifies four major stages within a teacher's career:

student or novice teachers – those who have no experience in the classroom; beginning teachers - those who are in the first 1-3 years of teaching; experienced teachers – those who have between 3-30 years' experience; and career-ending teachers – those who are ready to retire (Keller-Schneider, Zhong, & Yeung, 2020). Studies have shown that teacher self-efficacy oscillates, developing in 'fits and starts' throughout the early stages of career development (Chiu, Corrigan, & Hui, 2019), which is in line with the findings of the present study where there were clearly identified differences in teacher perception of self-efficacy depending on the career stage. The findings suggest that the same is true of self-permission, where teacher perception was observed to be dynamic in nature, while still indicating that the factors influencing levels of self-efficacy do not have the same influence over self-permission and vice-versa.

One possible explanation for this relationship lies in the affiliation between teacher confidence and autonomy. The findings would suggest that teachers who exhibit high levels of confidence and a strong sense of 'self', especially those who are new to the profession, do not necessarily find that they have the level of teacher autonomy that they expected. Aligned with the discussion of the literature surrounding teacher resilience, studies have shown that some pre-service teachers enter the profession with well-established beliefs about teaching, and that these are primarily determined by prior experience of their own schooling (Swainston & Jeanneret, 2013). For those who have only experienced the learning process from a student perspective, especially if they have not benefited from a formal teacher preparation program, it is understandable that these experiences might not include consideration of the level of teacher permission in the development of the learning process or even the establishment of classroom policies and procedures. As a result, teachers who enter the classroom with good motivation and excitement may feel stymied by a level of required conformity that had not been anticipated (Gray, Pascoe, & Wright, 2018). Similarly, teachers who enter the profession with a firm belief that they enjoy considerable 'permission' within the learning process, find that this is accompanied by a sizable sense of responsibility which may cause novice teachers to question their ability to meet the required standard. As such, the concepts of confidence and authority remain discreet in the minds of many teachers, and while each is susceptible to change over the span of a career, the two are not directly associated. Based on this assessment, and the premise presented in the literature that the ability to overcome situational adversity and to remain objective when subject to external influence are important to maintaining a positive attitude (Burrell, Allen, Gayle, & Preiss, 2014), the development of positive psychology appears to hold the promise of helping teachers at all

stages of their career. A focus on self-efficacy rather than a combination of the self-efficacy and self-permission is also warranted.

In the same way that these concepts are subject to fluctuation throughout a teaching career, the present study also indicates that perception of self-efficacy and self-permission are impacted by individual teacher characteristics, traits that also are subject to change over time. Once again, these findings are aligned with Huberman's (1993) concepts of developmental stages and studies that highlight the variation in speed of teacher exhaustion "and depersonalization" (Skaalvik, & Skaalvik, 2013. Affirming much of the literature discussed earlier regarding grit, there is considerable research focused on the high attrition rates of new teachers leaving the profession within the first five years (Gray, Lowe, Prout, & Jefferson, 2018), implying a different dispositional make up of those who remain in the classroom beyond five years. While some researchers identify a steady decline in motivation and commitment in later stages of teacher's careers (Huberman,1989), others have also discovered teachers who remain positive and committed throughout their careers (Meister, & Ahrens, 2011). What is not in doubt, however, is that teacher burnout is a process that occurs when a teacher endures exposure to high levels of stress over time (Pyhältö, Pietarinen, & Salmela-Aro, 2011), and that many teachers are susceptible to high levels of stress and teacher burnout (Ballantyne & Retell, 2020). Any ability, therefore, for professional development tools to reinforce teacher optimism or to sustain teacher determination has the potential to fortify teacher quality.

The study also affirms the notion that a teacher's sense of self-efficacy is likely to develop differently in various areas of teaching, influenced by their individual experience in school and their perceptions of whether they have met their pre-constructed goals or aspirations in the classroom (Keller-Schneider, Zhong, & Yeung, 2020). Having already established that teacher perception towards self-efficacy and self-permission is dynamic in nature, especially over the first decade in the job, this encourages meaningful professional development to be delivered using discrete areas of teaching and be flexibly delivered for teachers to be presented with content options that directly address areas where they might lack efficacy.

The relationship between self-efficacy and teacher experience

The findings indicate that, in general, self-efficacy increases as teaching experience increases. Mean differences were found in all four of the categories associated with self-efficacy between the responses of participants with the most and least teaching experience. This evidence supports multiple

studies that have found teachers with more than 10 years of experience reporting greater teaching efficacy than novice teachers (Liu et al., 2007; Karimvand, 2011; Sio Jyh Lih, & Ismail, 2019; Tschannen-Moran and Woolfolk, 2007). Given the importance of Bandura's (1997) mastery experiences in the development of self-efficacy, it is not surprising that participants in the study with more teaching experience and therefore exponentially more positive completion of teaching tasks, indicate higher levels of efficacy. This phenomenon, when coupled with the dispositional strength of teachers remaining in the profession beyond the first ten years discussed previously, manifests in a growth of personal efficacy over time. In simple terms, as professionals increase the number and variety of teaching 'encounters' they have, they also develop the professional skills and traits required for quality teaching, resulting in an increase in competence and efficacy. Accordingly, professional development that develops the same skills and traits is likely to be beneficial, especially to novice teachers.

Having said this, the results did not indicate an equal or consistent increase in self-efficacy across the four components tested, nor in the strength of efficacy reported by the participants. Again, this seems to substantiate previous research indicating that novice teachers' personal and professional efficacy can be just as high as that of peers with considerably more classroom experience (Karimvand, 2011). As previously discussed in the review of the literature, studies have observed that experienced teachers can often suffer from a significant loss of motivation and belief (Lauermann & König, 2016), while others have shown a mixed perception towards self-efficacy, depending on the specific category being discussed (Gorrell, & Dharmadasa, 1994). Such findings corroborate our earlier assertion that self-efficacy is dynamic in nature and oscillates over time depending upon a variety of factors, especially in the first ten years of teaching, and, as a result, attempts to stabilize and support a positive psychological outlook could yield significant results.

It is noticeable that not only did self-efficacy scores increase in alignment with years of teaching experience, but also that even when these increases were only moderate self-efficacy scores remained relatively high. One potential explanation of these findings lies in the fact that all participants in the study were a part of the Panama Bilingue program and so had received comprehensive professional development prior to teaching. Research indicates that teachers who participate in extensive programs of teacher training or professional development report increased enthusiasm and confidence towards teaching (Lumpe, Czerniak, Haney, & Beltyukova, 2012) Given this fact, it is understandable that even those teachers who had little experience in the classroom might

exhibit higher levels of teaching self-efficacy than they would have had they not received such training. Moreover, most participants were subject-specific teachers (all taught English as a primary subject), where studies have found that teachers' who participated in subject-specific professional development courses were more confident in offering classes in the same subject area (Oppermann, Hummel, & Anders, 2019). Given these findings, the study confirms the potential of high-quality professional development positively impacting the psychological factors that influence teacher quality.

The relationship between self-permission and teacher experience

In contrast to the clear relationship between self-efficacy and teaching experience, the study found that teacher experience does not appear to affect the perception of self-permission in teachers. Indeed, some differences in means across the four categories of experience were apparent in several of the questions used to ascertain levels of self-permission, but the averages of means were almost identical. Given the lack of prior research on self-permission, using the findings of prior studies to confirm or refute the results of the study is unachievable, and so the forming of definitive conclusions here would be imprudent.

Since there is a dearth of research on self-permission, a contextual definition of the concept is best established through a discussion of the terminology used in the questions asked of the participants. In the survey, self-permission was associated with personal jurisdiction as it pertained to professional goals, a fulfilling professional life, and realizing professional potential. In this sense, the study indicates that teachers' perception of their personal control over their professional destiny is not directly associated with factors that are impacted over time. This suggests that self-permission might be more closely linked to a teachers' sense of competence, rather than confidence, which research has shown may not grow significantly regardless of years of experience (Berliner, 2001). Novice teachers, especially those who have just qualified through the completion of a degree or certified teaching program, have been shown to exhibit strongly positive feelings about their professional abilities, pride, confidence and knowledge of education (Williams, 2009). These characteristics are likely to lead to elevated levels of self-permission, especially for teachers chosen for a selective program such as Panama Bilingue. The importance of personal and professional teacher dispositions, therefore, is likely to be a key element in the overall performance of the teacher regardless of experience. Such findings suggest that individuals who exhibit solid confidence in their ability to determine their own professional destiny even prior to their entering the profession, are likely to be at an advantage in

terms of teaching quality than their peers who might lack a similar outlook. Considering this, the development of professional development tools should include teacher choice as a core component and should seek to construct self-assurance.

The relationship between self-efficacy and teacher qualification

While teacher experience is directly linked to improved efficacy, this study confirms the assertion that teacher's qualification does not seem to affect the perception of self-efficacy. These results are supported by previous research findings that have observed that overall teachers' efficacy beliefs are not significantly different based on their qualification (Moosa & Shareefa, 2019). Additionally, studies have indicated no significant differences between teachers with different levels of qualification regarding perceived levels of self-efficacy of instruction (Casey, 2011). Bandura's (1997) concept of self-mastery goes some way to explaining this in outlining that experiencing successful teaching performance has a far greater impact on self-efficacy than qualification alone, and so while degrees and certificates may well improve an individual's ability to complete a task, this may not automatically translate into greater self-belief. This is especially true if the teacher has negative teaching experiences. The relationship between self-efficacy and teacher qualification is more nuanced than this, however, as several studies have linked teacher competence and confidence to personal qualification (Skaalvik, & Skaalvik, 2013). Given that self-efficacy has been defined as a manifestation of confidence (Block et al., 2010), and that efficacy is directly linked to improved competence (Moosa & Shareefa, 2019) it is unlikely that increased qualification does not impact overall sense of self, and as a result, overall efficacy. Nevertheless, any attempt to positively impact professional efficacy should choose to focus on all teachers equally regardless of professional qualification.

The importance of an overall 'sense of self' also serves as an explanation of one other finding of the present study. The results indicate that self-efficacy was found to be moderately higher in teachers with a no formal diploma than teachers who had any other type of qualification. At first glance, such a result may seem out of place, namely that the least qualified teachers exhibit more self-efficacy than their experienced peers, especially given the complexity of skilful planning and assessment in the learning process. Research has shown, however, that the importance of metacognitive confidence cannot be underestimated when considering the development of self-efficacy (MacLellan, 2014). It is not simply a teacher's perception of their capability that is important

therefore, but the level of certainty that they have in that belief that has lasting impact. Self-assuredness, and the judgement of certainty in beliefs are important as they support problem solving, promote team cohesion and serve to increase influence (Briñol and Petty 2009). In addition, there is significant evidence to suggest that miscalibration and especially overconfidence exists within some individuals regardless of objective reality (Koriat 2008). Given these insights, it might not be unusual for some teachers with little or no formal qualification to develop an inflated opinion of their own capability or skill, as well as their capacity to complete teaching tasks successfully (Stirin, Ganzach, Pazy, & Eden, 2012). Burson, Larrick, and Klayman (2006) suggest that this type of miscalibration exists because an individual's estimation of their performance is directly correlated to their immediate surroundings and is influenced by contextual "noise" (MacLellan, 2014). Such findings correlate closely with the detailed discussion of Mercer & Kostoulas's, (2018) theoretical framework presented earlier.

This phenomenon of miscalibration of ability occurs when self-judgement of accuracy is misaligned with objective accuracy (Moore and Healy 2008). In other words, when a teacher's own judgement of the process of teaching and their ability to successfully 'teach' is not supported by objective reason or the same as an independent observer. Naturally, any teacher who has gained a formal qualification in education is also likely to have completed multiple courses in the pedagogy of planning and assessment, and as a result is likely to fully understand the complexity of skills involved. They are more likely, therefore, to have good alignment between their own perception of performance and what it takes to be a good teacher. This may not be the case for teachers who have never benefited from taking professional education courses, resulting in the potential of an incomplete awareness of the complexity of skills required to teach effectively. It is this influence on judgement of adequacy for a particular task, which can enhance an individual's dimension of self-efficacy, optimism, and resilience (Stajkovic 2006). Once again, this premise aligns closely with the theoretical paradigm presented by Mercer & Kostoulas, (2018).

This finding is particularly apt given the profile of teachers within Panama. The likelihood of teachers having an incomplete awareness of the complexity of the teaching is high, and therefore the potential to improve understanding of teacher quality is good. Indeed, professional development experiences that can add substance and improved contextual understanding of the type of professional practices required for high quality learning experiences would be extremely useful.

The relationship between self-permission and teacher qualification

In contrast to the findings indicating no relationship between self-efficacy and teacher qualification, the study found that teachers with higher levels of formal qualification indicate a higher perception of self-permission. As previously mentioned, there is a lack of prior research on self-permission and as a result, using the findings of prior studies to confirm or refute the results of this study is unachievable. Nonetheless, Rose's (2014) descriptive analysis of the defining characteristics of self-permission allow for a series of educated assumptions to be made. Specifically, that self-permission is founded in the notion of an individual accomplishing professional goals and attaining long-term objectives in life. As such, it is no surprise that participants who have already realized advanced academic qualifications would score higher on self-permission that those who have not yet achieved the same academic goals. The study suggests that the completion of formal academic qualification serves as a confirmation in teachers that they can fulfil career goals, and the autonomy to make the decisions necessary to enjoy professional success. In effect, they have earned the right to make decisions from a knowledgeable perspective, and as such, experience elevated levels of optimism when it comes to accomplishing established goals.

One possible explanation for the discrepancy of findings in the relationships between teacher qualification, self-efficacy and self-permission lies in the layered definition of the concept of mastery. As previously discussed, mastery is a central component of both self-efficacy and self-permission and as a result serves as an important point of convergence of the two concepts. The findings endorse the suggestion that self-efficacy focuses on ability and as such mastery is concerned with the perception of control, where self-permission is centred around sanction and so is concerned with the perception of approval (Rose, 2014). This raises the prospect that obtaining professional qualifications or credentials while increasing a sense of legitimacy, does not necessarily impact the perception of professional capability. Consequently, it can be argued that teachers view increased qualification as having the potential of career enhancement and improved credibility, while understanding that classroom experience is required to improve professional practice. As such, effective professional development should be tailored to meet the needs of both those teachers who have experience but lack pedagogical foundation, and those who have advanced qualifications but lack experience in the classroom. Finding content that can address both audiences maximizes the possibility of meaningful learning.

In concert with Rose's opinions, the findings also suggest that self-permission is a continuous variable, and that different individuals are likely to exhibit significant variation in both the level of

self-permission that they report, and the consistency of perception over time. As discussed earlier, self-permission, while remaining a distinct construct, does share some similarities with self-efficacy, one of which appears to be its dynamic and changeable nature. Our findings indicate that, like self-efficacy, self-permission is impacted by individual teacher traits and is subject to change as teachers progress through career developmental stages. It is not unreasonable therefore, to assume that self-permission is one of the influencing factors in a teacher's career trajectory. That teachers are likely to consider not only the concepts of confidence and capability when making decisions about professional longevity, but also autonomy and standing.

Limitations of the Study

There are several limitations to the present study that should be noted.

Firstly, the variation of the participant group sample sizes and, in some cases, the small sample size, limit the reliability of any comparative findings. This is true of the sample sizes for the groups created using teacher experience (no experience n=6, 1-5 years' experience n=89, 5-10 years' experience n=77, 10+ years' experience n=141). and teacher qualification (No formal diploma n=25, High school diploma n=56, Bachelors degree n=122, Masters degree n=86, Other n=22) where there was significant variation in the size of the comparative groups. The small sample size of several of these groupings makes it difficult to determine if results can be generalized in any way.

Secondly, while the sample of teachers was generally representative of the teaching population in some criteria (gender distribution, place of birth), it were not representative on all criteria (teacher age, qualification). Additionally, the decision to select participants primarily from the Panama Bilingue program, while allowing for ease of access to teachers which resulted in a strong overall participation rate, may well have resulted in a sample that was not representative of the general teaching population in Panama. In that sense, while the data collected may well have a solid level of authenticity in terms of it being representative of the selected participants, it must be recognized that potentially it also lacks validity in that this group should not be considered representative of a broader group of teachers. As a part of the Panama Bilingue program each teacher will have participated in extensive professional development over an extended period of time, will be a specialist teacher of the English language, and will have completed a selection process based on established professional dispositions and skills. These characteristics are not likely to be universal when considering teachers in Panama more generally.

A third limitation was that although the sample was drawn from teachers in six regions of Panama, participation in the study was voluntary and therefore the sample may suffer from selection bias. This would only affect the generalizability of the central tendencies of the measures, but not necessarily the generalizability of the reported associations. At the same time, given that the sample size of some regions was also small (Veraguas n=17, Los Santos n=12, Herrera n=21), as previously mentioned the margin of error for these groups also remains too high for any results to be deemed to be highly reliable.

Fourthly, the fact that the data was collected using a single, closed survey and that participants were invited to participate during their regular monthly Panama Bilingue meeting increase the possibility that the findings are susceptible to the limitations commonly associated with administering a survey to collect data. Surveys given to populations in low-income countries have sometimes demonstrated additional limitations in their application, as well as other problems with regard to reliability and validity of data. This specifically includes the possibility that participants feel a responsibility to respond to survey questions in a way that they believe to be favourable to those asking them to participate.

Lastly, in addition to the more general limitations of giving a closed survey, there are additional limitations in this case specifically regarding the questions on self-permission. A common limitation attributed to survey research is oversimplification of complex concepts which can lead to a lack of understanding of the questions being asked. This phenomenon was witnessed in several participants who reported anecdotally that they were confused by some of the questions relating to self-permission and that they found it difficult to relate the wording of the question to their professional lives. While some elected not to respond to questions that were unclear, others admitted to "guessing". This feedback, though certainly not conclusive in any way, is suggestive of data that lack strong validity.

Despite these limitations, though the present study served as an independent and credible investigation in its own right, it must be remembered that the primary purpose of Phase One was to determine teachers' perceptions of self-efficacy and self-permission to inform the creation and the design of the content to be used in the educational application. Although the study was not designed as a pilot study in a traditional sense, it did serve as a sounding board to shape the forthcoming development of the "An Apple a Day" app, and as such, contained many of the same objectives and benefits that are often associated with a pilot study. Given this purpose there is little doubt that the

results of the study yielded valuable insights into the range of critical functions required to maximize the potential success of the application design. These prompted a review of all aspects of the application ranging from the manner of intended use to the conceptualization of the construction and organization of the educational materials to be shared. Ultimately, Phase One was highly successful in establishing a foundation of knowledge acquired from insights gained from the data that specifically shaped both what was shared with teachers and the way that it was presented. When this purpose is considered, many of the previously mentioned limitations become less relevant in the way that they limit the usefulness of the findings.

Paper Six: Reflections on the Shaping of Phase Two

Given that the findings of Phase One were primarily obtained to inform the content, structure, and approach of Phase Two, it was necessary to distil the key conclusions into a simple set of essential principles that could be used as guiding tenets. The following assumptions were therefore established to advise the development of the second phase of the study:

1. The application design should be designed solely for a platform that works with mobile technology for it to be used across all regions of the country,
2. The design of the application should be developed without a specific focus on any particular 'type' of teacher in terms of experience and/or qualification,
3. The application should focus on developing improved self-efficacy and teacher practice rather than self-permission,
4. The content should focus on developing practice rather than the introduction of concepts or teacher dispositions,
5. While attention to cultural norms should be central to the design, accommodation for regional variation (across Panama) was less imperative,
6. The application should be created using a totally bilingual approach rather than creating material in one language and simply translating it,
7. The application should be developed to be used for teachers with a wide variety of ability and comfort in the use of mobile technologies,
8. The application should be developed with a wide range of content for participants who do not have formal pedagogical training as well as those who have advanced qualifications,
9. The participant pool should include teachers across multiple disciplines rather than from one specific program or subject area,
10. The key areas of focus for the professional development content should include classroom management, instruction, and planning & assessment.

One of the most challenging aspects of creating a bespoke educational application is the scope of potential content that must be considered. The findings allowed for the specific categories of material to be explored further and helped focus the areas where there may be a higher probability of

improvement in teacher self-efficacy. In this sense, the results of the study were used to condense the breadth of the range of content to align materials based on specific contextual understanding of the participant sample for the second phase.

In addition to the collection of data that moulded the structure and subject matter of "An Apple a Day", vital information was also harvested regarding teachers' perception of technology use in the learning process. The integration of Gentry et al.'s instrument for modelling 21st-Century skills (ETS-ES) within the survey allowed for perceptions of teachers' comfort with the using digital technologies, as well as their previous experience of the use of similar digital tools in their classroom teaching. This data gave a broad, if somewhat limited, overview of the likely level of participant comfort in using an educational app, and therefore guided its development in terms of complexity of use and user interface.

The following sections outline the key design elements for Phase Two of the study that were significantly and directly influenced by the findings of Phase One.

Reflecting on the Role of Self-Permission

One of the most surprising findings from Phase One was the participant perception, or lack thereof, towards the concept of self-permission. The reason for the idea of self-permission being included in the original survey was primarily due to a hypothesis that the firmly hierarchical nature of the Panamanian culture had the potential to influence teacher's perceptions of 'self' and as a result their professional efficacy. The hypothesis posited that teachers working in Panamanian schools were likely to experience high levels of hierarchical order and clearly defined social expectations, which could lead to a distorted view of authority within the teaching process. As a result, teachers' perceptions of their ability to exert control over curriculum, classroom management, or teaching methodologies impact their motivation and performance. Given these assumptions, before the collection of data from Phase One, it was anticipated that the developed educational application would benefit from a series of supportive content outlining the best ways for teachers to generate healthy levels of professional self-permission.

The results of the study, however, did not support such a hypothesis. Indeed, the data indicated that none of the tested variables seemed to affect the perception of self-permission in teachers. There was also no relationship found between teachers' perception of self-efficacy and self-permission in two-thirds of the participants and those that did indicate a relationship did so with a negative

correlation. Given these results, it was challenging to maintain the assertion that self-permission plays a significant role in influencing participants' perception of self-efficacy, or that the concept has any association to their qualification or experience. Indeed, an analysis of even the most subtle of outcomes of the study, indicated the highest reported levels of self-permission being linked to the teachers with the least experience. This finding directly contradicted the expected result.

As a result of these findings, self-permission was eliminated as a category of professional development from Phase Two of the study. While the importance of a 'sense of self' and the relationship that this has with a teacher's sense of autonomy, esteem, and even worth remained of noteworthy importance to the study, the anticipated relationship with permission was not evident. Mindful of the fact that the primary focus of Phase Two was centred around the usefulness of mobile technologies rather than self-permission directly, it made sense to use the more established and understood categories of self-efficacy to create the content for the application. This would lessen the possibility of participant distraction or confusion working with the application based upon a lack of understanding or perception of the concepts involved.

Shaping the selection criteria of participants for Phase Two of the main study

The findings of Phase One also had a considerable impact on the selection criteria for participants for Phase Two. While it was always anticipated that this would be the case, once again, some of the determining factors that were influential in defining the selection criteria were unforeseen; considerations that reshaped the underlying rationale of the research project as a whole.

The initial motivation for the research project in its entirety came from a place of wanting to help teachers in Panama who had limited experience and had earned no formal qualification. The research outlined in the prior review of the literature delineates the many benefits of improving teacher quality, and the purpose of the study was to provide research-based professional development to teachers who were entering the profession without prior training and so who did not have even a rudimentary preparation to teach. The premise was simple; the creation of a simple network of support offered through mobile phones for those who do not have regular access to consistent internet or technological devices to help boost professional confidence levels. A primary assumption was that this, in turn, would benefit students.

As indicated in the findings section, however, the sample of respondents from Phase One notably limited the potential of reliable data collection from teachers who self-identified as having no

formal diploma and no experience. While the sample size of participants who indicated that they had no prior teaching experience was only six, none of these participants also identified as having no formal qualification. In short, given the sample of participants from Phase One, it was not practical to proceed with a participant pool for Phase Two that included a group of non-qualified, inexperienced teachers.

In light of this, changes were made to the criteria for selecting participants for Phase Two. Rather than looking to create a sample of teachers who would be representative of non-qualified, inexperienced teachers, the participant selection process was expanded to create a group that were more generally representative of the totality of profiles found in Phase One. This included a selection of teachers who had a variety of teaching experience, teaching qualifications, grade levels and subjects taught for the group to be more fully representative of the larger participant pool from Phase One of the study. Using a stratified sampling method, a focus was placed on ensuring that each the group was also proportionally representative except for two key areas. Firstly, the selection process consciously ensured that the gender imbalance was addressed selecting four female and four male teachers, and secondly, teachers who did not necessarily teach a single subject, especially addressing the number of teachers who taught English Language.

The decision to select a non-probability sample, while raising potential concerns over sampling bias and external validity more generally, was still preferred with the understanding that Phase Two of the study was designed to be qualitative in nature with predominantly descriptive findings. As a result, the decision was also made that all participants should be selected from the IAE sample of Phase One. This created a sample of convenience, though also a voluntary response sampling as participants were still only invited to be a part of Phase Two if they had directly expressed an interest. The result was a sample that would allow for the opinions and experiences of the broader group from Phase One to remain represented.

Developing and designing the mobile learning application

There were several aspects of the application development that were fashioned directly as a result of the findings from the initial phase of the study. These elements were primarily centred around the content of the materials created, but also impacted how participants interacted with the application and the additional resources made available to them.

In light of the fact that teacher perception of the four subcategories of self-efficacy showed no statistical relationship, it was decided to develop content in three of the four categories. As a result, the trial of the application was planned over three months (a month constituting 20 working days of material) using content in the areas of classroom management (Discipline self-efficacy), instruction (instructional self-efficacy), and planning and assessment (planning & assessment self-efficacy). It was determined that the fourth category of self-efficacy regarding a positive school climate was not one that transferred with the same ease as the other categories and so was not included. As the results also indicated no noteworthy difference in teacher perception of the categories no prioritised order of concept delivery appeared necessary and so the modules were built out alphabetically.

The fact that Phase One data indicated stable levels of self-efficacy, even in teachers with no experience or no formal qualification, gave rise to the development of additional and more comprehensive materials to be included in the application. Originally it was conceived that the research-based information shared would be more impactful if it was presented in a simple and easily understood format. The thought was that the application would serve as an introduction to concepts rather than a detailed discussion of complex pedagogical practice. A platform created to meet the needs of teachers who were new to the profession and who had never received formal training in the art of teaching. Due to the change in the sample population, there was a need to update this concept design to include materials that were broader and more complex in scope. As a result, the decision was made to add accompanying videos and/or articles that would serve as extension materials for those teachers who were interested in learning more about a given concept. It was hoped that these additions would allow the application to maintain the original purpose of offering simplified, research-based teaching tips, and at the same time allow teachers who have prior training to explore further through access to more comprehensive research-based sources.

The decision to make alterations to the sample of participants also had a significant impact on the production of the application. Initially, the app was designed to be created solely in English with the ability for all information to be translated into Spanish within the application, or at the very least for Spanish closed captioning to be available for all media used. This was deemed to be sufficient given that the anticipated sample would be members of the Panama Bilingue program and so should be able to interact with the application in both languages without too much difficulty. When the decision was made to ensure that the sample should be more balanced in terms of subjects taught, this presented a potential problem as many of the additional subjects would be taught in Spanish. This

would require an application that could be interacted with in the native language of the user to ensure that potential frustrations due to language could be minimised. To achieve this, it was concluded that two identical applications would need to be created with duplicate materials one that functioned in English and the other in Spanish. While it may not be possible for all supporting documents to be delivered fully bilingually, all of the everyday functions of the application were designed to be performed simultaneously in both languages.

Defining the purpose of Phase 2

As a consequence of the aforementioned modifications, the primary focus of Phase Two of the research evidently shifted. The phase remained concentrated on teacher self-efficacy and more specifically whether or not mobile learning can improve teachers' perception of self-efficacy. It did not, however, seek to limit the perceptions collected to those who had no prior teaching experience and no formal teaching qualification, but rather to look at a broader sample of participants. The study was also expanded to investigate how teachers interacted with the developed application, how useful this interaction was, and whether or not this impacted their professional practice.

The following research questions and sub-questions were developed to guide Phase Two of the study:

1) Can professional development delivered to instructors using mobile learning improve the self-efficacy of teachers in Panama?
    i) How do teachers interact with professional development delivered through a mobile learning application?
    ii) How useful is professional development delivered through a mobile learning application?
    iii) What is the impact of professional development delivered through a mobile learning application?

Section Three: Phase Two of the Main Study

Paper 1: Phase Two: Introduction

Phase Two of the study shifted focus from an investigation into the relationship between teachers in Panama and the positive psychological factors that are often associated with teacher quality, to an examination of whether mobile learning could be used to improve those same positive psychological factors. More specifically, this phase of the study was designed to determine whether a mobile learning application could successfully be used to increase teacher perception of self-efficacy, and in turn classroom practice. As previously mentioned, the original intent of this phase was designed exclusively for teachers who self-identified as being inexperienced and without formal qualification, later modified to include a more generally representative sample of the teaching population in Panama given the findings from Phase One. There is little doubt, however, that the origin of inspiration to help those who work in marginalized communities remained a central force throughout the project. As a result of this, much of the design, while addressing a broader context, was still mindful to ensure that it was directly applicable to those who teach in the least supported and equipped environments.

The following papers outline a second distinct piece of research, though profoundly shaped by the findings of the previous phase. It is scaffolded by a series of simple assumptions:

- teacher quality can significantly enhance students' learning experiences,
- well-designed professional development can positively impact teacher self-efficacy,
- mobile technologies can be used to successfully deliver impactful professional development programs,
- teachers who experience such programs will improve their teaching practices as a result.

Clearly, each of these hypotheses was also being tested in a strong ethnic context where teacher dispositions and cultural legacy were critical factors for consideration. Central to the focus was the need to determine how best to help professionals in the field by sharing with them supporting evidence-based practices without increasing levels of anxiety or intimidation.

At the heart of this was an examination of whether it was possible to differentiate highly complex pedagogical theory to professionals with vastly different backgrounds and formal education training. More importantly, perhaps, was whether this could be delivered on a mobile learning

platform, easily accessed in all regions of Panama, and without requiring connectivity to an unreliable and often cost prohibitive internet network.

The promise of mobile technologies

The continuous advancement of digital technology over the past two decades has resulted in considerable discussion surrounding the potential for its application within the learning process (Haßler at al., 2016). In recent years, this positive energy has been further strengthened by the availability of low-cost technology, and the steady graduation of a work force that has a far higher comfort level with the use of digital platforms (Haßler at al., 2016). In addition, the rapid growth and availability of wireless Internet has resulted in an exponential growth in the use of mobile technology in learning (Hwang & Tsai, 2011; Martin & Ertzberger, 2013). While cost, adaptability, and scalability are the primary influencers for using mobile technologies to support learning (Sattarov & Khaitova, 2019), for years research has demonstrated the value of incorporating such devices in teaching (Raelovich et al., 2020). This is particularly true of low-income countries, where the use of technology to provide access to good educational programmes is viewed to be an area of genuine potential (Ozdamli & Uzunboylu, 2015).

Even though broadband coverage has enjoyed several years of continuous global expansion, coverage is often restricted to larger urban communities and this growth has not necessarily increased equity of access, especially in Panama where mobile accessibility and speeds are much slower than other Latin American markets (McKetta, 2019). This reality exacerbates the access gap for the marginalized in societies in many cases. Consistently, those who champion technology as the answer to the access gap are frustrated by the fact that virtually all emerging technologies developed to date are products developed using services, models, and expertise that derive from high-income contexts (UNCTAD, 2018). As such, these are often solutions that have been designed and then imported into remote or low-income communities, rather than being designed while immersed in the environment they are to serve (UNCTAD, 2018). The benefit of such an approach has not been shown to be significantly scalable without widespread internet access in areas where there is little or no broadband availability and are often cost prohibitive. "Some 4.4 billion people remain offline" and "in 2013, the ITU estimated that there were 200 million more men than women online." (Kelly, 2013).

This situation is beginning to change, however. Recent years have seen the emergence of a variety of products designed specifically to overcome user challenges in areas where internet

connection and electricity cannot be relied upon consistently. The education solutions include solar-powered options, as well as mobile phone applications, which in low-income countries now accounts for four out of every five connections (Kelly, 2013). In more modernized communities mobile technology is already close to reaching complete saturation. According to the Pew Research Center (2018), more than 95% of all Americans now own a cell phone and 77% own smartphones. Indeed, every single demographic group, regardless of gender, age, race, income level, or education level, now indicate more than 90% ownership of mobile technology (Mobile Fact Sheet, 2018). This expansion of reliable and affordable access holds promise for future endeavours made possible using mobile devices.

While it is true that mobile devices have the capability of enhancing and enriching the concept of learning in a variety of ways (Traxler & Wishart, 2011), mere access to technology has little or no positive impact on education. (Haßler at al., 2016). There is no doubt that technology can enhance the engagement and motivation of students, however, this benefit is only an advantage for learning if the activity is effectively planned, supported and aligned with appropriately developed learning outcomes (The Scottish Government, 2015). It is the pedagogy for the application of technology in the classroom which we know is of most importance (Sharples, 2019). "Technology is most effective when there is a holistic strategy to integrate digital and non-digital resources; the school's infrastructure needs to facilitate the use of the technology being introduced" (Haßler et al., 2016 p.6). Nevertheless, the rapid expansion of information communication technologies around the globe, and the potential benefits of education technology specifically, result in a high level of interest in harnessing modern technology to help advance the education status of some of the world's poorest people (World, Smith & Winthrop, 2012).

The over-arching implication of the research to date is that the technology is best used as a catalyst for change, and that without the required paradigm shift within teachers to view it as a critical and central resource within learning, it has significant limitations (Marshall, 2018). The following series of papers examines further both the role that mobile applications can play in supporting the development of teacher quality and the potential role of mobile technologies in professional development in Latin America and, more specifically, the country of Panama. It begins with a review of the current literature, and continues to detail the methodology, results and conclusions drawn from a qualitative study on teacher interaction and use of a mobile application designed to deliver professional development. The review of the literature is presented in three distinct yet related

sections: mobile learning, effective professional development, and the characteristics of valuable learning applications.

Paper 2: Phase Two: A Review of the Literature

Mirroring the approach taken in Phase One, this review of the literature is designed to reflect a thoughtful exploration of the academic literature regarding the fundamental concepts underlying this section of the research. At the same time, the review seeks to reflect a culturally sensitive understanding of the concepts discussed, centred on their specific application in the social context of the study and the societal norms specific to Panama. The review is again presented in three distinct yet interconnected parts: Mobile learning, Effective professional development, and the Characteristics of effective mobile learning applications. As with Phase One, the following discussion served as the intellectual footing upon which the practical design of the study was built.

Part 1: Mobile Learning

Defining mobile learning

Any serious study of mobile learning capabilities must begin with a discussion surrounding definitions. This is especially pertinent for research conducted in low-income communities where technology development, availability and cost are likely to be vastly different than in more technologically advanced populations. At the same time, studies also acknowledge the fact that there are few, if any, definitions that have undergone more refinement in recent years (Rikala, 2015). Laouris and Eteokleous reported conducting a Google search using the formula {+" mobile learning" + definition} that returned 1,240 items in January and 22,700 items in June, just six months later (Laouris and Eteokleous, 2005). In 2020, a general search of these terms returned more than 525,000 results. One consequence of this type of rapid growth is that while new technologies have transformed modern society the theoretical framework and specific definition of terms that serve as a foundation for understanding have often not developed at the same pace (Peng et al., 2009). Indeed, the dynamic nature of the definition of mobile learning makes the comparison of research conducted over any reasonable timeline problematic. More than ever, people are connecting to an online network using a vast array of technologies to improve their personal and professional functionality (Squires, 2014), and the personalised nature of their preferences make them difficult to define consistently. As a result, there is a heightened need for the development of a more robust theoretical framework and a tightening of the common definitions used to frame the attributes and functions of mobile learning (Grant, 2019). This is especially true in the context of this study, where specific cultural characteristics are likely to add a further dimension to the definitions used.

According to Alrasheedi & Carpetz, "the concept of mobility refers to the prospect of having flexibility in terms of time, place, pace, and space that cannot be achieved when using non-mobile versions of devices." (Alrasheedi & Carpetz, 2015, p. 42). However, others have suggested that this definition needs to go further, placing equal importance on defining the *learning* as the mobility.

> Traxler (2007) and other advocates of mobile learning define mobile learning as wireless and digital devices and technologies, generally produced for the public, used by the *learner* as he or she participates in higher education. Others define and conceptualise mobile learning by placing a strong emphasis on the *mobility* of learners and the *mobility* of learning, and the experiences of learners are they learn by means of *mobile* devices. (El-Hussein & Cronje, 2010, p.14).

As might be expected given the trajectory of change, the scope of the definition has also been dynamic in nature, modifying presice meaning regularly to best reflect the latest iteration of the concepts involved.

Despite the fact that the term mobile learning has only formally been recognized since 2005 (Crompton, 2013), the considerable interest and 'hype' surrounding its use is based upon a history that spans decades (Rikala, 2015). Key definitions are listed in Table 13. While early definitions of mobile learning centered around the technology involved, more recent perspectives encompass a more diverse understanding (Giardi, 2019). This evolution is worth understanding, especially for those who are working in communnities that are less progressive in terms of mobile learning as they may well be still situated in earlier interpretations of conceptual construction.

Table 13: Mobile learning definitions through the ages*

Author(s) (Year)	Definition
Quinn (2000)	Mobile learning is electronic learning through mobile computational devices: Palms, Windows CE machines, even a digital cell phone.
Vavoula and Sharples (2002)	Learning can be considered mobile: Learning is mobile in terms of space (i.e., it happens at the workplace, at home, and at places of leisure); it is mobile between different areas of life (i.e., it may relate to work demands, self-improvement, or leisure); and it is mobile with respect to time (i.e., it happens at different times during the day, on working days, or on weekends).
Trifonova (2003)	Mobile learning is any form of learning (studying) and teaching that occur through a mobile device or in a mobile environment.
Geddes (2004)	Mobile learning is the acquisition of any knowledge or skill through the use of handheld technology, anywhere and anytime.
Georgiev, Georgieva, and	The definition of mobile learning must include the ability to learn everywhere at every time without permanent physical connection to cable networks. This can be achieved through the use of mobile and portable devices such as personal digital assistants (PDAs), cell phones, portable

Smikarov (2004)	computers, and tablet devices. The devices must have the ability to connect to other computer devices, to present educational information, and to realize bilateral information exchange between the students and teacher.
Laouris and Eteokleuous (2005)	The definition of the mobile learning (MLearn) function is: MLearn = f {t, s, LE, c, IT, MM, m} (where t=time, s=space, LE=environment, c=content, IT=technology, MM=mental abilities, and m=method)
Keegan (2005)	Mobile learning is the provision of education and training on PDAs/ palmtops/handhelds, smartphones and mobile phones.
O´Malley et al. (2005)	Mobile learning is any sort of learning that happens when the learner is not at a fixed, predetermined location or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.
Traxler (2005)	Mobile learning can be defined as "any educational provision where the sole or dominant technologies are handheld or palmtop devices."
Walker (2006)	Mobile learning is not about just learning using portable devices, but also learning across contexts.
De Marcos *et al*., (2006)	We can abstract three aspects recurrent in all of them: (1) To be mobile, learning should be able to be accomplished from any place, (2) should be able to be realized at any hour, and (3) it needs a device (small and easy to carry) that allows the student to complete the process.
Sharples, Taylor, and Vavoula (2007)	Mobile learning is the processes of coming to know through conversations across multiple contexts among people using personal interactive technologies.
Tétard, Patokorpi, and Carlsson (2008)	Mobile learning is situated, collaborative, and guided teaching, studying, and learning, supported by mobile devices that employ symmetric mobile communication channels that the learners and the facilitator can use; it can also involve specially designed learning objects for work, hobbies, or citizenship-related purposes or aids to traditional education.
Koole (2009)	Mobile learning is a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction.
Peters (2009)	The key features of mobile learning are its ability to provide learning that is "just in time, just enough, and just for me", learning that is situated (typically in the field or at the workplace), and learning that is contextualized through mediation with peers and teachers.
Peng et al. (2009)	To benefit from convenience, expediency, and immediacy, mobile learners use ubiquitous computing technologies to learn the right thing at the right time at the right place.
Cochrane (2010)	Mobile learning involves the use of wireless-enabled mobile digital devices (wireless mobile devices [WMDs]) within and between pedagogically designed learning environments or contexts.
Osman, El-Hussein, and Cronje (2010)	Mobile learning is any type of learning that takes place in learning environments and spaces that take account of the mobility of technology, mobility of learners, and mobility of learning.
El-Hussein and Cronje (2010)	The authors define mobile learning as a learning environment based on the mobility of technology, mobility of learners, and mobility of learning that augments the higher educational landscape.
ADL (2011)	Mobile learning involves leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviours, or skills through education, training, or performance support while the mobility of the learner is independent of time, location, and space.
Crompton, Muilenburg, and Berge (2013)	Mobile learning is learning across multiple contexts through social and content interaction using personal electronic devices.

*Reproduced from, Rikala, J. (2015). Designing a mobile learning framework for a formal educational context. *Jyväskylä Studies in Computing 220.*

Other studies suggest that a broader definition of e-learning is required that encompasses the way that the learner experiences learning and that only when this is accomplished using mobile devices and wireless transmission can it truly be defined as mobile learning (Giardi, 2019). While this characterisation adds the additional dimension of user experience to any definition, the interpretation does allow for cultural variance to be taken into account. Any comprehensive research involving mobile learning, should develop a theoretical framework that addresses the device, learner, and interaction, as well as understanding the cultural and contextual factors that are likely to impact it's adoption.

Arguably, all forms of mobile technological devices have the potential to provide educators with the ability to access tools and information that allow learning to occur instantaneously and without physical boundaries (Kumar Besak, Wotto, & Bélanger, 2018). While such devices also have the capacity to transform the learning process, making it more personalised, convenient, collaborative, or adaptive, whether or not this transformation is a pre-requisite for categorisation as mobile learning remains in doubt (West, 2013). This is not to suggest that the cognitive approach to mobile learning does not have importance, as clearly, mobile learning opens up a new paradigm of learning (Mavuso, Jere, & Matsebula, 2020). Ultimately, a review of perinent studies, suggests a generalised consensus that three elements must be considered within the definition of mobile learning: mobility of technology, mobility of learners, and mobility of learning (Kumar Besak, Wotto, & Bélanger, 2018).

Many people closely associate mobile technology with smartphones in particular, but mini-laptops, tablets, digital media players, and even digital cameras all now serve as potential mobile learning tools, provided that they have the ability to connect to a wireless network of some sort (UNCTAD, 2018). The most distinct feature of the technology, first and foremost, is that it is mobile, and therefore can be easily carried and used in any location. The concept of mobility, especially when discussed in a Latin American context, is subject to and limited by the wireless coverage that exists in the region. Naturally there is a significant variation of coverage, but even those areas that have good access are subject to the inconsistency of infrastructure often found in low-income countries (UNESCO, 2020). As a result, even though new technologies offer the potential of endless mobility, without an extensive infrastructure to support their use, they lose mobile functionality.

Learners also have the ability to benefit from the *mobility* of mobile learning. Mobile technologies allow for a student to be able to connect with a cohort of learners, and in a collaborative

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learning environment, across different locations and times, using different mobile technologies, therefore personalising the experience to their individual and specific circumstance (Grant, 2019). Indeed, throughout the evolution of the definition of mobile learning mobility, access, immediacy, situativity, ubiquity convenience, and contextuality have been determined to lie at the heart of the definition (Pedro, Barbosa, & Santos, 2018). Naturally, while the functionality of the hardware is a critical element, if the process allows for mobility and convenience of access, but does not ultimately result in the ability to actually learn, then the *mobililty* of the technology process is defeated.

Consequently the elasticity of the learning process is just as important as the operational flexibilty of the technologies used when defining mobile learning. The abilities to access and interact with information and learning content, as well as to access peers collaboratively and presentations 'synchronously and asynchronously,' must be in place for the learning to be genuinely mobile (Hummel and Hlavacs, 2003, p.6). This, in turn, requires a different (and innovative) instructional design, centred around the learner rather than the process of instruction or any specific institution or person. The precondition for mobile learning to occur successfully is determined significantly by an understanding that it can offer the flexibility to address significant individual learning needs (Hashemi et al., 2011), as well as independent and collaborative learning experiences in both formal and informal settings (Tangirov, 2020).

In recent years, a raft of new research has worked to expose the numerous layers within the definition of mobile learning (Giardi, 2019). Nevertheless, the term remains in its relative infancy as more comprehensive theoretical frameworks are developed, and a more complete picture of the differing aspects of the concept emerges. Until then, perhaps the best attempt at defining mobile learning lies in a dynamic and comprehensive approach that addresses the mobility of technology, learner, and learning. This is especially apt when also considering the context in the majority of countries within Latin America, that exist beyond the economic stability of being on the cutting edge of innovative mobile technologies and practices (UNESCO, 2020). In these environments, focus on the research from the earlier, less sophisticated definitions of mobile learning is often more appropriate.

Given this specific contextual reality, a more precise construction of the concept of mobile learning in Latin America is required for a comprehensive understanding to be garnered.

Mobile learning in Latin America

There is little doubt that Information and Communication Technology (ICT) has been one of the most compelling influences on education over the past decade, in all regions of the world. Awed by the potential to deepen, individualise, and transform the learning process, eager early adopters have looked to utilize innovative technologies to solve many of the most fundamental challenges facing schools and teachers in Latin America (UNESCO, 2020). While solid progress has been made in using ICT to grant access to schooling, challenges remain in maintaining the quality of experience and both the efficiency and equity of the system more generally. In Latin America and the Caribbean, a concerted effort to integrate technology into schools has resulted in close to 90% of secondary students having access to ICT at school (GSM Association, 2020). In many cases, however, this has taken the form of formal computer labs that are shared across many grade levels, often significantly restricting the quality of access for students (Alvarino and Severin, 2009). Despite the infusion of technology devices into classrooms, therefore, more practical exploration is needed to determine a deeper understanding of which technologies work better in which circumstances, and how each might be blended with successful traditional approaches to teaching to provide a comprehensive and congruent learning experience for students.

Like most education systems, the integration of technology into schools has primarily focused on the development of technology infrastructures and the implementation of hard-wired computers (Alvarino and Severin, 2009). While many students in major cities enjoy the benefits of impressive technological resources, access to mobile technologies remains significantly limited outside of the urban centres of the region, and even when available the widespread use of computer technology lies beyond the financial capacity of many families (OECD/MEDUCA, 2017). Considerable research has shown that Internet access is often determined by household income, family size, education, age, gender, location and cost of Internet access (Jansen, 2010). This is certainly the case in Panama where Internet penetration remains under 65% of the country, and where mobile connections *decreased* by more than 120,000 between January 2020 and January 2021 (Hootsuite & We Are Social, 2021). Despite this decline, the number of total mobile connections was equivalent to 108% of the total population of the country, but many of these connections (86%) are prepaid month-to-month accounts and so are subject to economically based fluctuation. (Hootsuite & We Are Social, 2021).

Consequently, for the majority of Panamanians mobile phones are not only the most cost-effective option, but they also benefit from being easily portable and affordable with monthly

flexibility. Clearly, however, the region still suffers from pervasive connectivity gaps where up to 25% of Latin American 15-year-olds from socio-economically disadvantaged backgrounds, lack access to a computer (desktop, laptop or tablet) at home and at school (OECD, 2020). Strikingly, this is not the case for students from socio-economically advantaged backgrounds where access to mobile technology is comparable to peers in more technologically infused countries from across the world (OECD, 2020). Research indicates that this connetivity gap is primarily a result of a lack of affordability resulting in lower income families having to pay on average 29% of their monthly income to receive good connectivity compared to 3% and 4% for equivalent earners in North America and Europe (GSM Association, 2017).

As a result, even though mobile technology is considerably less expensive than networked computers, the cost of smartphones and the mobile plans that support their use can still be prohibitively costly for many. Wireless communication plans rarely offer affordable unlimited data plans, and so the sustainability of using mobile technology in everyday learning activities is limited. Many families, especially those living in impoverished communities, are limited to purchasing phones with basic features, allowing them to utilise calling and messaging capabilities, but not the more complex applications often associated with smartphones (GSM Association, 2017). As such, the ability for most to use downloadable education apps outside of the classroom, a significant advantage of mobile technology, disappears. Additionally, the size and operating speed of basic mobile phones on basic plans serve as a source of frustrations for many users (UNESCO, 2012). While being imminently portable, these small screens do not always allow for ease of use over a prolonged time when it comes to reading text or manipulating numbers (Pedro et al., 2018). In many cases, using and creating multimedia resources for classroom settings requires considerably more functionality than social media or making calls might, the fundamental purpose of use for the phone. The result in many areas of Latin America is a network of mobile technology that does not readily adapt to use for educational purposes (OECD, 2020).

Nevertheless, given the increasing accessibility and relevance of mobile technology, substantial potential remains for its use in the learning process. In view of the previously outlined barriers to realizing this potential within Latin American countries, however, it is important to rethink how instructional mobile technology is integrated within the education system in order to seize the benefits of new technologies in Latin American schools (OECD, 2020). Clearly teachers are a critical component for maximizing the benefit of using mobile technologies to enhance the learning process as

such integration is likely to require both a transformation of teaching practices and a shift in professional paradigm.

Teachers and the use of mobile learning

Teachers are facing a complex array of challenges in the classroom as they look to prepare their students for the 21st Century (Albion et al., 2015) and, for a variety of reasons, teacher education programs in Panama, and the lack thereof, are struggling to prepare new teachers with the skills and confidence to utilise new technologies. Research indicates the importance of new teachers entering the profession confident in their level of knowledge and skill to design classroom practice and learning experiences using a variety of technologies (Mouza et al., 2014). However, this is only likely to happen when teachers have experienced sufficient quantity and quality of instruction (Zonoubi et al., 2017), as teacher beliefs, confidence, and attitudes towards personal technology continue to serve as a barrier to its use (Chiu & Churchill, 2016). It is equally important that teachers be provided with continued professional development to strengthen their use of innovative teaching practices further if they are to embrace a more student-centered approach (Von Suchodoletz, 2018). This continuing education is of particular importance in Panama where significant resources have been committed to supporting teaching and learning in recent years.

The trend of students using mobile technology for academic work has been well-documented in recent years. Throughout Latin America, more than 70% of teachers report that they frequently let students use instructional technology to complete class work or projects although there are large disparities within the region with approximately 40% reporting similar trends in less urban areas and 20% of teachers admiting that they never use technology in the learning process (OECD, 2020). The use of personal technology, however, is far more pervasive though again, the type and functionality of the technology can vary coinsiderably (Burns & Gottschalk, 2019). While this use of new technologies has saturated the vast majority of people in Latin America, it has not yet connected with teachers' professional lives. Mirroring research findings elsewhere, teachers do not appear to acknowledge or value the extent to which students seamlessly integrate their mobile technology into the learning process (Biddix, Chung, & Park, 2015). As a result, there is a mismatch between the opportunities that technology might provide and the ways that they might be implemented in academic contexts (Kinley, Zander, Georgsen & Choeda, 2013).

There is significant research showing a pervasive perception that ICT capability is an important and necessary competence in preparing students for the 21st-century (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2013; Griffin et al., 2012; Voogt et al., 2013). Nevertheless, while this may be a widely accepted truth amongst teachers, certain background variables do have a bearing on teachers' use of technology (Gerick & Eickelmann, 2014). Recent studies have indicated that older teachers are less likely to utilize mobile technology (Fraillon et al., 2014), and that male teachers are more apt to use technology more frequently and consistently than their female peers (Eickelmann et al., 2104). Also, teachers who regularly experience technology use in their personal life are more disposed to experimenting with its use in their professional lives (Chiu & Churchill, 2016). Once again, these research findings present a challenge for countries like Panama, given the profile of teachers in the region.

It follows that while Panamanian teachers remain convinced of the usefulness of mobile technology, and ICT more generally, in their daily activities, many remain reticent to embrace it fully in teaching and learning (OECD, 2020). For many, teacher self-efficacy lies at the heart of the problem, where in an aging workforce with limited technological proficiency the possibility of failure is very real in the minds of many professionals, which often results in a deterioration of overall efficacy (Fraillon et al., 2014).

Teacher self-efficacy and mobile technologies

In Phase One I discussed in some detail the understanding that teachers' sense of self-efficacy is a highly influencial motivational factor and a strong predictor of teacher engagement and career development (Watt, Richardson & Wilkins, 2014). I asserted that high levels of self-efficacy impact teacher enthusiasm, motivation, satisfaction, persistence and performance; in turn these all influence student achievement (Kunter & Holzberger, 2014). Research has also identified that teacher performance and success are not only positively impacted by individual self-efficacy, but also by the collective efficacy beliefs within groups of teachers and schools (Bandura, 1997). It is important to remember that issues around confidence and competence tend to be cumulative in nature with teaching level, experience, training, personal characteristics, and social status can all influence teachers' self-efficacy. While there is a tendency for professional confidence to improve over time (Klassen & Chiu, 2010), the reverse trend is evident when considering the use of mobile technology where younger, less experienced teachers demonstrate higher levels of comfort (Mouza et al., 2014).

Given that the vast majority of the teaching workforce in Panama have a low socio-economic status, are ageing, and are academically under-qualified (UNESCO, 2015d), it is not surprising that many face low levels of self-efficacy generally, and specifically when it comes to the use of mobile technology. While there remains considerable variation across the country, many new teachers, especially those who have been raised in impoverished rural areas, lack a consistent exposure to innovative mobile technologies, and so lack experience with the use of smart technology in the learning process (OECD, 2020). Various studies have found that teacher degrees of self-efficacy have a direct correlation to whether or not they are comfortable using technology in their professional lives (Kenny et al., 2012). This comfort is, in turn, directly related to the degree to which teachers feel that they have acquired the requisite skills (McAleavy, 2018). It is not surprising, therefore, that teachers in Panama suffer from a lack of comfort in the use of mobile technology where teacher preparation programs often lack the ability to equip pre-service teachers to integrate technology into teaching and learning. This lack of effective training has a significant impact, even when teachers have high levels of comfort in the use of mobile technology within their personal lives, as it takes specialised and specific training on the use of instructional technology before self-efficacy is likely to be increased (Chiu & Churchill, 2016).

Table 14: Top 8 Competencies of a Mobile Learning Designer*

Competency	Goal
Knowledge	Knowledge of the instructional approaches, tools, systems, and processes required for designing and developing effective mobile learning content.
	Knowledge of successful mobile learning implementations around the world.
	Knowledge of effective practices related to the development of mobile learning content.
	Knowledge of today's trends, research initiatives and experiments happening in the field of mobile learning.
Skills	Ability to analyse a business situation and the learning context, and recommend appropriate mobile learning solutions to address them.
	Skills to design and develop effective mobile learning applications to meet business objectives.
Attitude	Passion for learning and improvement in the areas of instructional design and mobile learning, and all related fields.
	Appreciation of the power and effectiveness of mobile learning.

*Retrieved from: Singh, R. (2014) *"Top 8 Competencies of A Mobile Learning Designer - eLearning Industry"*. eLearning Industry. N.p., 2014. Web. 14 May 2017.

If teachers are to integrate mobile technology into their professional practice successfully, therefore, they must first develop a set of professional capacities around its use. According to Singh (2014), there are eight competencies that teachers should master before they are likely to feel that they can successfully implement technology and these involve not only the development of specific knowledge, and skills, but also attitudes (Table 14).

Similarly, several studies have concluded that if the benefit of mobile technology is to be maximised, teachers must not only understand how to use the technology effectively but also have a positive perception regarding its potential as a learning tool (Eickelmann et al., 2014a; Spezia, 2010; Teo, 2009). Teachers' attitudes to the use of ICT specifically in effective teaching and learning are likely to have a significantly positive impact on them implementing technology in all aspects of their professional practice (Youngkyun, Hui, & Seongchul, 2017). The raft of research regarding the importance of both the capabilities and attitudes of teachers has powerful implications for Panama, where the profile of teachers indicates a lack of critical characteristics.

It is not simply the characteristics of the teacher that have the ability to influence self-efficacy surrounding the use of mobile technology, however. The features and traits of the developed technology are equally important when it comes to user confidence – specifically the ease of functional use, abundant interaction and communication tools (Delialioglu & Yasaman, 2014). Several studies have highlighted the fact that some mobile learning also has the ability to influence and even change individuals' attitudes and behaviours toward learning (Liaw, Hatala, & Mei Huang, 2010). Consequently, there is an imperative to consider the professional development required to support and guide teachers toward effective adoption of mobile technology as an important element of its successful implementation.

Part 2: Effective professional development

Professional development of teachers

As we have already established, teacher quality is decisive in student learning, given that the quality of educational experience for a student hinges largely on the quality of their teacher (Nye, Konstantopoulos, & Hedges 2004). Simultaneously, professional development for teachers has consistently been regarded as one of the most promising practices for improving teacher quality (Desimone & Garet, 2015; Desimone & Stuckey, 2014). When well-designed, professional development has the potential to support the effectiveness of teachers through a series of individual

and collaborative learning opportunities, and as such, also possesses the potential to improve student achievement (Elmore, 2007). It stands to reason, therefore, that any genuine attempt to positively impact teacher quality should begin with the consideration of an effective and efficient delivered professional development program.

It is not simply the process of teacher training that prompts teacher improvement however, as not all professional development is equally effective, and teachers continuously report on the frustrations of participating in sub-standard training sessions (Darling-Hammond et al. 2009). To be genuinely successful, professional development must be content-based, high quality, sustained and focused on student improvement (Darling-Hammond, Hyler, & Gardner, 2017). It is also important to note that in addition to these design-based factors it is highly likely that additional influences affect the outcome of teacher training sessions including the dispositions of the teachers and facilitators involved as well as the school setting (Lipowsky, 2014).

Given this reality, valuable professional development should be designed with close alignment to the known traits of effective professional development (von Suchodoletz, 2018). These include close application to everyday practice, sustained delivery over time, practitioner reflection and peer collaboration as outlined in Table 3. It is important that training is delivered in effective learning environments, that teachers should be given opportunities to actively control their own professional learning and that the learning process builds on already accumulated subject knowledge and experience (Kalinowski, Gronostaj, & Vock, 2019). Creating learning experiences that are personally insightful for teachers increases the direct connection with the content covered and subsequently improves the attitude of teachers to the training more generally, resulting in a more successful experience (Darling-Hammond et al. 2009). Identifying how these factors impact the outcome of training underpins the development of suitable professional development that increases teacher knowledge, understanding and skills (Gunter & Reeves, 2017). In this sense, robust professional development of teachers mirrors many of the research-informed practices that are encouraged in the teaching of students in their classrooms more generally (Darling-Hammond et al., 2017).

As might be expected, teachers differ in how they learn as well as what they need to learn, and so are likely to benefit most when learning activities are differentiated (Hoekstra, 2009). Thus, offering a variety of training formats to professional development maximizes the opportunities to engage in meaningful learning and therefore the possibility of practical improvements to teaching (Albion et al., 2015). Despite this variety of approach, studies have shown that content is better

received when it is focused and contextually appropriate where teachers are immersed in information that has relevance to them where they can see a direct applicability and a likelihood of useful change (McConnell, Parker, and Eberhardt 2013). Of equal importance is the need for professional development to be a result of teacher-led initiatives, where training is designed to build upon pedagogical proposals that originate from teachers rather than leadership (Lotter, Smiley, Thompson, & Dickenson, 2016).

Complimenting the need for teacher voice to play a central role in training, numerous studies have also noted the importance of allowing for teacher choice in the process, where teachers might volunteer for or select specific professional development rather than being required to participate (Harris & Graham, 2017; Koellner & Jacobs, 2014). Indeed, a direct link to the participant's experience, interests and needs has been shown to have a positive impact on teacher perception of training (Müller & Papenkort, 2013), as well as the use of experts in areas of specific interest to the participants (Lipowsky & Rzejak, 2015). It is important therefore, to make available professional development in areas of effective teaching and learning closely aligned to learning opportunities and policies that are interwoven with the current context of the group (Timperley, Wilson, Barrar, & Fung, 2007). Building on individual teachers' practices as a foundation for new learning yields productive results (Darling-Hammond et al., 2009; Timperley et al., 2007); especially when introducing new knowledge about learning, and reflection on the benefit of the new practices (Lipowsky & Rzejak, 2015). Attention to these factors grounds teacher training opportunities in relevance for participants and as a result has the potential to impact both the outcome of the learning and the experience of the learner (Darling-Hammond et al. 2009).

The benefit of active engagement in professional development goes beyond the design and content choices made, as studies have shown that active learning is necessary for lasting changes to take effect (Darling-Hammond, Hyler & Gardner, 2017). Effective teacher professional learning requires teachers to be active contributors in the learning process and this is especially true when there is also a focus on cultural and contextual factors and local institutional priorities (Calvert, 2016). Interestingly, this is why the use of the term "training" can be problematic for some, as it suggests a more top-down delivery where teachers are assumed to be autonomous professionals, an assumption that often does not align with the reality, especially in low-income communities. Additionally, when teachers learn cooperatively in groups and when this collective participation reflects the key themes faced by the group, teachers profit considerably more than when learning is more generic and sterile

(Darling-Hammond, Hyler & Gardner, 2017). Once again, these findings mirror what is observed in student learning where studies have consistently shown that "students learn more when they are actively engaged in the classroom than they do in a passive lecture environment… research also shows that active teaching strategies increase lecture attendance, engagement, and students' acquisition of expert attitudes toward the discipline." (Deslauriers, McCarty, Miller, Callaghan, & Kestin, 2019) p.19251). In view of these findings, clearly those tasked with the design and implementation of valuable professional development are best served investing in the creation of activities that require active and vibrant participant involvement.

The effectiveness of professional development is also linked to the number of hours of provision and the period of time over which it continues (Gulamhussein, 2013). The more time committed, the more potential there is for teachers to be impacted by the information gained and the subsequent improvement of professional practice (Whitworth and Chiu 2015). This contrasts with shorter programs or single day trainings where longer-term influence is often not evident (Whitworth and Chiu 2015). "Even though there is no linear relationship between time spent in a PD program and its success, longer periods of training seem to be necessary to change and extend teachers' generally stable beliefs and professional knowledge, as well as well-established classroom routines." (Kalinowski, Gronostaj, & Vock, 2019), p.3) Longer duration of program has also been linked to increased learning, reflection, and practice which often translate into increased classroom gains (Landesman Ramey et al. 2011).

Given this multifaceted and complex framework, finding a single template for successful teacher professional development seems unlikely. While key components of successful provision can be established, the situational nature of learning, specifically the cultural and contextual influences, make a "one size fits all" approach imprudent (Timperley et al., 2007). The distinctive make-up is intensified further when considering the complication of delivering professional development using mobile learning. In these cases, it is important not only to take into account the factors that are likely to lead to successful learning, but also the influence that teacher confidence using mobile learning might have. The following section reviews prior research regarding the delivery of professional development using information and communication technologies.

Professional development supported by technology

As might be expected a review of the literature regarding the delivery of professional development using technology closely mirrors that of professional development more broadly. These observable links between the principles of effective teacher development and the potential application of technology validate that professional development, facilitated by technology, can engage teachers and promote learning (McAleavy, Hall-Chen, Horrocks, & Riggall, 2018). Furthermore, the use of technology addresses the often-cited weakness that in-person coaching models, while effective, can be expensive and therefore technology offers a cost-effective delivery option (McAleavy et al., 2018).

Table 15: Guidelines for effective professional development

Elements	Effective professional development must:
Context (relevant and immediate)	be meaningful be relevant (authentic, local and real) be practical meet immediate needs (direct impact) meet ongoing needs (sustained impact)
Time (sustained and timely)	be timely (just-in-time) be sustained (over time) provide adequate time for participation, reflection and implementation
Community	encourage sharing with others, hear other stories from the field provide ongoing support and heightened collaboration expand professional and personal networks
Personal Growth	add to personal knowledge increase personal skills enhance status (within learning community) take account of teachers' prior knowledge, levels and learning styles enable reflection allow personal selection allow teachers to take responsibility for their own learning

Note. Reprinted from Dynamic Not Static: *Characteristics of Effective Teacher Professional Development in ICT* by M. Lloyd, J. Cochrane & S. Beames. 2005 Paper presented at AARE 2005, Education Research Creative Dissent: Constructive Solutions.

Lloyd, Cochrane, and Beames outline four key categories of guidelines for the development of successful teacher development for technology use in the learning process (Lloyd, Cochrane, & Beames, 2006). These categories suggest that context, time, community, and personal growth (Table

15) all contribute to the impact of teacher professional development, and can be considered a "generalizable finding" from the extant literature (Lloyd et al., 2006).

      With this foundation in mind, many of the key elements that influence the delivery of meaningful professional development do not appear to be significantly altered by the additional component of the use of instructional technology – whose presence does not feature in the list. That being said, the influence of each identified category of effective professional development can vary substantially, and the impact of teacher efficacy with the use of technology has the capability of influencing the impact of each considerably. This is profoundly evident when considering the concept of time and training. As might be anticipated research shows that both the amount of time and the duration of the training have an impact on its success. Giving professionals the time to work with and try out mobile technologies is important, and this informal practice should take place before, during, and after any transfer into the classroom (Bai, 2019). The need for teachers to be comfortable with a technology-infused pedagogy is vital to a successful implementation of improved teaching methods as engagement increases the most when teachers effectively integrate authentic interventions into learning (Kucirkova, Messer, Sheehy, & Fernandez Panadero, 2014). As a consequence, if teacher professional development is to be maximized it should be delivered in a timely and sustained way (Figure 15) – in other words it must be presented at the right time as well as over a period of time (Lloyd et al., 2006).
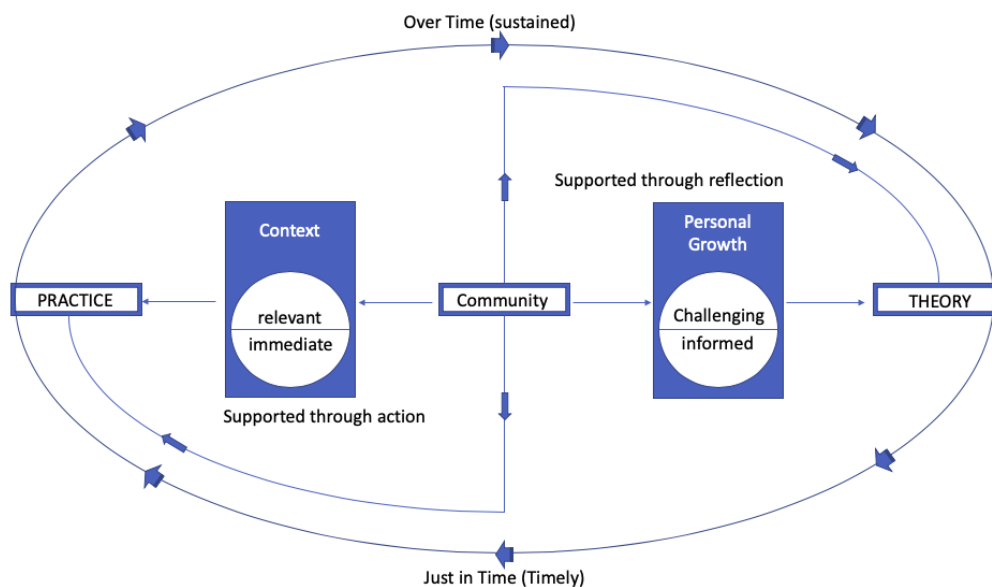
Figure 15: Dynamic model of professional development showing the interaction of its Four elements. From Dynamic Not Static: Characteristics of Effective Teacher Professional Development in ICT by M. Lloyd, J. Cochrane & S. Beames. 2005 Paper presented at AARE 2005, Education Research Creative Dissent: Constructive Solutions.

In addition to the increased importance of the concept of time, research also highlights the need for increased collaboration if teacher training is to successfully integrate the use of technology. When training or attempting to utilize new technologies, teachers report being more comfortable when they do not work alone but interact with peers (Zonoubi, Eslami Rasekh, & Tavakoli, 2017). Such research is hardly surprising as educational theorists have suggested that learning is a participatory event (Dewey, 1916; Vygotsky, 1978) and learning is often assumed to be social and occurring in informal contexts with interaction in communities (Maivorsdotter & Quennerstedt, 2019). Indeed, developing communities of practice for teachers has considerable promise regardless of whether these are local or global, face-to-face or online (Wenger-Traynor & Wenger-Trayner, 2015). Interestingly, peer collaborators do not need any expertise in the new pedagogies being implemented as there are mutual benefits in the mentoring process generally (Holland, 2018) if other proficient colleagues are available to work with when specific assistance is needed (Barton & Haydn, 2006). When this collaborative learning is combined with the potential of access to technology and the power of the internet there is an opportunity to implement highly effective teacher professional development (McAleavy et al., 2018).

Similar to the development of effective teacher training more generally however, professional development using technology yields inconsistent results when pedagogical changes are forced or where there is a lack of detailed knowledge regarding how best to utilize the technologies in an authentic and useful way (McDaniel & Kenny, 2013). Indeed, there is evidence to suggest that a lack of well-developed and consistent professional development has the potential to be detrimental to teacher effectiveness (Tomlinson, 2014). It is important therefore, for technology-based training to be developed with a situationally specific focus where topics are consistently delivered with an authentic and integrated approach (Smith, Grant, Conway, & Narayan, 2016). Naturally this requires particular attention to culturally indemnifiable distinctions regarding the best use of technologies in learning. The type and purpose of the training environment as well as the cultural factors that influence the optimal approach must be reflected upon in some detail before valuable learning can take place (Gerick & Eickelmann, 2014). In informal learning circumstances, mobile devices have been shown to offer a natural improvement in the way that teachers learn given that these devices serve the specific objectives of the training (Gunter & Reeves, 2017). In more formal educational settings these advantages are less evident unless the purpose of the training is enhanced by the benefits of the mobile

nature of the learning (Gunter & Gunter, 2015). As a result, flexibility and adaptability of approach is a key aspect in the design of effective ICT professional development (Wynants & Dennis, 2018). To achieve such a pliable approach many institutions have turned to the use of video technology to deliver adaptive and convenient professional development for their staff. Indeed, the past 20 years has witnessed successful professional development programs introducing video technology to effectively support teacher learning (Marsh & Mitchell, 2014).

The use of video to support professional development

The use of video in the learning process has been directly associated with a parallel increase in the pervasiveness of video-equipped mobile devices (Major, Haßler, & Hennessy, 2016. A range of mobile devices has been used educationally, including a variety of handheld devices including, phones, smartphones and tablets (Kearney et al., 2012). This natural progression is also directly linked to improved accessibility and affordability of mobile technologies (Martin & Ertzberger, 2013), and corresponds to an expansion of wireless internet access in many parts of the world (Hwang & Tsai, 2011). In short, the last decade has witnessed an exponential growth in the access and affordability of mobile devices that are specifically designed to support video technology.

Mirroring this phenomenon, as technology use in education has magnified so too has the variety of subjects, disciplines, and learning environments using video in the learning process, which now covers the full spectrum of the educational curriculum (Nikopoulou-Smyrni & Nikopoulos, 2010). While initial use of video-based learning was predominantly found in language domains, the practice rapidly expanded to include information and communication technology (ICT), economics, sciences and mathematics (Giannakos, 2013). In tandem with this broadening from the social sciences to the more applied and technological domains, there has been an emergence of a more digitally adept workforce willing and capable of increased integration of technology into the learning environment (Simon & Nemeth, 2012). The influx of more technology proficient teachers has prompted a paradigm shift within the profession which suggests that the use of video is likely to continue to increase and develop further as technological advances add new and beneficial dimensions to teacher professional learning (Baran, 2014).
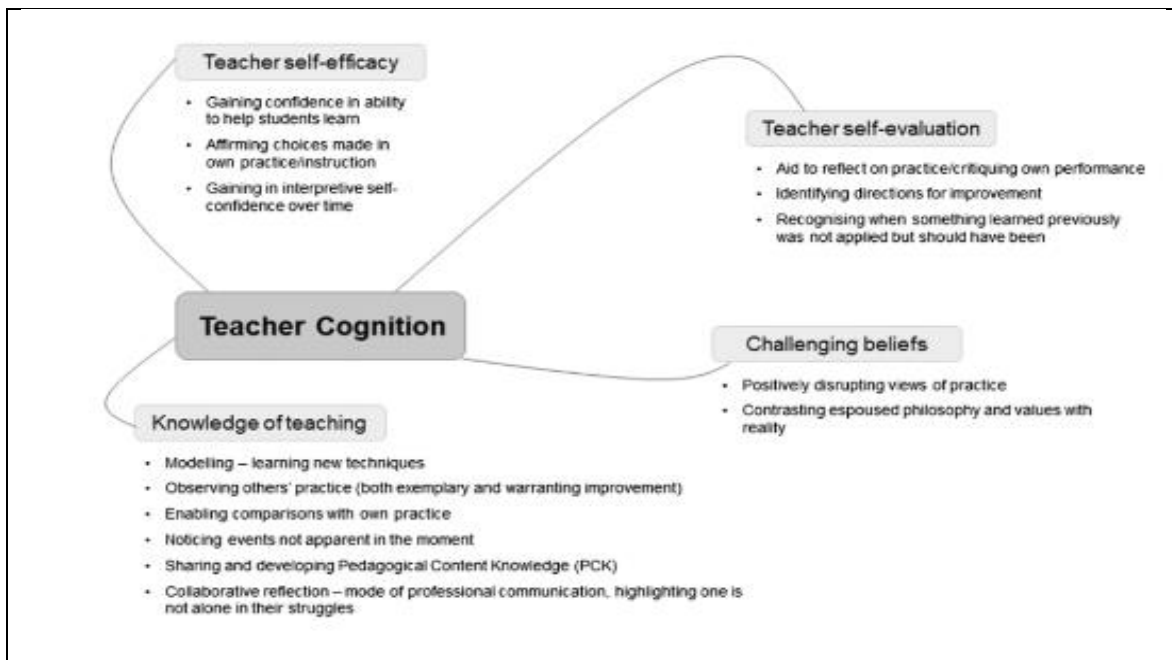
Figure 16: How video is reported to be effective for supporting the development of teacher cognition – thematic synthesis overview. From: Major, L., & Watson, S. (2018). Using video to support in-service teacher professional development: The state of the field, limitations and possibilities. Technology, Pedagogy and Education, 27(1), 49–68.

In their comprehensive scoping review of the literature on the use of technology to support in-service teacher professional development, Major & Watson (2018) outline in considerable detail how the characteristics of the existing research are focused around a central theme of teacher cognition, and can be categorized into four key dimensions (Figure 16); teacher self-efficacy, teacher self-evaluation, knowledge of teaching, and challenging beliefs (Major & Watson, 2018). Within these dimensions, the use of video technology varies significantly, both from a perspective of its purpose or objective and from the manner in which teachers interact with the video. While in some studies teachers used videos of their own teaching to reflect on their own practice, both individually and collaboratively, other research utilised a variety of more structured reflective exercises, to increase knowledge, and to observe modelling of good practices (Tripp & Rich, 2011). The OER4Schools programme employs lesson video clips of interactive practice to stimulate discussion and trialling of new approaches, rather than as models to copy (Hennessy, Haßler, & Hofmann, 2016). Regardless of approach, and especially when used asynchronously, video technology has been shown to support analysis and reflection within teachers and to extend the learning experience beyond the classroom (Marsh & Mitchell, 2014). Nevertheless, those who are interested in using video technology in future research would benefit from

understanding the varying dimensions of past studies and the key indicators for successful implementation (Tripp & Rich, 2011).

In general, research has established that using video technology positively impacts teacher motivation and understanding (Borg, 2003), and also has the ability to positively shape classroom practice (Gaudin & Chaliès, 2015). More specifically, contemplating video use for professional development, studies have shown that video can be more effective than text alone in motivating professionals (Choi & Johnson, 2005). Teachers have reported that the use of video allows for a level of analysis that live professional development sessions without video do not - principally that video can be viewed multiple times and from different perspectives (Santagata & Guarino, 2011). There are relatively few studies, however, that quantify the usefulness of video to present digital lectures, and in those that do the results remain mixed (Davies, Ramsay, Lindfield, & Couperthwaite, 2005). It is important therefore, to consider both the content and purpose behind the use of professional development videos before determining the effectiveness of the media as an instructional tool. Nevertheless, well-designed professional development using video technology has the potential to engage and focus teacher reflection and to generate productive discussions surrounding critical issues in teaching and learning (Borko et al., 2008).

Research indicates that the use of video to create impactful professional development lies in its use as one of a set of powerful tools used in combination, to prompt reflection on existing and aspirational practice and in deepening understanding of pedagogy and classroom techniques (Major & Watson, 2018). Viewing video in a vacuum, without context, discussion, and thought does not result in successful teacher learning (Gaudin & Chaliès, 2015). "Indeed, accompanying high-quality support is a prerequisite if video is to realise its transformative potential in supporting in-service teachers and in improving classroom practice" (Gaudin & Chaliès, 2015, p.65). Video technology allows for the illustration of highly complex concepts to be presented in a multi-modal format, concepts for which a simple verbal explanation would be incomplete (Marsh & Mitchell, 2014). As might be expected, however, without the intellectual and practical interaction of such content the impact of the learning process can be significantly diminished. It is important, therefore, that those intent on using video to support teacher development take the time to consider how and why such media might be successfully implemented within their specific cultural context. Given the importance of cultural influence on learning, this necessity has a substantial value.

What is apparent, however, is the fact that several authors have highlighted the potential of video to assist teachers in reflecting on their own teaching as well as the practice of others. Roth (2014) suggests that the benefit of using video to reflect on teaching allows for teachers to be able to think while in a "cold" state and therefore not caught up in the emotion of being observed in the teaching moment. It also allows teachers to view their own teaching from an independent and objective lens with the camera likely to provide a new and additional observation of what took place in the lesson (Marsh & Mitchell, 2015). This impartial and non-human "third-party" capturing of events allows teachers to re-examine their own experiences objectively and without the need to be emotionally defensive in any way, encouraging a more in-depth and analytical discussion of the class than might be experienced if colleagues were the provider of the observations (Borko et al. 2016).

Interestingly, there is a dearth of research surrounding the use of video with teachers in an international context (Major & Watson, 2018). This, despite the fact that video media is well suited to use on mobile technologies in developing countries, where penetration rates far surpass access to broadband internet connection (UNESCO, 2012). This is unexpected considering the potential impact for professional development in low-resource and marginalized school settings (Hennessy, Haßler, & Hofmann, 2016), and is clearly an area of research that has the potential to yield useful data.

Any serious research into the use of technology to deliver effective teacher training, therefore, is best developed with a clear grasp of the fundamental aspects of the type of technology to be utilized, the cultural nuances likely to influence the use of these technologies, the specific characteristics of the intended audience, and the way in which this training might impact the participants. Thus, any research study with the intent of examining how mobile learning might be used to impact self-efficacy, should first spend time understanding the characteristics of useful applications, especially those designed to have an educational purpose.

Part 3: Characteristics of effective learning applications

There are several models of factors associated with the successful development of teaching and learning mobile applications (Alwi et al., 2019). Given that the rapid emergence of mobile applications has primarily manifested globally in recent years, research into well-developed, culturally relevant models remains relatively limited. Indeed, several exploratory options have emerged over the past decade, which serve as similar yet discreet archetypes. When combined, each of these frameworks

provides an important element of a more comprehensive understanding of the critical factors leading to the motivation of those benefiting from mobile applications (Alwi et al., 2019).

Stages of mobile application

Prior to any significant identification of overarching characteristics of impactful mobile learning applications, it should be noted that not all applications are developed in the same way, or for the same purposes (Hamidi & Jahanshaheefard, 2019). It follows, therefore, that it would be unwise to assume that one set of factors are likely to universally impact all types of application. Indeed, Almaiah et al., (2020) identified three specific stages when considering the classification of mobile learning application services: the static, interaction and transaction stages (Almaiah et al., 2020). Each identified stage carries with it a discrete description and associated by distinct purposes in proposed objective (Table 16). According to this model, the technical requirements and functional characteristics, specifically in the transactional stage of the paradigm, are quite different than in the static or interactive stages (Almaiah et al., 2020). Consequently, prior to the beginning of any design process of new mobile learning applications, consideration of the specific purpose associated with the application is likely to be a good idea. Coupled with this understanding is the fact that Human computer interaction (HCI) is a wide-ranging field, and one that is often found at the intersection of computer science and behavioural science (Carroll, 1997) and so, attempting to classify mobile learning application must begin with a behavioural understanding of the intent behind it (Kumar & Mohite, 2018).

Table 16: Description of mobile learning services at the three main stages.

Stages	Description
Static stage	At the static stage level of mobile learning services, students and instructors can use mobile learning application for accessing and checking their important information. For students, the application enables them to access and check their registration courses, date and time of courses, course grades, fees, university announcements, exam dates, assignments, and financial status. The mobile learning application enables faculty members to access course schedules, number of students in each course, financial and payroll information.
Interactive stage	At the interaction stage level of mobile learning services, students and instructors can download, fill and upload the required forms, update their information, download learning courses and upload assignments. Also, students can communicate easily with instructors from anywhere using two-way communications such as email and chat systems. Instructors can then respond to the queries in a timely response with up-to-date and authentic information.

| Transaction stage | At the transaction stage level of mobile learning services, through mobile learning application, instructors are able to open virtual classes, download the course materials, evaluate the homework and get the students profiles from the system. The application also allows faculty members to upload documents, homework and notes during the class. Students are able to register in the virtual classes, add and delete new courses, answer the quizzes and pay registration fees by connecting with their bank accounts through cell service technology, virtual interactions, security levels and tasks confirmation. |

Note: From Almaiah, M. A., Alamri, M. M., & Al-Rahmi, W. M. (2020). Analysis the Effect of Different Factors on the Development of Mobile Learning Applications at Different Stages of Usage. *IEEE Access*, *8*, 16139–16154.

There are obvious operational characteristics that are universal in that they address whether or not the application performs in the expected way and whether or not it can be accessed and used easily (Sarrab et al., 2015). Given that these concentrate on the technical operation of the mobile application rather than being related to content or perceived usefulness, they are likely to be impactful regardless of the stage or precise purpose of the application. These quality characteristics are associated with successful mobile applications of any type and attend to the key practicality of mobile application use more broadly.

The quality characteristics of mobile learning applications

As might be expected, similar to the research surrounding the optimal dispositions of teachers for effective professional development, there are equally important quality characteristics for mobile learning applications (Carroll, 1997). These characteristics speak to the way the application works and the usefulness of it in realizing its intended purpose. Clearly with a rapidly increasing availability of mobile learning applications as options have increased for users, so too has user's ability to be more discerning in their choice. As a result of this advancement mobile applications began to face increased scrutiny regarding the feasibility and functionality of design (Zeng & Luyegu, 2011). In 2015, Sarrab et al., asserted that there were five relevant system quality characteristics or desirable features of mobile learning applications. The study contended that in terms of systemic quality the categories of usability, performance, functionality, availability and dependability were critical to a successful application (Sarrab et al., 2015). While there remains missing detail as to the precise definition of these terms, they are useful in that they establish the primary tenets of the technical aspects of a successful learning application:

- that application should be operational at all times and that it should operate effectively and efficiently,

- it should be easily understood and utilized by a wide variety of users,
- it should be easy to install, setup and update,
- it should meet the objectives of the determined user (and teacher) needs
- it should be able to perform consistently and proficiently (Sarrab et al., 2015).

More recently, Dinu Mihail-Vaduva maintained that the quality characteristics of mobile learning applications should include functional correctness, performance efficiency, compatibility, usability, reliability, security, and maintainability (Mihail-Vaduva, 2019). Once again, without the benefit of a robust discussion surrounding the precise definition of terms, there appears to be considerable overlap of practical concepts and at the very least several areas of commonality.

Critical factors in successful mobile learning applications

Thomas Cochrane (2010) identified five Critical Successful (CS) factors attributed to the development of effective mobile applications. These factors included the presence of regular formative feedback, the integration of pedagogy into the technology used within the course, consistent modelling of the pedagogical use of the technological tools, the appropriate use of mobile devices and an appropriate level of support for users (Cochrane, 2010). In identifying these characteristics, Cochrane clearly recognised the importance of considering three fundamental components of mobile applications, namely the way in which the application is used, the importance of the pedagogical design, and the support given to the user both in the choice of type of technology used and that way in which is used (Cochrane, 2010). In this construction, Cochrane's work integrates well with Singh's (2014) understanding of the competencies required of teachers successfully adopting mobile technology into their professional practice discussed earlier.

Aligned with this model, Bidin & Ziden (2013) also posited the importance of the pedagogical advantage of using mobile applications as one of their three main factors influencing the use of mobile applications. This framework, however, also focused considerably on the user experience in using the tool, specifically noting the importance of the features of the device as well as the user's expectation when in use (Bidin & Ziden, 2013). Within this paradigm the practical realities of usability are highlighted, a framework that aligns closely with the theoretical underpinning of this study. Additionally, the model speaks to the importance of the application actually delivering on the terms of the use with concepts such as flexibility, privacy, convenience and self-regulation becoming central

factors in the successful adoption of mobile applications (Bidin & Ziden, 2013). This approach, once again, is closely associated with several of the considerations discussed earlier surrounding the reticence of some teachers to fully embrace the full potential of mobile applications as effective tools for teaching and learning.

Building on this platform of understanding, Hamidi & Chavoshi (2018) identified seven factors deemed to be influential, with a strong concentration on practical application. This model highlighted many of the same factors including ease of use, perceived usefulness and behavioural intention (H Hamidi & Chavoshi, 2018). It is not specifically these characteristics, however, that distinguish the model from others, but in the manner in which it integrates the prevailing culture, context, and behavioural intent of the user. Hamidi and Chavoshi hypothesize that the successful integration of mobile applications cannot be separated from the individual context and culture of the user over and above the specific functions of the application itself (H Hamidi & Chavoshi, 2018). Consequently, this theoretical framework serves as an important benchmark for use in research conducted where cultural norms are likely to play a central role. Indeed, the notion that individual behavioural intention lies at the heart of personal decisions when it comes to the use of mobile applications provides essential insight for those designing them. This comprehension is magnified further given the importance of the cultural context of this study where teachers might be less likely to embrace innovation and change than in a more westernised social context.

Lastly, perhaps the most detailed approach taken to identify success factors in the use of mobile applications, was developed by Alrasheedi & Capretz in 2018. Using the work of Teoh (2011), this paradigm clustered a vast array of variables into four easily defined categories of technologies, management, teaching pedagogy, and learning approach (Alrasheedi & Capretz, 2018). This meta-analysis analysed the findings of 19 studies, resulting in consideration of more than 21 factors and represents one of the most complete evaluative studies of its type (Table 17).

While this paradigm does not have the same level of attention to cultural legacy, it does reflect a strong connection to user feedback and positionality. In this capacity, the model places the perceptions of participants as a fundamental tenet of the design.

Table 17: Classification of Critical Success Factors affecting mobile learning.

Variables	CSF Categories
Availability	Technology
Accessibility	
Affordability	
Internet Access	
Connectivity	
Choice of Mobile Devices	
Web 2.0 software	
Cross-platform capability	
Institutional Support	Management Support
Administrative Support	
Assimilation with Curriculum	
User Feedback	
Educator perceptions	Teaching Pedagogy
Technical competence of instructors	
Develop assessment techniques	
Faculty commitment	
User feedback	
Assimilation with curriculum	
Learning community development	Learning Approach
User feedback	
Learner perceptions	
Technical competence of students	
User friendly design of content	
Assimilation with curriculum	

Note: From Alrasheedi, M., & Capretz, L. F. (2018). Determination of critical success factors affecting mobile learning: A meta-analysis approach. Turkish Online Journal of Educational Technology, 14(2), 13.

Indeed, when tabulating the collected data for frequency of citation, the study found that learner's perceptions, ownership and user friendliness were most frequently cited, often twice that of more technical elements such as choice of device or quality of content (Alrasheedi & Capretz, 2018). Such findings appear to confirm the findings of Hamidi & Chavoshi (2018) that the success of mobile learning applications is to a significant extent predicated on the perceived benefits from the user's perspective. Given that individual context has the potential to be an ever-changing variable, those who seek to design successful mobile applications would be well served to consider the cultural context of the environment in which it is to operate.

In light of this evolution of theoretical frameworks, Alwi et al. (2019) conclude that there are five distinct factors for the successful development of teaching and learning mobile applications.

These include user perception, technological aspects, content, pedagogical advantages, and application management. Additionally, though not defined as a discrete category, this research affirms the importance of user attitude, engagement and learning in the process (Heflin et al., 2017).

*****

The preceding discussion served as the theoretical foundation on which the following methodology section was constructed. Understanding the chronological development of how mobile learning has been successfully utilised and specifically how this can be integrated into effective professional development, provided guidance for the design of the learning process and application use in the study. At the same time, consideration of the specific chararcteristics of worthwhile mobile learning applications aided the creation of each element of the application as well as the emanner in which participants were invited to interact with the application. The following section outlines the theoretical framework developed and lessons learned from a comprehensive pilot program, before detailing a qualitative study designed to determine the interaction, usefulness and impact of the "An Apple a Day" application.

Paper 3: Phase Two: Design

Purpose

Building on the findings of the initial phase of the study, this phase was designed to determine whether specific support and guidance delivered by mobile technology could have a positive impact upon the self-efficacy of teachers in Panama. More precisely, it was sought to build and deliver a mobile application to teachers that would share a series of evidence-based practice videos (Daily Thoughts) alongside more detailed supporting documentation, designed to give helpful and practical tips for professional practice. The idea was that if such resources were deemed to be useful, teachers would interact with the mobile application on a regular basis and potentially begin to modify practice because of the insights gained. Ultimately, it was hoped that this process would have a positive impact upon teacher self-efficacy. As a result, the following research questions were formed.

Research Questions

The following research questions and sub-questions were developed to guide Phase Two of the study:

1) Can professional development, delivered to teachers using mobile learning, improve the self-efficacy of teachers in Panama?
    i) How do teachers interact with professional development delivered through a mobile learning application?
    ii) How useful is professional development delivered through a mobile learning application?
    iii) What is the impact, if any, of professional development delivered through a mobile learning application?

Theoretical Framework

The second phase of the research design was founded upon Marguerite Koole's Framework for the Rational Analysis of Mobile Education (FRAME). The FRAME model describes mobile learning as a "process resulting from the convergence of mobile technologies, human learning capacity" (Koole, 2009 P.24). Based upon the constructionist theories of Vygotsky and Piaget the model is centred around the transfer of information through new and innovative technology.

Koole's framework was particularly apt for a study of this nature as it allowed for the seamless integration of all three influential elements of the mobile learning process (Figure 17). The model

consists of three overlapping components or aspects: the device aspect, which referred to the physical characteristics of the technology being used; the learning aspect, which referred to the cognitive ability, knowledge, and motivation of the learner; and the social aspect, which referred to the social and cultural influences on the process of learning. Each of these components had a critical role in the research design and specifically addressed many of the culturally unique elements of a Latin American sample.
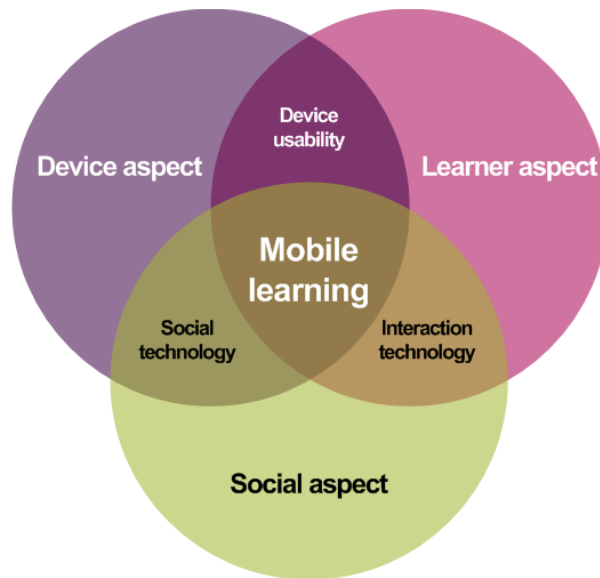
Figure 17: Koole's Framework for the Rational Analysis of Mobile Education. Retrieved from Mobile Learning info kit / Frameworks for mobile learning. (2018).

The most useful aspect of Koole's FRAME model regarding this study did not necessarily lie in the three distinct aspects, but in the way that these intersect. It is in these intersections that the application of the model could be maximized. The device usability, social technology, and interactional technology sections of the model genuinely endorse a research design that considers not just the portability or convenience of access to information, but also the cultural differences in how the process of learning is social and collaborative. It is in the integration of 'the how' and 'the why' of mobile learning that the flexibility for cultural differences exists.

The FRAME model, though presented in a simple visual format, allowed for the comprehension of the complex nature of mobile learning when coupled with the detailed tables provided by Koole to illustrate the depth of the concepts represented in the diagram. Each table

provided contextual depth to the framework, allowing for the model to maintain a high level of situational flexibility. In simple terms, while the diagrammatic representation represented a structure that was relevant and easily understood, the complexity of the concepts involved also permitted the subtlest of social and cultural distinction.

Koole's Checklist for Planning and Analysis of Mobile Learning Environments (Koole, 2009) was used as a framing document for the design of the second phase of the study to ensure that the device, learner, and social aspects of the design were equally attended to. In this sense, perhaps the best definition of mobile learning was found in Patokorpi et al.'s (2007) writing where it is suggested that mobile learning is "situated, collaborative and guided teaching, studying and learning, supported by mobile devices that utilize symmetric mobile communications channels by which the learners and the facilitator may use and mound specially designed learning objects for work, hobby or citizenship." (p.191). This definition recognizes the complexity of considering the role of the technology, user, and cultural influence when examining the effectiveness of the learning process.

In addition to Koole's model, the constructs and conceptual definitions outlined in Almaiah et al.'s (2020) Mobile Learning Application Model (MLAM), were used as guiding tenets for the development of our own mobile application. Based upon a detailed review of existing models, the MLAM was determined to be the most complete and culturally appropriate model to serve as a theoretical foundation for the creation of a mobile application. The model covers mobile learning adoption factors from several aspects including technology, systems functions, security, and specific behavioural factors (Almaiah et al., 2020). More importantly, the model specifically includes constructs that address a multilingual option, self-efficacy, perceived trust and perceived image, all significant considerations within our own study given the previously discussed findings in Phase One (Table 18).

The additional benefit in adopting such a theoretical model was in the flexibility that it afforded (i.e., it was applicable to all three stages of mobile learning services); thus, it allowed for adaptations to be made to the original application design, following the intended pilot study, should they be required. Moreover, it was in good alignment with the overarching research paradigm outlined in the introduction of this study, which drew from the concepts of realism and pragmatism, and understood learning to be delivered through dynamic experience and practical application.

Table 18: Conceptual definitions of all constructs and hypotheses

Constructs	Conceptual definitions	Hypotheses
Perceived Compatibility (PCM)	The degree to which a mobile learning application is perceived as consistent with the needs and perceptions of potential users	Perceived Compatibility (PCM) has a significant relation with adoption of mobile learning
Perceived Awareness (PA)	The degree of users' consciousness through acquiring knowledge to be sufficient to learn the characteristics of mobile learning applications, use it with skill, and realize its functions, advantages, and disadvantages	Perceived Awareness (PA) has a significant relation with adoption of mobile learning
Availability of Resources (AVR)	Availability and freedom of using mobile devices, mobile applications, and Internet with competitive features such as speed, access, and cost	Availability of Resources (AOR) has a significant relation with adoption of mobile learning
Self-Efficacy (SE)	The degree of user's technological capability to use, interact, and transact with mobile learning applications based on prior knowledge, experience, and skill as they perceive it is required to do so	Self-Efficacy (SE) has a significant relation with adoption of mobile learning
Perceived Ability to Use (PATU)	The degree to which user perceives his/her competence in and comfortable ability for using mobile learning applications technologically, organizationally, and psychologically that match with individual's values, social needs, and overall attitudes	Perceived Ability to Use (PATU) has a significant relation with adoption of mobile learning
Multilingual Option (MLO)	Mobile learning application supports different prime languages to facilitate users in viewing, searching, selecting, downloading, interacting, and transacting with their convenient language in the absence of human interaction	Multilingual Option (MO) has a significant relation with adoption of mobile learning
Perceived Information Quality (PIQ)	Information quality covers the extent to which complete, accurate, organized, understandable, up-to-date, and timely information is provided in mobile learning applications for users to obtain information about any of their intended services	Perceived Information Quality (PIQ) has a significant relation with adoption of mobile learning
Perceived Trust (PT)	A user's confidence in the mobile learning applications ability to provide a reliable and efficient service	Perceived Trust (PT) has a significant relation with adoption of mobile learning
Perceived Uncertainty (PU)	The degree to which users perceive risk in transactions due to uncontrollable and unknown situations in the virtual environment associated with mobile learning applications	Perceived Uncertainty (PU) has a significant relation with perceived trust of mobile learning
Perceived Security (PS)	The degree to which users perceive that the level of data privacy and data integrity is efficient and ensure security for all electronic transactions and online identity authentication via mobile learning applications	Perceived Security (PS) has a significant relation with perceived trust
Perceived Functional Benefit (PFB)	The degree to which users perceive the overall functional benefits, including cost, time, efficiency, and effectiveness of using mobile learning applications, instead of using traditional physical office functions	Perceived Functional Benefit (PFB) has a significant relation with adoption of mobile learning

| Perceived Image (PI) | The degree to which users behaviourally and culturally perceive that adoption of mobile learning applications enhance and improve social status and prestige | Perceived Image (PI) has a significant relation with adoption of mobile learning |

Note: From Almaiah, M. A., Alamri, M. M., & Al-Rahmi, W. M. (2020). Analysis the Effect of Different Factors on the Development of Mobile Learning Applications at Different Stages of Usage. *IEEE Access*, *8*, 16139–16154.

Perhaps the most appealing element of the MLAM was that the conceptual definitions were crafted from the perspective of the user. Given the cultural context of this study, such an element was a critical factor that allowed for a design to be centred in the social and cultural perspective of the participants rather than that of the researcher. Initial considerations were made to adapt the model removing the included hypotheses, given that they were determined primarily for an already completed research study, but ultimately it was decided to leave them intact as they would serve as a specific reminder of the relationship between perceived trust, security, and uncertainty. As such, it was intended for them to serve as cultural prompt throughout the design phase.

Design

This phase of the study followed a case study design as defined by Malcolm Tight (2009) in that it was a small-sample, in-depth study. This was a relevant design given the extensive nature of the description and the complexity of the individual circumstance of the Panamanian setting (Yin, 2017). The case study approach involved a 'group' of eight participants selected from the original IAE sample within Phase One. Data collection was multi-dimensional and based on Yin's six sources of evidence (Yin, 2009). Although the findings were intended to be predominantly descriptive, a high level of qualitative content analysis was conducted with a systematic evaluation of each source allowing for valid inference to be made.

The need to develop a high level of cultural sensitivity in Phase Two lent itself to the use of Charmaz's Constructivist Grounded Theory as a general platform, where the voice of the research participant should be a significant partner in the development of data collection and the various stages of analysis (Charmaz, 2006). Indeed, several of the methodological structures can be found at the overlap of case study and grounded theory approach. While some classic, grounded theories warn of the need for the researcher to maintain a distance to reduce injecting potential bias (Glaser, 2001), the rationale for using such an approach in this study was found in the benefits in developing a trusting relationship with participants (i.e., where the researcher and participant co-construct data in a non-hierarchical manner with an open exchange of viewpoints) (Mills, Bonner & Francis, 2006). With the

most significant challenge to the validity of the study design being the cultural acceptance of candid and reflective teacher feedback, the need to create an open-ended conversational style to data collection was critical if participants were to feel at ease with the process. It was this premise that was the principal factor in the final selection of a case study as the preferred approach.

This phase involved the creation of mobile learning modules for three of the four pre-determined categories of self-efficacy categories applied in Phase One (planning and assessment, instruction, discipline/classroom management). Each learning module consisted of four weeks of multimedia resources designed to inform, support, and guide teachers in the fundamental proficiencies required for successful teaching. These resources included a comprehensive schedule for the 4-week module, short informational and mentoring videos, additional resources and guidance covering the module topic, and digital reflection components for each teacher if desired.

Multiple factors were deliberated in discussions surrounding the choice of name and accompanying logo for the application. The intent was to create an identity that would give the mobile application a level of credibility through a brand association. This was deemed to be of particular importance given that the mobile application would be new to all participants and so would not have an already established standing. In these cases, studies have consistently shown that association with a brand that elicits the perception of positive characteristics has the capacity to bring added value in the eyes of consumers as well as implying that the product is free of deficiencies and will meet participant needs (Chinomona & Mazirini, 2017). It was hoped that both the name and the accompanying logo would benefit from previously established research indicating that positive brand association increases trust, commitment, and satisfaction (Yu-Chuan, 2017).

Several underlying aspects were considered with particular attention being paid to the cultural preferences of the region. Clearly the application was most closely connected with the concepts of learning, mobile technology, and professional development, but the nature and dynamics of the application and the way in which it was to be used was of equal importance. The fact that the application provided high quality, research-based, information to participants, and that it was designed to be used consistently in small convenient segments was of equal importance. While it was known that each participant would be fully cognizant of the content and benefits of the mobile application, if the brand association could also reinforce these elements, it would be more complete.

In naming the application "An Apple a Day" several of these associations were accomplished. First and foremost, an association with the technology company Apple was of significant value,

especially in a Panamanian context. For the past decade, Apple have been intentionally increasing their brand presence in the region, a strategy that has seen an extensive marketing campaign resulting in a significant rise in brand awareness and the linked benefits. Apple have become the third seller of mobile devices in the region more than doubling their market share, and the IOS operating system is also the third most popular system (StatCounter, 2021). This growth has been mirrored by an increased awareness of the Apple brand and the accompanying connotations, namely a product that is directly perceived as having innovation, imagination. style, and quality (Nast, 2021). Equally important "the company has established a "heartfelt connection" with its customers. This can take several forms, from building trust to establishing a community around a product." (Nast, 2021, p.19). These inferences were precisely the terms that the mobile application would benefit from and so the fit was deemed to be strong.

In addition to the importance of the term "Apple" the "a Day" element within the name was also determined to be central to the message. The notion that the title might serve as a subtle but consistent reminder that the mobile application should be visited daily was equally important to shape application use. One of the most critical practices for the mobile application to be successful was that participants interacted with the content as frequently as possible and so the suggestion that the benefit would be daily was valuable.

Lastly, the similarity to the phrases "an apple a day keeps the doctor away" and "an apple for the teacher" was also viewed to hold the possibility of positive association. While it was obvious that this would not be the case for Panamanian participants, who would be unlikely to identify with either phrase given their western origin and heritage, the fact that some participants may identify as international teachers suggested that there may be some small benefit. In each case the positive association with wellbeing and a healthy gift as well as the idea that there should be a regularity to the practice further added to the perceived fit of the name "An Apple a Day".

In retrospect, while the choice of "An Apple a Day" made logical sense, and when coupled with the designed logo did appear to serve it's intended purpose, the argument can be made that it was not culturally sensitive. The reality is that despite the objective intent of the choice, more reflection on the cultural nuance of the name may have been beneficial. The fact that the apple is not indigenous to Panama was not something that was overlooked, and the choice of a mobile phone company that was already fully established in the region (Samsung), rather than one that locals might aspire to may have been more appropriate. While it is difficult to know with a certainty what difference, if any, this may

have made to participant association, it may well have been more in keeping with the culturally sensitive steps taken throughout the study. In this sense the choice of "An Apple a Day" serves as a reminder of the fact that more work needs to be done to embed the findings of this study fully culturally.

A multi-dimensional approach was adopted, using several tools for data collection based on a selection of Yin's six suggested sources of evidence (Yin 2009). This included the collection of feedback through teacher surveys, data collected from the analytics of the application, and multiple semi-structured interviews with participants. The most significant and consistent data collection took place through a series of recorded interviews, completed over a period of three months. As the design of the study was founded upon the role of mobile learning, all surveys were completed virtually, and teachers were also given the option of answering the interview questions in written form should they prefer to do so.

Participants

For the case study design to be implemented fully, and given that the data collection design was detailed, varied, and comprehensive in scope, the decision was made to select a non-probability sample for phase two. The selection process, though primarily based on convenience, was also based on voluntary response sampling as participants were only considered if they had already expressed an interest in participating in Phase two.

The ultimate selection of participants was made based on several considerations, though primarily based on their self-expression of interest following the completion of Data collection in Phase One, and the fact that they were members of the IAE community. Participants were considered individually though in some part, for personal characteristics that were representative of a larger sample of participants from the original pool. The result was a sample that was representative of the professional aspects of the broader group from Phase One. The sample was also selected to ensure that participants would need to interact with both the Spanish and English versions of the developed application.

The initial pool of participants comprised 22 educators with professional responsibilities ranging from pre-school to 12th grade (ages x-y). All were members of the initial IAE sample, and each was informally interviewed to discuss suitability for the project, in their native language by a committee of three, independent of the primary investigator. Each panel member was given an outline

of the research questions for Phase Two and the approved selection benchmarks and asked to create a sample that met the overall criteria. Once chosen, the profile of each participant was shared with the primary researcher with specific identities redacted, to ensure that the sample met the established objectives (see Table 19). This process was followed to allow for participants to remain anonymous outside of the selection committee.

Table 19: Participant profile for Phase Two.

Participant Demographics

	Gender	Qualification	Teaching License	Experience	Grade Taught	Technology Use	Language
1	Male	Master's Degree	No	5-10 years	Primary	Moderate	English
2	Female	Bachelor's Degree	Yes	10+ years	Secondary	Moderate	English
3	Male	High School Diploma	No	1-5 years	Primary	Weak	English
4	Female	Bachelor's Degree	No	10+ years	Pre-school	Weak	Spanish
5	Male	Bachelor's Degree	Yes	10+ years	Secondary	Weak	Spanish
6	Male	Bachelor's Degree	No	None	Primary	Strong	Spanish
7	Female	No Formal Diploma	Yes	5-10 years	Primary	Strong	Spanish
8	Female	Master's Degree	No	10+ years	Secondary	Moderate	Spanish

The eight participants selected made up a sample that was equally divided by gender, that taught in classrooms ranging from pre-school to secondary, and who interacted with both the English and Spanish versions of the application. The sample included participants who self-identified as having weak, moderate, and strong levels of comfort using technology, and who used mobile technology that used both IOS and Android operating systems. The sample represented teachers with no formal diploma, high school diplomas, Bachelor's and Masters degrees, as well as teachers who were fully licensed and those who had no formal teaching credential. Lastly, the group included novice teachers, mid-career, and veteran teachers.

At the same time, volunteers who were a part of the initial pool but who were not selected to be a part of the research sample were invited to interact with the educational application on an informal basis, without the requirement of participating in the collection of data.

Cultural and ethical considerations

There were several cultural and ethical challenges that had a significant influence on the methodological design of the data collection throughout the second phase of the study. These

complications transpired because the principal investigator was neither Panamanian nor a native speaker of Spanish. At the same time, the researcher also held a position of authority within the leadership structure of the Albert Einstein Institute (IAE). As a result of these traits, the role of the principal investigator had to be adjusted, specifically as it related to the collection of data from participants.

As previously mentioned, all participants involved in Phase Two were also employees of the same institution as the researcher and so additional safeguards were required to ensure that the privacy and career interests of all participants were protected at all times. Several steps were taken to secure participant anonymity and confidentiality, the most obvious of which required the securing of a proxy who could collect data, thus negating the need for the researcher to interact directly with participants. The use of a proxy in a research study can be a controversial choice for any investigator as a critical role of any good researcher lies in the active collection, filtering, and interpretation of data and a first-hand understanding of the context in which it was collected (Plowman, 2017). Indeed, the idea of delegating the fundamental function of physical presence (being there) in the data collection process may be considered, by some, as a dereliction of the primary duty of the researcher (Plowman, 2017). As a result, the impact of the use of a proxy to collect data had to be balanced with the potential of the data being unreliable if collected by a researcher who potentially had significant influence over the career trajectory of the participants.

That being said, proxies have been successfully employed as interviewers in several studies, and have been found to be particularly useful when they possess a cultural awareness or affiliation with the interviewees that can help develop trusting relationships that might not be possible with the original researcher (Wallman, Dhooge, Goldman, & Kosmin, 1980). This was a substantial factor in the development of this phase of the study given that the framework of the project involved the simultaneous collection of data across two different languages and several diverse cultural foundations. The need to find an individual with the ability to seamlessly and successfully relate to each of the cultural nuances presented.

Cross-cultural research design, however, must consider more than accurate translation of materials. "Research has shown that even after linguistic equivalence has been established, issues pertaining to construct validity and measurement invariance between the original instrument and the translated instrument may still exist" (Tan, Yi, Li, Cheng, & Li, 2020, p.2). This paradigm was especially pertinent for this phase of the study, where the concepts of "usefulness", "impact",

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"interaction" and "self-efficacy" were open to several indistinct or imprecise dimensions. In these cases, without the common understanding of a shared culture, misinterpretation of data can be a frequent challenge. The problem with ensuring that the design for data collection protects construct validity was not overcome solely through culturally sensitive translation, but in understanding and recognizing the differences in the conceptualization and operationalization of the concepts being discussed between the two cultures (Bond, 1986). For this reason, the need for the individual conducting the interviews in this phase of the study to be fully cognizant of the cultural nuances of the participant was deemed critical to the overall success of the data collection process.

At the same time, the bilingual nature of the application also required specific emphasis to be placed on measurement invariance. Research has consistently revealed that significant cultural differences can make achieving measurement invariance difficult to achieve, even if linguistic equivalence has been realized (van Widenfelt, Treffers, de Beurs, Siebelink, & Koudijs, 2005). There was a clear need, therefore, to ensure that specific attention was paid to the process of translation, cultural sensitivity within the data collection process, and consistency of understanding the feedback given, regardless of language. Consequently, it was determined that the use of an appropriate proxy was a reliable way to mitigate the impact of the cultural and ethical shortcomings of using the lead investigator as the primary data collector.

As a result of this conclusion, a detailed profile was developed of a suitable proxy, outlining the optimal characteristics and experience desired to fulfil such a role:

1. Fully bilingual (English/Spanish)
    1.1.1. Fluent in Panamanian Spanish (Local dialect)
    1.1.2. Fluent in American English
    1.1.3. Reading, written, & spoken fluency
2. Native Panamanian
    2.1.1. Educated in Panamanian school system
    2.1.2. Culturally immersed in Panama
3. Experience with academic research
    3.1.1. Comfortable with academic terminology
    3.1.2. Comfortable using technology
4. Experience with school community
    4.1.1. Member of the IAE community
    4.1.2. Non-educational employee
    4.1.3. No supervisory role with participants
5. Professional disposition
    5.1.1. Strong inter-personal connector

5.1.2. Trustworthy and Discreet
5.1.3. Organized and detail-oriented
5.1.4. Willing to take the initiative and solve problems

The profile developed identified a need for the proxy to be comprehensively fluent in reading, speaking, and writing in both English and (Latin-American) Spanish, and also needed to have an in-depth understanding and comfort with the Panamanian culture and the education system in Panama. It was also important that the proxy be a known and trusted member of the IAE community, but not one that served in an education capacity or with any professional supervision over any of the participants. As such, the proxy could connect with participants in an informal and non-threatening way, freely communicating in a Panamanian dialect, while at the same time be able to maintain a more formal and structured tone while conducting the interviews. The proxy was also required to interact with equal ease when interviewing international participants; and so, having experience with an understanding of an international (American) education system was also important. Finally, the proxy needed to have personal and professional dispositions suitable to fully appreciate the research process and, in particular, the steps involved in data collection. More specifically, the individual needed to be willing and capable of following agreed protocols as a focal point, but also be willing to take the initiative to be flexible and adaptive in approach to allow the interviews to be a two-way communication with participants able to guide the process as much as the proxy.

Despite the complexity of the developed profile a suitable proxy was identified within the IAE community who met most of the identified characteristics and who was willing to join the project. The individual was a member of the IAE leadership team, with a background in communication and marketing, and though born and raised in Panama, had several years' experience studying and working in international settings. The proxy was known and well-respected within the institution but was not directly involved in teaching and learning within the school involved. The proxy also led the team charged to work with employees throughout the institution helping them with translation and interpreter services when required, and as such was a natural fit for the collection of data where precisely those services were needed.

Piloting the design of the mobile learning application

An overview of the Pilot study

As with Phase One, a small-scale pilot study was carried out to inform the design of the mobile application in Phase Two. This was of particular importance in this section of the study given the fact that this phase was designed to be qualitative in nature and in view of the cultural differences of the individuals involved. Brock-Utne (1996) emphasizes the importance of validity in qualitative research, especially when conducting studies in low-income countries regardless of the origin of the researcher but especially when they are citizens of more industrialized countries. Bearing this in mind, the pilot was designed to specifically assess the cultural appropriateness and to improve the research protocols and the quality and efficiency of the research project as a whole (Tayeb, 2001).

More specifically, the pilot was created with the intention of a fulfilling model, to evaluate whether the research design was realistic and workable, to develop and test the adequacy of the research instrument (mobile application), to gain general feedback on clarity, appropriateness, and readability of the instrument and methodology, and to identify logistical problems that might occur using the developed instrument, and generate items for further exploration/discussion (Gudmundsdottir & Brock-Utne, 2010). It was also used to ensure the development of appropriate interview questions for specific cultural or social contexts, and to ensure that the open-ended interview questions clarified and rectified potential misunderstandings in the closed surveys (Cohen, Manion, & Morrison, 2007).

The pilot was conducted over a period of eight days and in line with the intended format of data collection for Phase Two and was managed entirely by a selected bilingual proxy. Participants were invited to download the mobile application in either English or Spanish (or both), and all meetings, resources, and materials were presented using a multi-lingual approach. Data were collected regarding the number of downloads in each language, and the number of downloads using IOS and Android platforms.

Each participant was invited to a 30-minute meeting and given directions regarding how to download the application and a general overview of how to use it. They were also given clear direction as to the parameters of the pilot study, and the recommended areas of consideration for feedback. Participants were also informed that their participation and feedback were optional, and that feedback data would be collected anonymously. One week later, participants were again invited to meet in order to give open-ended feedback. Data were collected in a group format using a thematic approach

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covering the previously identified parameters. This meeting was recorded, transcribed, and translated into English where necessary.

Defining the scope of the pilot study

Determining the parameters of the pilot study was an important step in shaping the focus of the feedback received and therefore also of the scope of the pilot and resulting modifications to the mobile application. Given the fact that the participant pool was made up entirely of professional educators, it was important to establish that feedback regarding the use of a mobile application to deliver professional development or the selected content was not of primary importance. Instead, participants were specifically requested to interact with the mobile application in any way that they wanted, with a view to giving feedback on the following areas:

1. The technical aspect of the application
    1.1. Ease of download
    1.2. Ease of use
    1.3. Main functions
2. The introduction and instruction video
    2.1. Ease of understanding
    2.2. Explanation of ethical research
3. Aesthetics of the application
    3.1. Ease of navigation
    3.2. Visual appeal
4. The 'Daily Thought' videos
    4.1. Technical functionality
    4.2. Visual appeal
    4.3. Soundtrack
    4.4. Text
5. The supporting videos
    5.1. Technical functionality
    5.2. Visual appeal
    5.3. Sound
    5.4. Text
6. The supporting articles
    6.1. Technical functionality
    6.2. Academic appropriateness
7. The WhatsApp messaging system
    7.1. Ease of use
    7.2. Value of interaction
8. The notes system
    8.1. Technical functionality

8.2. Value of interaction
9. The notification system
    9.1. Timing & reminders
10. Any other comments

Participants were encouraged to use the 'notes' function within the application to be able to record impressions as they interacted with any or all of the functions. They were asked to cite specific examples or evidence to support their feedback where possible and the rationale behind their impressions when these were based on opinion or preference. It was anticipated that if the reasoning for the feedback may expose potential cultural nuances, that might not be readily evident with feedback given with little or no contextual understanding.

The characteristics of the users in the pilot study

The sample population used for the pilot study were all selected from IAE group and originally included 20 individuals, though this number was reduced to 13 attendees who actually presented feedback at the second participant meeting. The sample included two categories of professional; those who were a part of the Leadership group (Principal, Assistant Principal, Instructional Coach, Dean of Students), and those who were part of the teacher group (Teacher, Teacher Assistant, Department Head). The sample had a robust balance of Panamanian natives and immigrants, Spanish and English speakers, preschool, primary, and secondary team members, and those who self-identified as having moderate, strong and weak technology skills (see Table 9) and were broadly representative of the sample population for Phase Two. It should be noted that the participant sample for the pilot study did not have a good gender balance – a characteristic that was not representative of the Phase Two sample.

Table 20: Pilot Study participant characteristics

	Gender	Language (App)	Section	Panamanian	Position	Technology Skills
1	Female	English	Preschool	Yes	Leadership	Weak
2	Female	Spanish	Primary	No	Teacher	Strong
3	Female	Spanish	Primary	No	Teacher	Moderate
4	Female	Spanish	Primary	Yes	Teacher	Moderate
5	Male	Spanish	Primary	Yes	Teacher	Weak
6	Male	Spanish	Secondary	Yes	Leadership	Strong
7	Female	English	Secondary	No	Leadership	Strong
8	Female	Spanish	Secondary	Yes	Teacher	Moderate
9	Female	Spanish	Secondary	No	Teacher	Moderate
10	Female	Spanish	Preschool	Yes	Leadership	Weak

11	Female	English	Primary	Yes	Leadership	Strong
12	Female	English	Primary	Yes	Leadership	Strong
13	Female	English	Primary	No	Leadership	Weak

Feedback from the users in the pilot study

The following is an abbreviated summary of the main points from the participant feedback session.

1. All but one of the participants reported that the process of downloading the application was easy to complete and that the application worked well on both the IOS and Android platforms. All participants informed that the application was downloaded only on to smartphones. The only participant who had difficulty, managed to download the application without any problem; however, could not always access all functions within it. No participants gave details of significant technological glitches, though some indicated that the notification system did not always indicate when there was more than one notification received. This appeared to be a source of very minor frustration.

2. Technically there were several participants who recounted that the 'rotate-to-Fullscreen" automation on their phone did not work when watching the Daily Thought videos. This was specific to a couple of search engines (Chrome and Firefox) but caused some significant frustration as resolving the issue manually sometimes took 10-15 seconds or up to 25% of the entire video. There were times when the video would need to be played again to watch in its entirety something that was raised as a potential deterrent for participants of the main study to watch the daily Thought videos regularly.

3. The fact that the supporting articles required participants to leave the application and open such articles in a separate platform, for the page to be automatically translated into Spanish, caused some confusion. This resulted in the need to go back to the home screen and reopen the application to return to it, after viewing the article. Again, this was reported as a source of frustration and a potential deterrent for participants to return to the application to interact more fully. It should be noted that some participants felt that engaging with the articles served as good engagement with the material but as this took place outside of the actual application it was described as a frustrating process to easily move to and from while still using the notes or chat functions to engage further.

4. Some feedback testified to the fact that the introductory video was not very interesting and that given it is one of the first elements of the application experienced, that it should be replaced with something more dynamic in nature. Concerns were raised that the message was only in English,

even though it had Spanish subtitles, and that the idea of a single spoken message was not consistent with the rest of the application where messages were delivered through the multi-sensory approach of pictures, words, and music.

5. There was almost a universal concern with the visual appeal of the application. Many suggested that there was "too much blue" in the application and that this came across as cold and unattractive. It was suggested that the application would need to be reframed in terms of making it more for participants to want to engage with it. Feedback advocated for more pictures and a layout change from a list perspective to a more user-friendly tile format. Additional it was proposed that the application be more colourful and inviting rather than 'somewhat sterile' use of differing shades of blue. *"Most people don't want an app with too many words. You can use pictures to communicate a lot."*

6. There were multiple concerns with the use of WhatsApp as the preferred platform for interactive chat. Some participants were concerned about privacy and did not want to link the application to their personal WhatsApp account. *"I didn't want to connect with my WhatsApp because I didn't know whether or not this would allow you to see my other chat threads!"* Others had concerns about connecting with their peers at times that may not be convenient. Comments included *"I didn't want to chat during work hours because then others would know that I was using my phone during work hours."* and *"I often looked at the application when I went to bed and so did not think that I should be WhatsApping my colleagues at that time!"* Additionally, in the same way that reading the supporting articles required participants to leave the application, so too did use of the WhatsApp function and therefore the function caused the same frustration and concern for some participants.

7. The Notes function was also identified as an element of the application that did not function smoothly. While the option provided to create notes was linked directly within the application, as with the supporting articles and the WhatsApp functions, the use of this option took users out of the main application and so, once again, raised the same concerns for some participants. Feedback also highlighted the fact that several of the participants did not believe that the notes function was necessary as most smartphones already had alternate applications that could be used to save and store thoughts that were easier to use alongside the "An Apple a Day" application (Google Keep, OneNote. Apple Notes, etc.).

8. The Daily Thought videos were deemed to be problematic, especially those that were prepared for the Spanish version of the application. The videos that were produced were identical in nature to those created for the English version of the application apart from the written text. The feedback from most participants using the Spanish application was that the videos were not culturally sensitive, and that the pictures and music should be changed to be more culturally connective to the participants of Latin American background. It was suggested that the pictures should be of Panamanian school children and classrooms rather than stock photos and that the soundtracks should be altered to use Latin music that participants could identify with culturally.

9. Some participants also felt that the timing of the text within the Daily Thought videos was not optimal. Feedback recommended that either the amount of text needed to be reduced or that the videos be lengthened to give the observer more time to be able to read and comprehend the information being shared. Participants shared that *"It was difficult to keep up with the text and I found myself skim-reading rather than reading for real understanding?"* and that *"It was a little stressful to try and read the message before it changed."* In short, *"there was too much to read in such a short video – even if the information was pretty good."*

10. Some of the Supporting Articles were described as too complicated to understand easily and a little too long to be able to get through on the spur of the moment. This was especially the case when participants decided to read through the articles when they received the Daily Thought notification – during their workday. While under pressure of time, the short Daily Thought videos could be viewed conveniently, a research article that took far longer to read and reflect upon was not optimal. As such, participants reported that they quickly formed a habit of viewing the Daily Thought videos but not necessarily continuing on to review the supporting materials. Participants reported that *"I knew that the articles would take me a good twenty minutes to get through and so I would decide to wait until later to read them, but then when I got home, I forgot."* and *"I got the point from the Daily Thought video and so I didn't want to read a lot more from an article."*

11. Some of the Supporting videos were also depicted as being too lengthy for ease of viewing. This was not always the case, but feedback indicated a clear preference for supporting videos (and articles) that could be seen in no more than 5-10 minutes. One of the reported benefits of the application was that it presented research-based ideas in a simple and convenient way. For many of the participants, the "simple and convenient way" was more important than the depth of information about the shared concepts. *"I love the fact that I can get video reminders of how to be*

a good teacher, but I don't want to worry about spending a long time having to find out about the information… when the videos or articles were too long or complicated, I ended up not watching them."

12. Participants shared concerns that there were quite a few sections to the application and when videos were added each day that soon became a little overwhelming to try and find the matching supporting videos and articles. *"I did not go to the app every day, so sometimes when I went, I watched more than one video and it was not always easy to find the supporting video or article that went with it."* Concern was also raised about how this would be managed if the application was live for a period of three months. *"I don't think that it will be easy to navigate through the app when there is a month of videos and articles everywhere… you will need to find a way to organize all of the resources in the app so that it is easy to navigate."*

How the pilot study shaped the development of the "An Apple a Day" application

The feedback received from the Pilot Study was used to transform the structure and design of the application as well as the way that it was intended to be used by the participants in Phase Two.

The first, and most definitive modification was the decision to make two separate Daily Thought videos each day: one for the English version of the application and one for the Spanish version. This allowed for each video to be created with an appropriate cultural identity rather than creating one video and then making minor edits as was the case in the Pilot Study. The result was the creation of videos that shared the same content but that in all other aspects were significantly culturally different (Figure 18).
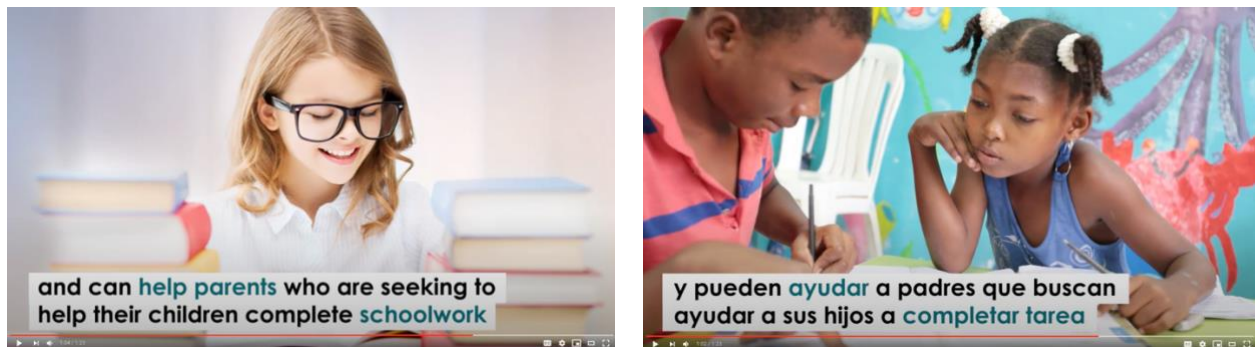

Figure 18: 'Daily Thought' cultural comparison

Research has consistently shown that cultural identity has an important effect on learning and should be taken into consideration whenever professionals contemplate teaching and learning

(Altugan, 2015). While the development of dual videos maintained the integrity of the content as being the same in each, it also allowed for images, music, and text to be specifically developed with the cultural identity of the audience in mind. As such the design aligned with the premise that "cultural backgrounds of learners are significant because ethnic, racial, linguistic, social, religious, or economic differences can cause cultural disconnection leading corruption of motivation to learning" (Altugan, 2015, p.1159). The construction of videos that were closely aligned with the cultural values and norms of the participants was intended to serve as a social conduit and therefore augment the authenticity of the message and the credibility of the research-based text being shared.

Secondly, the aesthetic design of the mobile application was also comprehensively reformatted as a result of the feedback received from the Pilot study. The original design was structured around the concept of organisation and logical sequencing of information rather than attention to aesthetic appeal (Figure 19).

Figure 19: Original application design

The design was created using a list format throughout with differing shades of a single colour (blue). In this application design the focus was primarily text-based with each element of the application listed on the home screen and the videos, and articles listed using the same format on the subsequent pages of the application. Some images were used on the pages where individual articles or videos were housed, but navigation through the application was achieved through the list of components. The design prioritized function over motivation to browse, assuming that participant would enter the application already enthusiastic about what they might learn.

Following the categorical feedback regarding the visual appeal of the application from participants in the Pilot Study this assumption was modified, and the application reformatted

accordingly. The focus of the application moved from a text-based system to an image-based structure. This revised the homepage from a list of components to a series of tiles or images, and in doing so greatly altered the visual appeal of the application. In contrast to the original design, varied and vibrant colour was adopted to increase engagement and to maximize the attractiveness of each page of the application. This is supported by several research studies which indicate that "in the past decade, research in a wide range of disciplines has embraced the importance of aesthetic impressions or visual appeal. In our context, we consider visual appeal as a user's perception of website aesthetics derived from website visual design factors such as colour, shape, and layout" (Pengnate, Sarathy, & Lee, 2018)

Figure 20: Modified application design

Active images were used throughout the application in the hope of enticing participants to want to read or watch further based on the appeal of the image as much as the accompanying text (Figure 20). On pages where larger amounts of text were required (specifically the explanation of the research and the ethics disclaimer pages) images were placed beneath the text, once again to give a visual attractiveness to the page as well as to give subliminal context to the information being shared.

A third adjustment to the application was made regarding the chat function. Following reported concerns over "An Apple a Day" being connected to participants' WhatsApp chat accounts, and concerns that any internal chat function would lead to the identification of participants involved in the discussion, the decision was made to remove the WhatsApp chat option and to replace it with a Contact Information page. This page gave participants the opportunity to contact the research assistant should they have any questions or concerns regarding the application but removed the main pathway

for participants to be able to chat with each other about the application or any of the concepts discussed.

The removal of an internal chat function caused a change in the manner in which participant interaction was recorded. Rather than being able to readily observe to what extent participants discussed concepts raised in the content, data regarding these types of interactions were instead collected as a part of the participant interviews. This modification also reduced the status of participant interaction in the study somewhat, a development that while not optimal, was considered necessary in order to maintain participant comfort and privacy levels as they interacted with the application. There was little doubt that during the pilot study the requirement to integrate personal WhatsApp accounts with the application was a cause of concern for participants, and therefore the "convention of confidentiality" needed to be upheld as a means to endure that the identity of all respondents was in no way compromised (Kaiser, 2009).

Fourthly, the structure of the application was re-organised to maintain the simplicity of access to the relevant Daily thought videos and supporting materials, while also allowing participants to revisit previously published resources. This involved two noteworthy amendments to the application. First, archive libraries were added to the main page of the application which stored content for Daily Thought videos, Supporting Videos, and Supporting Articles. These resources were sorted by order of publication with the newest resources loading to the top of the page therefore allowing participants to easily navigate to previous materials that they might have not seen yet or wished to view again. Secondly, the decision was made to create an accompanying website that would house all resources, again categorised by resource type and sequenced in monthly modules as delivered through the application. This website was created as an accompaniment to the application, but also as a standalone resource and so it included an introduction to the research project and context regarding its purpose (Figure 21).
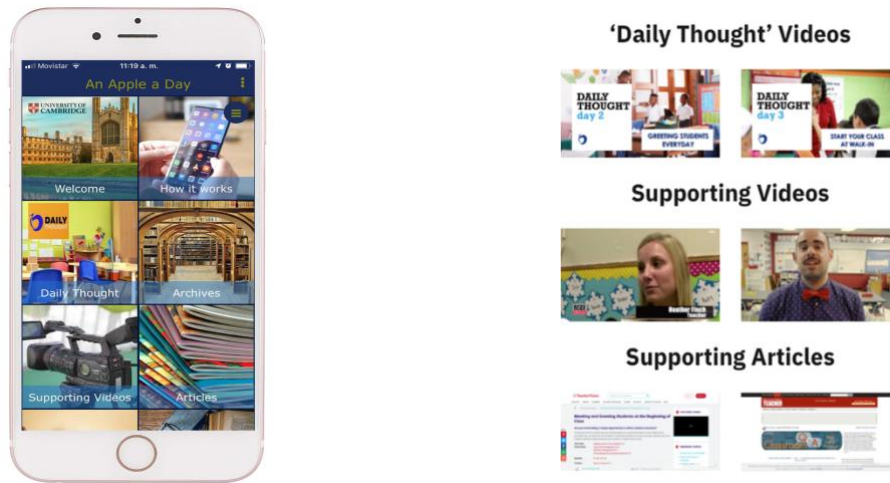
Figure 21: Archive libraries on application and accompanying website

The last of the foremost revisions made as a result of the pilot study surrounded the format of the "Daily Thought" videos. Feedback from the pilot reported that the videos, while perhaps the strongest of the resources, were difficult to comprehend easily on initial viewing due to the amount of text covered in such a short timeframe. Participants conveyed that the text was useful but that it was difficult to be able to read it at a comfortable pace and as a result viewing was more stressful than it needed to be. Considerable discussion followed as to whether the best approach to address this issue was to lengthen the "Daily Thought" or to maintain the 60 second time limit and reduce the amount of text within the video. Ultimately, in an attempt to preserve the integrity of the function of the Daily Thought video, it was decided to edit the amount of text presented keeping it strictly to six short bullet points per "Daily Thought". While this revision increased the potential of diluting the depth of the message (this was of particular concern given that another element of the feedback was that some participants felt that the content of the Daily Thought videos would benefit from being more academically challenging), it was deemed a risk worth taking, given that well-branded short videos have been shown to form a strong relationship with users who are likely to believe the information shared (Gao-fu, Peng-chao, Yu-chun, & Zhuo-ping, 2019).

In addition to these important reconsiderations, there were more minor aesthetic 'tweaks' to the application prior to its formal launch, and other minimal alterations that were made as the research project progressed through the 90 days of use. Some of these were as a direct result of the feedback given from the pilot study and others as a result of updates to the application software and platform

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used. In each case, these adjustments were made to allow participants to interact easily with the shared content and to be able to maintain focus on the primary intent of the application.

Data Collection: Interviews and Surveys

The predominant data collection took place using two exploratory, semi-structured interviews with each of the 8 participants over the course of three months. These interviews took place after 30 days and after 90 days of using the application. Ensuring the credibility of such a research design can be challenging, especially in proving the validity and reliability of the data collected (Brink, 1989). This reality is exacerbated even further when a differing cultural paradigm is in play, where "even when the interviewer and interviewee seem to be speaking the same language, their words may have completely different cultural meanings" (Qu & Dumay, 2013, p.239). Nevertheless, research has shown that interviews can be particularly well suited to the exploration of attitudes, values, beliefs, and motives (Smith, 1975).

To maintain a consistency of approach and yet still allow for individual flexibility within each interview, a semi-structured approach was adopted (see Appendix F). The main topics of discussion were predetermined, although specific probing and follow-up questions were allowed by the research assistant at the time of interview. Interview construction was guided by Kvale's (1996, pp133-5) typography of questions and was conducted in the interviewee's native tongue and translated at a later stage to reduce any potential loss of authenticity. As discussed earlier, all interviews were conducted by a suitably qualified proxy to overcome any potential language barriers. Each interview was recorded and transcribed into English where necessary. This heuristic technique was very much in keeping with the pragmatic research paradigm at the heart of the study. The exact particulars of the interview questions were determined once the design of the application was finalised. This approach ensured that all elements of the application design were included in a discussion driven by guiding questions but that also allowed participants considerable latitude in their responses.

In addition to the interviews, supplementary data was collected from each participant in the form of a brief Likert-style survey (see Appendix G). As with the interviews, the survey was administered at the end of 30 and 90 days and the questions were designed to mirror the information gathered from the interview process. As with all resources in the study, the surveys were created in English and Spanish, and each participant was given the option of which language they would prefer.

The survey was conducted online through the use of a distributed link emailed to participants in order for respondent information to be anonymised.

Data Analysis

In concert with the pragmatic nature of the study, the exploration of participants' thoughts and experiences was completed using an inductive analysis, through the triangulation of data from multiple consistent sources of evidence. Similar to the analysis of data in Phase One, the study again used Boone and Boone's suggested data analysis procedures "to construct a descriptive analysis using non-parametric procedures… as well as calculating a composite score using an interval measurement scale with the mean for the central tendency and standard variations for variability." (Holden, 2021, p.70)

The rationale for adopting this multi-analytical approach was to maximize the validity and reliability of the data collected in Phase One and to increase the flexibility of the potential design of the second phase of the study. Interview transcripts underwent a focused coding procedure, primarily to determine the positivity and/or negativity of the responses to each element of the application, and manual coding to determine potential patterns in the specific vocabulary used. This use of qualitative content analysis was intended to bring a "rule-based and theory-guided" (Kohlbacher, 2005) level of structure and discipline to the evaluation of data that increased the credibility of this phase of the study. Content analysis was used to create "a careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings" (Berg, 2007, p.338).

The general techniques employed throughout the second phase were founded upon Yin's analytic strategies and techniques (Yin, 1994). Ultimately, the design resulted in a case description organized around the emerging characteristics of the data collected. These methods included pattern matching, where empirically based patterns were compared to predicted ones; explanation building, where an explanation of the cases was built using causal links, where changes in relationships and events over time were also discussed (Yin, 1994). As it was imperative that the research remain exploratory and culturally aligned in nature, any developed system of analyses needed to be flexible and adaptive in nature so as to allow for perspectives to be presented that had not been anticipated in the initial theoretical framework. As a result, the use of Glaser & Strauss's (1967) methodology of constant comparison allowed for developed codes to be dynamically modified as required.

Analysing the participant surveys

Data from an eleven-question participant survey was collected after 30 days of interaction with the application and then again after 90 days of interaction (see Appendix H). The interviews were designed to gain insight into how the application was received by teachers, with a specific focus on acquiring more detail regarding thoughts, feelings, and essential feedback on the application. The data were inputted into the Statistical Package for the Social Sciences (SPSS) software in order to evaluate. The data were analysed using a ratio scale of measurement and was represented solely numerically. No manipulation of the raw data took place prior to the importing into SPSS. The survey was conducted using a 5-point Likert scale, where each rating was assigned a numerical value (i.e., 5=Always, 4=Often, 3=Sometimes, 2=Rarely, 1=Never). These values were then tabulated using descriptive statistics to calculate the satisfaction of participants using the app, focusing on the interaction, usefulness, and impact of the app. To evaluate the survey responses, the data was analysed using mean, standard deviation and variance for each individual survey question.

Following the descriptive analysis, two main additional analyses were conducted: factorial analyses of variance (ANOVA) and paired t-tests. The factorial ANOVA tests were conducted to determine whether or not there was any significant difference in the means of the responses between 30 days and 90 days for a different set of 'like' questions (e.g., "Did you implement...", "how often…") as well as testing the difference in responses between 'like' questions simultaneously. Additionally, the paired t-tests were used to determine the relationship between perceptions after 30 days and those after 90 days regarding the overall satisfaction of the application.

Although these analyses were completed to determine the level of statistical significance utilizing the conventional level used in education research, it should be noted that collected data were integrated as evidence into a descriptive analysis of the case study as a whole. The survey data were gathered to validate data assembled from a series of participant interviews from a perspective of supporting patterns found in participant comments. Though sustained by these quantitative analyses, the focus of the data analyses remained qualitative and descriptive in design.

Analysing the participant interviews

In addition to the surveys, semi-structured interviews were conducted with each of the eight participants. As with the surveys, these were carried out after 30 and 90 days of interaction with the application. The semi-structured approach was adopted primarily as it is the most frequently used

interview protocol adopted in qualitative research and also because it allowed for maximum flexibility and variation to the rigidity of its structure (Kallio et al., 2016). With the intent of increasing the trustworthiness of the study, Kallio et al's, framework for the development of a qualitative semi-structured interview guide was used to inform the development of the interview questions, specifically in establishing the credibility, confirmability, and dependability of the process (Kallio et al., 2016). At the same time, room was allowed for modification to the precise nature of the questions asked based on the insight gained from the experiences during and after the interviews (Holloway & Wheeler, 2010). Each of the interviews were audio recorded, transcribed, and translated into English (if necessary) and then coded for meaning and pattern (see Appendix I). This process was completed using an originally designed code in Python, a favourable option given its ease of interaction with text documents.

There were two distinct elements to the developed code (see Appendix J). Firstly, the code was designed to record the frequency of each word used in the responses of the participants to determine the frequency of word use. Secondly, the data (in the form of individual words) were cleaned. This involved the removal of words that were determined to be inconsequential to determining participant meaning (ignoring words such as: 'the', 'and', etc…) and then the sorting of the remaining words into one of five categories of positivity or negativity. The categories included: highly positive, moderately positive, neutral, moderately negative, and highly negative. From these results, it was then possible to perform statistical analyses with some degree of confidence about how people generally felt about the app and its features. The data were also used to determine the level of positivity or negativity each participant had with each element of the application. Words were manually sorted by a team of three individuals with unanimous agreement required as to the selection of which category the words were assigned. Once each word had been assigned to one of the five categories the information gathered could then be used for further analyses.

Sorting & cleaning the data

Before running the code, data were copied from the transcribed answers of each participant into a Windows 'Notebook'. The developed code then changed all letters to lowercase and removed any special characters (punctuation), before combining all text into one document creating a single entire transcript. This allowed for an analysis of the 'totality' of the feedback given by participants, that could also be sorted by interview question, research question, or even theme. Due to the nature of the

code, contractions such as "I'm" were left intact, requiring them to be analysed in context when the manual coding of the transcripts took place later in the coding process. The result was a dataset that had been cleaned and had that ability to be sorted using a variety of actors.

Manual coding of the interview data

Once cleaned the data were then analysed manually within the created 'Notebook'. During this process, each transcript was annotated and analysed individually with a specific reference to the positivity or negativity of the response. These comparisons were conducted using the pre-determined categories of highly positive, moderately positive, neutral, moderately negative, and highly negative vocabulary. Additionally, the frequency of categorised words was highlighted within each response and then recoded alongside the context in which they were used. Surrounding words were also coded to give additional context (Words such as 'like' 'helpful' or 'useful' could be used in several contexts and so could potentially be coded in multiple categories of positivity or negativity, depending on the context of use), especially when these words had a modifying effect on the chosen term.

Independent of this coding process, each transcript was also hand-annotated to look for patterns within the responses as well as significant outliers to the previously completed coding. This process also was intended to allow for the development of bespoke coding or analysis depending on the insights gained that might be found outside of the primary focus of categorisation of terms. It also allowed for manual and intuitive analysis of the final question of the interview which remained totally open-ended and therefore not easily assessed within the earlier coding process.

Additionally, independent samples t-tests were conducted to determine whether there was a difference in means (averages) between the interaction with the application after 30 days compared to 90 days, as well as to determine if there was a difference in means between different types of interaction (e.g., videos watched, articles read). Again, both the variables of time and people were independent as required for the independent samples t-test.

Given the fact that more than one statistical analysis was conducted on the data for each of the established research questions, complimentary tests were used on both the participant surveys and interviews to ensure a comprehensive approach. For ease of understanding this approach was organized by research question (Table 21).

Table 21: Statistical analyses organised by research question.

	RQ1 Can professional development delivered to instructors using mobile learning improve the self-efficacy of teachers in Panama?	*1.a. How do teachers interact with professional development delivered through a mobile learning application?*	*1.b. How useful is professional development delivered through a mobile learning application?*	*1.c. What is the impact of professional development delivered through a mobile learning application?*
Participant Survey	Basic descriptive statistics (mean, standard deviation, variance)	Factorial ANOVA on 'like' Qs (daily thought vids, supporting vids, supporting articles, "how often")	Factorial ANOVA on 'like' Qs (usage) T-test (overall app satisfaction as well as individual Question breakdown)	Factorial ANOVA (implementation of strategies)
Participant Interview	Break down of data using Python code	Independent t-test (no. vids watched vs articles read), Independent t-test (30 days vs 90 days) Box plot (visual showing the same results as the linear regression model)	Basic percentage breakdown	Table on specific open-ended interview Q responses to "anything you'd like to add"

Paper 4: Phase Two: Results

Participant Demographics

The data from this study came from a survey and semi-structured interviews given to 8 teachers. The response rate was 100% in that all teachers completed all survey questions and participated in a semi-structured interview after 30 days of interaction with the application, and then again after 90 days. There was a balanced representation of participants by gender with 4 female participants and 4 males. The participant pool included all three teaching levels: pre-school (1), primary (4), and secondary (3), and incorporated teachers who self-described themselves to be strong (2), moderate (3) and weak (3) in terms of ability and comfort with the use of technology. Participants were given the freedom to choose which language application they would prefer with 5 participants downloading the Spanish application and 3 the English one.

The participant pool was also representative of all categories within both variable groups of teacher experience and teacher qualification (from Phase One). This contained teachers with no prior teaching experience (1), 1-5 years of teaching (1), 5-10 years teaching (2) and 10+ years teaching (4). It also consisted of teachers with no formal qualification (1), a high school diploma (1), a bachelor's degree (4), and a Masters degree (2). In addition, to these formal qualifications 35.5% of participants held a formal teaching license. Detailed demographics of the participants can be found in Table 7.

Descriptive Analyses

As mentioned earlier, the descriptive analysis of participants' thoughts and experiences were completed "using an inductive analysis, through the triangulation of data from multiple consistent sources of evidence" (Holden, 2021, p.175). Data collected from the questions asked in both the survey and the semi-structured interviews with participants, were sorted into one of the three research sub question categories of interaction, perceived usefulness, and impact (Table 22, Table 23). This resulted in the collection of 14 data points used to describe participant interaction with the application, 8 regarding its usefulness, and 12 for the impact that the professional development had on teachers' professional practice. The combination of these data points, alongside the specific questions asked regarding teacher confidence, were used to explore the overarching research question.

Table 22: Survey data points categorised by research sub-question

	Research Question		
Survey Question	How do teachers interact with professional development delivered through a mobile learning application?	How useful is professional development delivered through a mobile learning application?	What is the impact of professional development delivered through a mobile learning application?
1 How often did you watch the Daily Thought videos?	🍎		
2 Were the "Daily thought" videos useful to you?		🍎	
3 Did you implement the tips from the Daily Thought videos in your classroom?			🍎
4 Did you learn something new after watching the Daily Thought videos?			🍎
5 Do you feel the "Daily Thought" videos helped improve your confidence in the classroom?			🍎
6 How often did you watch supporting videos?	🍎		
7 Did you find the supporting videos helpful?		🍎	
8 Do you feel the supporting videos helped improve your confidence in the classroom?			🍎
9 Did you implement tips from the supporting videos in your classroom?			🍎
10 How often did you read supporting articles?	🍎		
11 Did you find the supporting articles helpful?		🍎	
12 Do you feel the supporting articles helped improve your confidence in the classroom?			🍎
13 Did you implement tips from the supporting articles in your classroom?			🍎
14 How often did you find yourself using the chat feature per week?	🍎		
15 Did you explore the app when you received a notification?	🍎		
16 Did you only access the app during work hours?	🍎		
17 Did you access the app in your free time?	🍎		
18 Did you use the app every day?	🍎		
19 How often did you find yourself going to app per week?	🍎		
20 Did you feel the app has provided helpful information for you to implement in the classroom?		🍎	
21 Did you discuss the app with other professionals?	🍎		
22 What part of the app did you access the most?	🍎		

Table 23: Semi-structured interview data points categorised by research sub-question

	Research Question		
	How do teachers interact with professional development delivered through a mobile learning application?	How useful is professional development delivered through a mobile learning application?	What is the impact of professional development delivered through a mobile learning application?
Survey Question			
1 How useful is the Apple a day app for you as a teacher?		🍎	
2 How useful was this month's thought of the day videos?		🍎	
3a How useful were this month's supporting videos?		🍎	
3b How many did you watch?	🍎		
4 How useful were this month's articles?		🍎	
4a How many did you read?	🍎		
5 Did you implement any of the strategies in the thought of the day videos?			🍎
6 How successful were you in implementing the strategy?			🍎
7 Do you believe the app has helped you improve or change your instruction in any way?			🍎
8 Do you believe the app has increased your professional confidence with instruction?			🍎
9 If you could make a single change to the app, what would it be?	🍎		
10 Have you gone back to look at the daily thought videos from last month?	🍎		
11 Anything else you would like to share?			🍎

Analysing participant interaction with the application

The first research sub-question determined how teachers interacted with professional development delivered through a mobile learning application. This was achieved through the completion of a series of independent t-tests and Factorial ANOVA tests.

Independent t-test: comparing videos watched and articles read

Independent t-tests were used to determine whether there was a significant difference between the number of supporting videos watched and the number of articles read after 30 and 90 days (see Table 24). The t-tests were conducted with the resources used within the application (supporting videos, articles) as the independent variable and the amount of interaction with these resources (number of videos watched/articles read) as the dependent variable. It was assumed that the observations were independent, and that the dependent variable was normally distributed for each

resource. With p< 0.05, the t-test demonstrated that there was a significant difference in the number of supporting videos watched compared to articles read after 30 days, with more supporting videos watched than articles read. This was not the case after 90 days, however, where with p> 0.05, there was no significant difference found between the number of supporting videos watched and articles read. Clearly, after the first 30 days, participants preferred watching the supporting videos rather than reading the articles. This was not the case after 90 days, suggesting that there was a significant increase in the number of articles read after 90 days compared to the same number after 30 days. (It should be noted that the mean number of supporting videos watched after 90 days was still higher than the mean number of articles read after 30 days.)

Table 24: Videos watched, and articles read after 30 and 90 days

	(Mean±SD)		t-value	Degrees of Freedom
	30 Days	90 Days		
Videos watched (per month)	14.25 ± 13.74	17.24 ± 11.16	0.658	7
Articles read (per month)	5.50 ± 5.95	11.25 ± 8.78	1.65	7

Further Independent t-tests were also used to determine whether the difference in supporting videos watched and articles read after 30 days compared to the number after 90 days was significant (Table 24). The t-tests were conducted with the time spent using the app (after 30 days, after 90 days) as the independent variable and the amount of interaction with the app (number of videos watched, number of articles read) as the dependent variable. It was assumed that the observations were independent, and that the dependent variable was normally distributed for each month. With p> 0.05, the t-test demonstrated that there was no significant difference between the number of videos watched after 30 days compared to those watched after 90 days.

With p< 0.05, the t-test demonstrated that there was a significant increase in the number of articles read after 30 days compared to those read after 90 days. This suggests that over time, the longer participants spent using the application, the more popular the articles became, while participants were consistent in their engagement with the supporting videos.

Factorial ANOVA on 'like' survey questions

A series of factorial analysis of variance (ANOVA) tests were conducted to ascertain the way in which participants interacted with the application. To perform these, numerical values were assigned to each rating in the 5-point Likert scale that the survey used (5=always, 4=often, 3=sometimes, 2=rarely, 1=never). The results of the ANOVA tests were used to determine if there was any significant difference in the participant survey feedback between 30 and 90 days (figures shown in the row labelled 'Days'), as well as to determine if there was a significant difference between the 'like' questions (figures shown in the row labelled 'Questions'). Additionally, the ANOVA results were used to determine whether the interaction between days and questions was significant (figures shown in the row labelled 'Days*Questions'), i.e., does one appear to affect the other? Two assumptions were made when performing each of the following factorial ANOVAs. The first assumption was that the 'Days' represent the independent variable, while the 'Questions' represent the dependent variable. The second assumption was that the error variance of the dependent variable is invariant of the population size.

The first factorial ANOVA was completed to determine any change in means of 'like' questions from 30 days to 90 days for "how often" participants interacted with the application generally (Table 25, Figure 22). Similar to the "Daily Thought" Videos, there was a significant statistical difference between 30 days and 90 days, where the overall interaction with the app (e.g., watching videos, reading articles, using chat feature) increased from 30-days to 90-days. It should be noted, however, that the p value ($p<0.05$) regarding the 'like' questions was also significant, again implying that ratings may have varied strongly between the individual 'like' questions. This intimates that certain elements of the application were used more often than other parts of the application.

Table 25: Results from the factorial ANOVA with alpha = 0.05

<u>'Like' Questions regarding "how often" a resource was used</u>

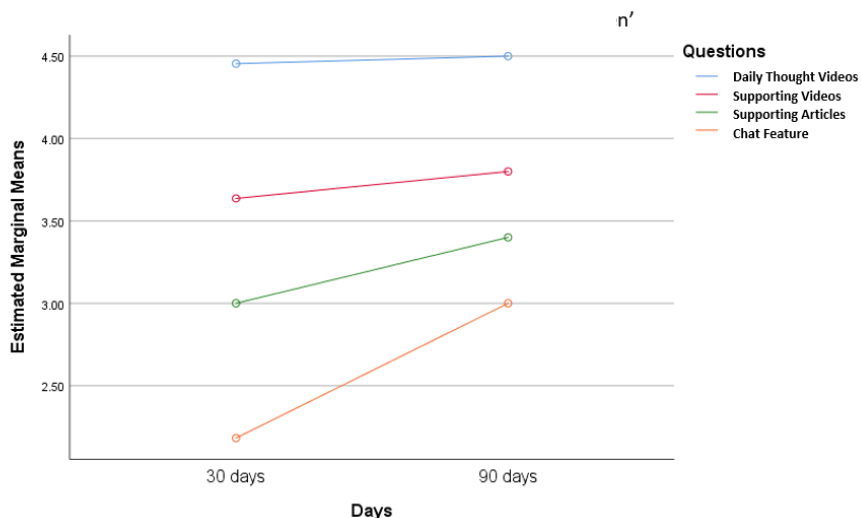|		
Days:	$F(1,80) = 4.36$	$p = 0.04$
Questions:	$F(3,80) = 21.9$	$p < 0.001$
Days*Questions:	$F(3,80) = 0.996$	$p = 0.399$

Figure 22: Change in means of 'like' questions from 30 days to 90 days for "how often"

A second factorial ANOVA indicated that there was a significant difference ($p < 0.05$) in the responses after 30 days compared to 90 days, where the average rating for questions regarding the satisfaction with "Daily Thought videos increased (Table 26, Figure 23). Despite the overall increase in satisfaction, however, the p value for 'like' questions ($p < 0.05$) also indicated a significant difference. This implied that the ratings for some questions regarding the daily thought videos did not match ratings to similar questions, hence responses were not consistent between 'like' questions regarding the daily thought videos.

Table 26: Results from the factorial ANOVA with alpha = 0.05

<div align="center">

'Like' Questions regarding "Daily Thought" videos

</div>

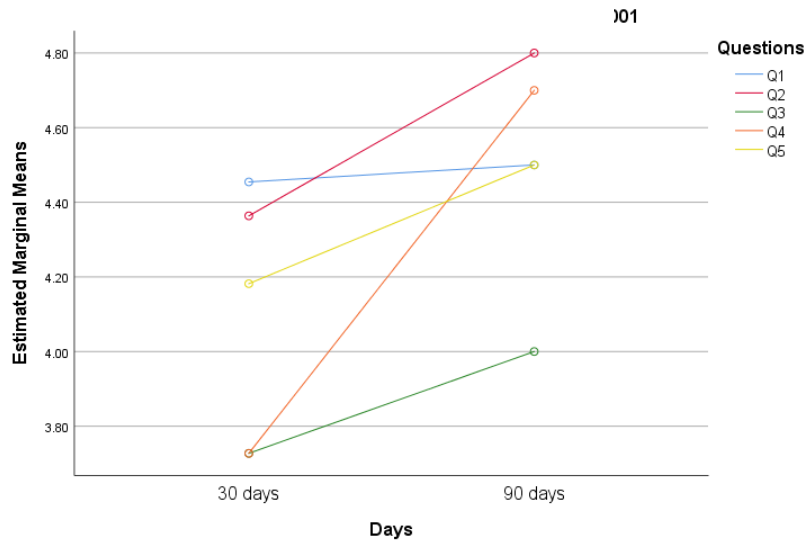|		
Days:	$F(1,100) = 12.12$	$p = 0.001$
Questions:	$F(4,100) = 4.49$	$p = 0.002$
Days*Questions:	$F(4,100) = 1.73$	$p = 0.149$

Figure 23: Change in means of 'like' questions from 30 days to 90 for "Daily Thought Videos"

A third ANOVA indicated that there was no significant difference (p>0.05) in the ratings given to questions regarding supporting videos between 30-days and 90-days. There was also no significant difference between the 'like' questions, indicating that the opinions regarding the supporting videos remained consistent over time (Table 27, Figure 24).

Table 27: Results from the factorial ANOVA with alpha = 0.05

<u>'Like' Questions regarding supporting videos</u>

Days: $F(1,80) = 0.717$ $p = 0.4$

Questions: $F(3,80) = 1.007$ $p = 0.394$

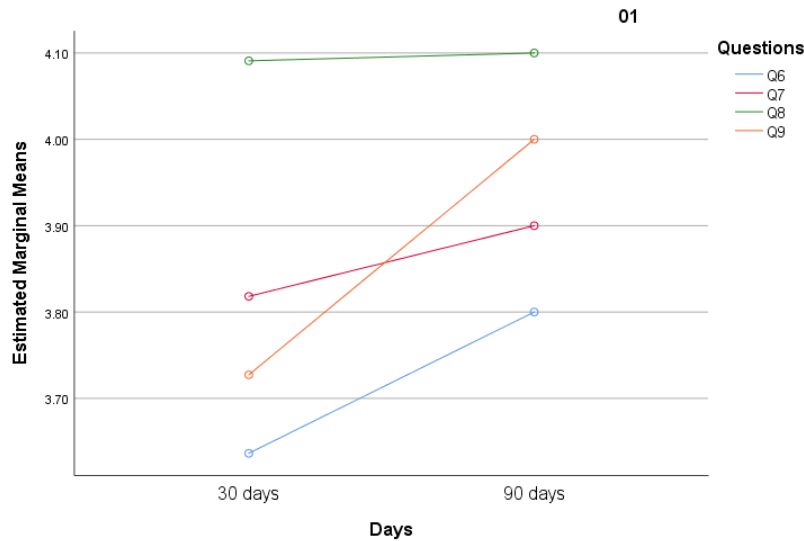Days*Questions: $F(3,80) = 0.132$ $p = 0.941$

Figure 24: Change in means of 'like' questions from 30 days to 90 for "supporting videos"

A final factorial ANOVA looked at the questions regarding the supporting articles. The ANOVA demonstrated a significant difference ($p < 0.05$) between the ratings between 30 days and 90 days (Table 28, Figure 25). This revealed the fact that participants were more satisfied with the articles the longer they interacted with the application. This further supports the findings of the independent t-tests conducted on the open-ended interviews, claiming that the popularity of the articles grew over time.

Table 28 : Results from the factorial ANOVA with alpha = 0.05

‘Like’ Questions regarding supporting articles

Days:	$F(1,80) = 5.84$	$p = 0.018$
Questions:	$F(3,80) = 1.14$	$p = 0.366$
Days*Questions:	$F(3,80) = 0.036$	$p = 0.911$

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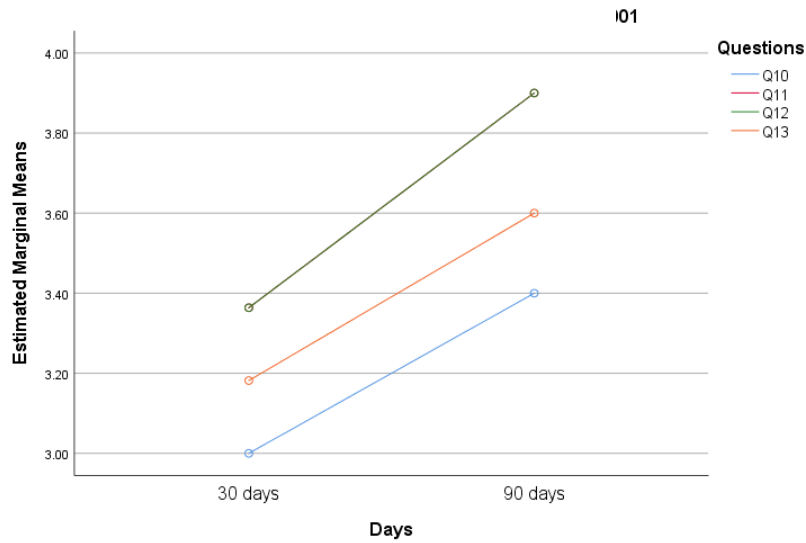*Figure 25: Change in means for 'like' questions from 30 days to 90 for "Supporting Articles"*

Boxplot analysis

Lastly, a boxplot analysis was created for side-by-side visual comparison of data, with the horizonal axis displaying three categories: positive, negative, and neutral, and the vertical axis showing interaction with the application (Figure 26, Figure 27).
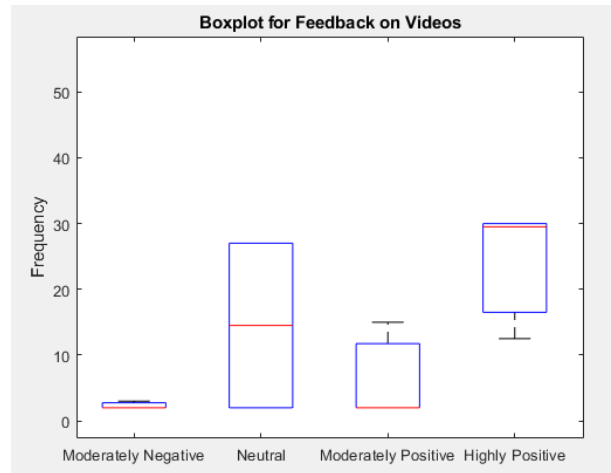

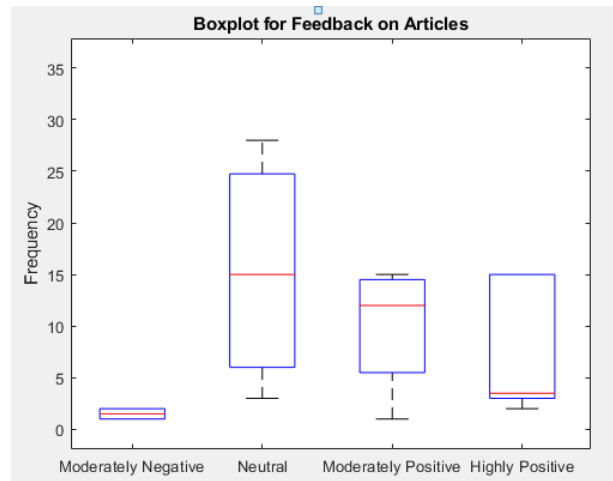*Figure 26: Boxplot for feedback on videos*

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Figure 27: Boxplot for feedback on articles

From this visual representation participants who gave negative feedback regarding the supporting videos and supporting articles tended to have very little interaction with them, with an average of 2.3 videos watched and 1.5 articles read (compared to the average interaction from positive feedback: 19.5 videos watched; 6.9 articles read). The resources included are supporting videos and supporting articles.

Analysing the usefulness of the application

The second research sub-question determined how useful participants perceived the application to be in the delivery of professional development. Once again, the data were collected from a series of analyses including a breakdown of simple percentages, a paired t-test, and a Factorial ANOVA test.

The most obvious breakdown of the data was a simple analysis of the python code taken from the transcripts of the semi-structured interviews. Within the structured section of the interview, specific questions were asked of all participants regarding the usefulness of various elements of the applications. Figure 28 represents how useful the interview participants felt the 'Apple a Day' mobile learning application was to their professional development between 30-days and 90-days of use.
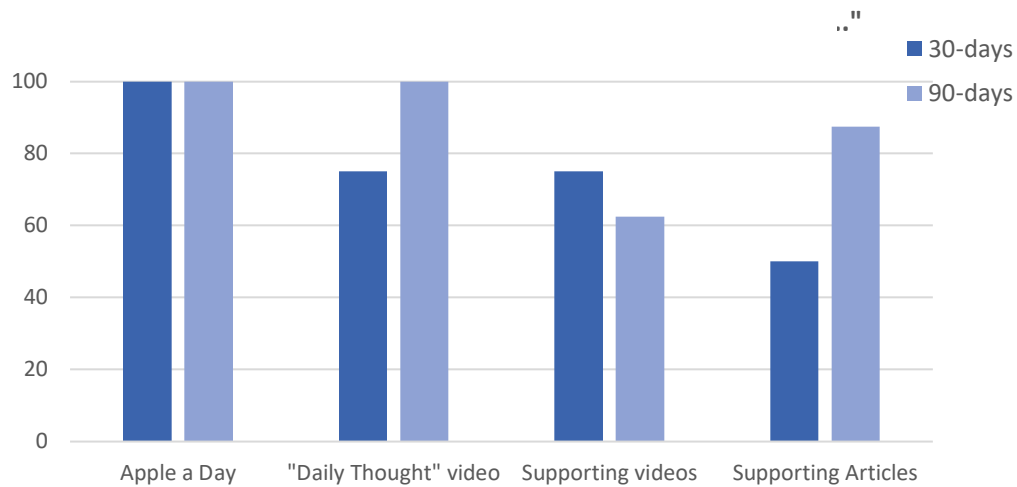
176

Figure 28: Simple percentage breakdown comparing 30 and 90-days

It was immediately evident from the simple data that after both 30 days and 90 days participants unanimously agreed that overall, the "An Apple a Day" application was useful for them. This data was the most definitive of all collected. Further examination of the data exposes several additional insights of note. The usefulness of the supporting articles increased significantly from 50% to over 80% from 30 days to 90 days of interaction with the application, while the supporting videos decreased from 75% to almost 60% over the same timeframe.

Table 29: Total number of different resources used after 30-days and 90-days

	Resources used	
	30 Days	90 Days
Videos watched per month	114	136
Articles read per month	44	90

The data of actual resources used after 30 and 90 days, substantiates that the total number of articles read more than doubled, suggesting that the more articles participants read, the more they found them useful (Table 29).

Table 30 provides a more detailed exploration into the first four questions concerning the usefulness of the app, with subcategories expanding on the notion of usefulness. This data gave further clarification to our initial findings. As previously outlined, while question 1 (*How useful is the Apple a day app for you as a teacher?*) had a 100% positive response rate after both 30 and 90-days, further

analysis of the precise categorization of vocabulary used in participant responses indicates that this feedback improved from 50% highly positive vocabulary to 75% highly positive vocabulary over the same timeframe. Question 2 (*Were the "Daily thought" videos useful to you?*) yielded the most significant improvement in terms of vocabulary used, with only a 12.5% highly positive rating after 30-days, growing to 87.5% highly positive after 90-days. This data confirms that the "Thought of the Day" component of the application was an essential and universally appreciated element, and that it evolved with use into the most 'useful' tool of the application.

Table 30: In depth percentage breakdown of 'Usefulness' Questions from interviews

	Categorization of 'usefulness'			
	Positive		Neutral	Negative
30 Days	Highly	Moderate		
Q1	50%	50%	0	0
Q2	12.5%	62.5%	25%	0
Q3	50%	25%	0%	25%
Q4	25%	25%	25%	25%
90 Days				
Q1	75%	25%	0	0
Q2	87.5%	12.5%	0	0
Q3	50%	12.5%	25%	12.5%
Q4	62.5%	25%	12.5%	0

Table 31: Word count of the interview transcripts sorted in descending order

30 Days: words commonly used (>5 times) in responses to Qs1-4				90 Days: words commonly used (>5 times) in responses to Qs1-4			
	Number of times used	Used in a positive context	Used in a negative context		Number of times used	Used in a positive context	Used in a negative context
Like/d	43	13	5	Videos	40	21	6
Useful	36	27	0	Useful	33	25	0
Videos	27	10	5	Read	27	13	4
Read	23	6	8	Love	21	12	3
Articles	21	7	6	Students	20	10	1
Good	21	13	1	Like	20	19	0
Help/ed/s/ful	18	8	2	Information	17	13	1
Day	11	5	2	Time	17	10	3
Thought	9	7	1	Help/ed/s/ful	14	12	0
Change	7	4	2	Learn	14	8	1
successful	6	6	0	Articles	13	9	4
				Successful	8	4	1
				Share	6	6	0

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The developed Python code was also used to complete an additional descriptive analysis of the transcripts to determine the contextual word count. This process categorized all words used into either a positive, neutral or negative context, and allowed for a more effective analysis of the simple data (Table 31, Table 32 & Table 33).

Key

🍏 Highly positive

🍏 Moderately positive

🍎 Neutral

🍎 Negative

Table 32: Visual representation of positive responses to Interview Questions after 30 days

30 days		**Participant**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Interview Question									
1	How useful is the Apple a day app for you as a teacher?	Highly positive	Moderately positive	Highly positive	Highly positive	Moderately positive	Highly positive	Moderately positive	Highly positive
2	How useful was this month's thought of the day videos?	Moderately positive	Highly positive	Moderately positive	Moderately positive	Neutral	Neutral	Moderately positive	Moderately positive
3a	How useful were this month's supporting videos?	Highly positive	Highly positive	Moderately positive	Negative	Moderately positive	Moderately positive	Highly positive	Negative
3b	How many did you watch?	>15	30	2	3	30	2	30	2
4a	How useful were this month's articles?	Moderately positive	Highly positive	Negative	Highly positive	Moderately positive	Negative	Neutral	Neutral
4b	How many did you read?	<15	3	2	4	1	1	15	3
5	Did you implement any strategies from the thought of the day videos?	Highly positive	Highly positive	Negative	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive
6	How successful were you in implementing the strategy?	Highly positive	Moderately positive	Neutral	Moderately positive	Neutral	Moderately positive	Highly positive	Moderately positive
7	Do you believe the app has helped you improve or change your instruction in any way?	Neutral	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive
8	Do you believe the app has increased your professional confidence with instruction?	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive	Highly positive
9	Have you gone back to look at the daily thought videos from last month?	Negative	Negative	Negative	Highly positive	Negative	Highly positive	Highly positive	Highly positive
10	If you could make a single change to the app, what would it be?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	Anything else you would like to share?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 33: Visual representation of positive responses to Interview Questions after 30 days

90 days	Participant							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Interview Question								
1 How useful is the Apple a day app for you as a teacher?	dark green	dark green	light green	dark green	light green	dark green	dark green	dark green
2 How useful was this month's thought of the day videos?	dark green	light green	dark green	dark green	dark green	dark green	dark green	dark green
3a How useful were this month's supporting videos?	light green	dark green	dark green	yellow	yellow	red	dark green	dark green
3b How many did you watch?	15	30	>10	2	27	2	18	29
4a How useful were this month's articles?	dark green	dark green	light green	dark green	yellow	red	light green	dark green
4b How many did you read?	15	2	10	3	28	3	14	0
5 Did you implement any strategies from the thought of the day videos?	dark green	dark green	dark green	dark green	red	dark green	dark green	dark green
6 How successful were you in implementing the strategy?	dark green	dark green	N/A	light green	yellow	light green	light green	yellow
7 Do you believe the app has helped you improve or change your instruction in any way?	dark green	dark green	dark green	dark green	dark green	dark green	dark green	dark green
8 Do you believe the app has increased your professional confidence with instruction?	dark green	dark green	dark green	dark green	dark green	dark green	dark green	dark green
9 Have you gone back to look at the daily thought videos from last month?	red	red	red	dark green	red	dark green	dark green	dark green
10 If you could make a single change to the app, what would it be?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11 Anything else you would like to share?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

There were three significant observations gained from this analysis. Firstly, videos were talked about more frequently than any other elements of the application after both 30 days and 90 days when participants answered questions about usefulness. Most of the time these uses were positive in nature, suggesting that the participants felt more favourably inclined towards videos within the application than other elements. Secondly, as might be expected for these specific questions, the word 'useful' was the second most used word in each of the time periods (and the most used overall). Most notably, however, was that even though 'useful' was used 69 times over both sets of interviews combined, none of these responses were used in a negative context. This suggests that participants reposted a strong feeling that the application was useful in a positive sense, both in terms of some individual elements within the application and with the application. Additionally, a review of the use of the words help, helped, helps, or helpful (Help/ed/s/ful) shows a similar trend where after 90 days 12 of the 14 uses mentioned were in a positive context and nonnegative. The third observation of interest was that the word 'love' was used less than 5 times after 30 days (i.e., not shown in table), compared to more than 21 times after 90-days, with more than 50% of these uses being in a positive context.

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This again suggests an increase in positive feedback concerning the use of the application, the more that participants interacted with it.

Factorial ANOVA on 'like' questions concerning usage

A factorial ANOVA test was conducted on the data collected from the participant survey to determine if there was any significant difference between the means in the following three variables: 30-days and 90-days, Question 15 to Question 20 and the interaction between these variables. One factorial ANOVA was used since this was an overall look at usage of the application, so there were no subcategories. Two assumptions were necessary before performing the factorial ANOVA, the first being that there was at least one dependent and one independent variable; this was met from each teacher completing the survey independently and the two time periods were independent of one another. The second assumption was that the variances needed to be the same within the population. This was determined using Levene's test; the assumption was checked and met in SPSS.

Table 34: Results from the factorial ANOVA with alpha = 0.05

Variables compared	Test Statistic	P-Value
Days	$F(1,120) = 8.62$	0.04
Questions	$F(5,120) = 14.37$	< 0.001
Days*Questions	$F(5,120) = 8.10$	< 0.001
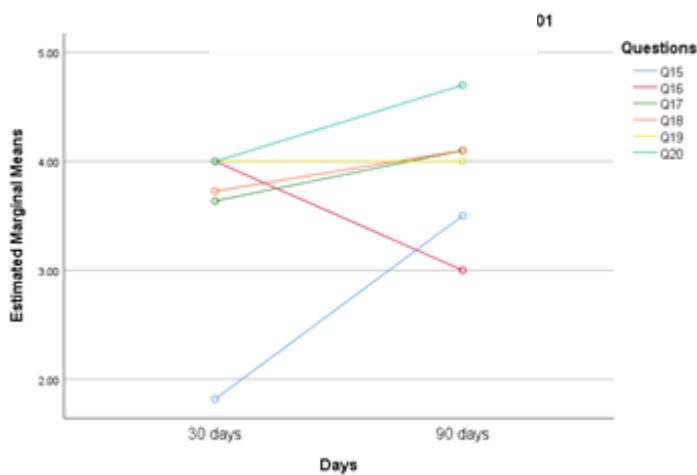
Figure 29: Change in means for 'like' questions from 30 to 90 days for "Usage"

For each of the "like" questions, the change in means yielded statistically significant differences, with p-values less than 0.05 (Table 34, Figure 29). The implication of these results is that there is a significant difference in the means between 30 days and 90 days, moreover, given that the mean (average) after 90 days was higher, the participants were more satisfied with the application after 90 days of interaction compared to 30 days. It appears, therefore that, according to the participant surveys the perceived overall usefulness of the application did indeed improve to a significant level for the majority of questions, as well as several specific sections of the application as individual elements. It should be noted, however, that there were two questions that did not return these results: Q9 indicated little change, and Q16 showed a significant negative change.

Paired t-test to determine overall satisfaction

Finally, a series of paired t-tests were conducted on the survey questions to determine if there was any significant difference between 30 days and 90 days in the overall satisfaction with the application. The results of the t-test are shown in table 20, and as $p < 0.05$ and an increase in the mean, the results demonstrated a significant difference in the overall satisfaction of the application from 30 to 90 days.

$$3.576 \pm 0.654 \quad 3.971 \pm 0.499 \quad \text{two-sample } t \text{ (df=3.612), } p=0.002$$

Further paired t-tests were performed on all individual questions of the survey to determine individual significance between 30 days and 90 days (see Table 35). Most of the individual questions had no significant difference, implying a consistency of ratings after 30 days and 90 days.

There were a few notable exceptions, however. specifically, Q4 (*Did you learn something new after watching the Daily Thought videos?*), Q15 (*Did you explore the app when you received a notification?*), Q16 (*Did you access the app. during work hours?*), Q17 (*Did you access the app in your free time?*) and Q20 (*Did you feel the app has provided helpful information for you to implement in the classroom?*). In these questions a significant difference was evident from 30 to 90-days. Question 16 (*Did you access the app. during work hours?*), was the only question where the mean significantly decreased, indicating that as time spent using the application increased, the amount of time spent accessing the application during work hours decreased.

Table 35: Table 20: Results of the individual t-tests from the survey

| | (Mean±SD) | | | |
	30 Days	90 Days	t value	p value
Qn				
1	4.45 ± 0.68	4.50 ± 0.53	0.232	0.821
2	4.36 ± 0.81	4.80 ± 0.42	1.604	0.14
3	3.72 ± 0.65	4.00 ± 0.47	1.399	0.192
4	3.72 ± 0.65	4.70 ± 0.48	4.357	0.01*
5	4.18 ± 0.75	4.50 ± 0.71	1.472	0.172
6	3.63 ± 0.92	3.80 ± 0.63	0.55	0.595
7	3.18 ± 0.75	3.90 ± 0.74	0.21	0.838
8	4.09 ± 0.70	4.10 ± 0.74	0.03	0.977
9	3.72 ± 0.65	4.00 ± 0.82	0.83	0.432
10	3.00 ± 0.89	3.40 ± 0.84	0.987	0.351
11	3.36 ± 1.12	3.90 ± 0.74	1.303	0.222
12	3.36 ± 1.12	3.90 ± 0.88	1.582	0.145
13	3.18 ± 1.08	3.60 ± 0.70	1.154	0.275
14	2.18 ± 0.98	3.00 ± 0.94	2.17	0.055
15	1.18 ± 0.87	3.50 ± 0.71	5.286	0.001*
16	4.00 ± 1.18	3.00 ± 0.47 †	2.236	0.049*
17	3.63 ± 0.67	4.10 ± 0.57	2.883	0.016*
18	3.72 ± 0.90	4.10 ± 0.88	1.152	0.161
19	4.00 ± 0.77	4.00 ± 0.00 †	1	0
20	4.00 ± 0.62	4.70 ± 0.48	2.681	0.023*
21	3.09 ± 0.94	3.90 ± 1.29	2.148	0.047

* - indicates a significant difference (i.e., $p < 0.05$).
† - indicates a decrease or no change.

The significant increase from 30-days to 90-days for Q4 (*Did you learn something new after watching the Daily Thought videos?*), Q15 (*Did you explore the app when you received a notification?*), Q17 (*Did you access the app in your free time?*), and Q20 (*Did you feel the app has provided helpful information for you to implement in the classroom?*) indicated that over time: participants reported learning more from the "Daily Thought" videos, spent more time exploring the application after receiving a notification, spent more time accessing the application in their free time, and indicated a perception that there was more helpful information to implement in the classroom.

Analysing the impact of the application

The third research sub-question determined whether there was any the impact of the application on the teacher's professional practice. More specifically, this sub-question examined how elements of the application impacted on confidence in the classroom, confidence in instruction and implementation of strategies learned. The data were collected from a Factorial ANOVA test and a descriptive analysis of the semi-structured interviews.

Factorial ANOVA to determine 'like' questions on implementation

A factorial ANOVA was performed on the questions specifically concerning implementation of strategies from the participant survey. This was to determine if there was any significant difference in the implementation after 30 days and 90 days, as well as how consistent feedback was from the participants were between these 'like' questions. The assumptions needed for a factorial ANOVA previously outlined were met as in prior tests.

Table 36: Results from the factorial ANOVA with alpha = 0.05

Days:	$F(1,80) = 7.91$	$p = 0.006$
Questions:	$F(3,80) = 7.01$	$p < 0.001$
Days*Questions:	$F(3,80) = 0.464$	$p = 0.708$
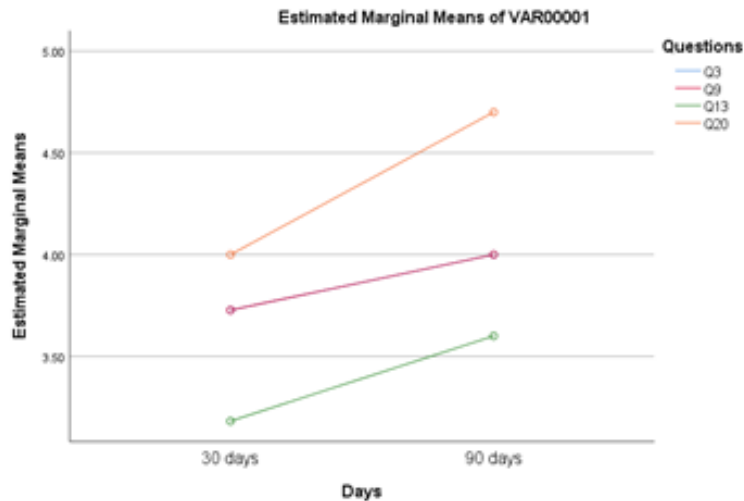
Figure 30: Change in means for 'like' questions from 30 to 90 days for "Implementation"

The results indicated a highly significant increase between the means of 30 days and 90 days, implying that after 90 days using the application, participants felt more confident to implement the new strategies gained from interaction with the application (Table 36, Figure 30). Furthermore, data from most (>80%) of the participants felt that the strategies implemented were successful in the classroom after both 30 days and 90 days. It can therefore be concluded that, over time, interaction with the application had a profound impact on participants and equally, had a positive impact on their willingness to try the adoption of new teaching strategies.

Descriptive analysis of 'like' questions on participant implementation

A descriptive analysis of the structured questions indicated several trends regarding the implementation of concepts highlighted in a variety of elements within the application. Participants reported that a significant increase in frequency of implementing tips from the "Daily Thought" videos after 90 days than after 30 days. After 90 days 90% of participants indicating that they implemented these tips "often" or "all the time" (see Table 37).

Table 37: Implementation of tips from the application after 30 and 90 days

Q3. Did you implement the tips from the "Daily Thought" videos in your classroom?

| | Interaction with the application | |
	30 Days	90 Days
All of the time	9%	10%
Often	55%	80%
Sometimes	36%	10%

Q13. Did you implement the tips from the supporting articles in your classroom?

| | Interaction with the application | |
	30 Days	90 Days
All of the time	9%	10%
Often	38%	40%
Sometimes	27%	50%
Rarely	36%	

Q9. Did you implement the tips from the Supporting videos in your classroom?

	Interaction with the application	
	30 Days	90 Days
All of the time	9%	30%
Often	55%	40%
Sometimes	36%	30%

There was also an increase reported in implementation between 30 and 90 days in the case of the supporting videos and articles though not to the same degree as the "Daily Thought" videos. In the case of implementing tips from the supporting articles, 36% of participants indicated that they rarely did so after 30 days, and only 50% asserted that they implemented these tips "often" or "all the time" (see Table 37).

The results were unequivocal, however, when participants were asked whether the application had provided helpful information for them to implement in the classroom. Not only was there a significant positive difference in responses after 30-days and 90-days, but 100% of participants indicated that the application provided helpful information for implementation "often" or "all the time". Additional data from the semi-structured interviews with participants confirmed this finding. When asked whether they believed that the application had helped improve or change instruction in any way, 87.5% of participants indicated that it had after 30-days and 100% reported the same after 90-days (Table 38).

Table 38: Perception that the application provided helpful information after 30 and 90 days

Q.20 Did you feel the application has provided helpful information for you to implement in the classroom?

	Information was helpful	
	30 Days	90 Days
All of the time	18%	70%
Often	64%	30%
Sometimes	18%	

Descriptive analysis of 'like' questions on participant confidence

The data from questions regarding whether various elements of the application helped improve participant confidence in the classroom mirrored those regarding implementation (Table 39). When asked if the "Daily Thought" videos improved their confidence in the classroom, there was a significant

increase in positive responses from 30-days to 90-days, with 90% ultimately reporting that confidence was gained "often" or "all the time". These same results were also evident when participants were asked about how the supporting videos increased their confidence, where again 80% of participants reported that their confidence improved "often" or "all the time", though it should be noted that, in contrast to the "Daily Thought" data, fewer of these responses were in the "all the time" category (Table 39).

Table 39: Perception of increased confidence after 30 and 90 days

Q5. Do you feel the "Daily Thought" videos helped improve your confidence in the classroom?

	Interaction with the application	
	30 Days	90 Days
All of the time	36%	60%
Often	45%	30%
Sometimes	18%	10%

Q8. Do you feel the supporting videos helped improve your confidence in the classroom?

	Interaction with the application	
	30 Days	90 Days
All of the time	27%	30%
Often	55%	50%
Sometimes	18%	20%

Q12. Do you feel the supporting articles helped improve your confidence in the classroom?

	Interaction with the application	
	30 Days	90 Days
All of the time	18%	30%
Often	27%	30%
Sometimes	27%	40%
Rarely	27%	

Once again, data collected regarding how well the supporting articles increased participant confidence demonstrated that the articles were perceived to be far less impactful. After 30 days, 27% of participants indicated that interaction with the articles "rarely" improved confidence, and after 90 days only 60% felt that their confidence improved "often" or "all the time".

Descriptive analysis on open-ended interview questions

The open-ended questions within the participant interviews provided further insight into participants' implementation of strategies and their confidence levels performing them. All participants (100%) recounted implementing at least one strategy after 90-days of interaction with the application, and most participants felt that these strategies were successfully implemented in their classroom. At the same time, 100% of the participants testified to the fact that interaction with the application had increased their professional confidence with instruction.

Open-ended feedback was also collected from participants to collect constructive criticism and modifications or changes that had the potential to improve the application (Table 40). Given that participants were allowed to answer these questions in any way that they wished, the range of answers was quite wide in scope. That being said, 87% of participants discussed the potential for use of the application to be expanded and shared with more teachers, some even indicating that they had shared several of the videos with colleagues and friends both inside and outside of Panama. Participants also indicated several areas of improvement for the application. This included feedback concerning the time of the notifications sent out, speed of the "Daily Thought" videos, frustration with the time taken by automated translation of articles that were originally in English, the inclusion of a notes section within the application, and the need for more precise and defined notifications. Interestingly, one participant found the music within the "Daily Thought" videos distracting and even irritating, though this sentiment was not raised by others. While each of these noted areas for improvement appear to be of a minor nature, they do speak to the overall need to refine the application to make it more user friendly, particularly when it comes to language barriers, and to ensure that participants find interaction both simple and convenient.

Table 40: Feedback from open-ended interview questions

Person	Q9 90-days	Q11 90-days	Q9 90-days	Q11 30-days
1	Videos preferred to be in the morning or during working hours	Good experience. want the app to continue next year.	Would prefer it to be more click friendly. Don't like jumping back and forth. Start in a different time of year (beginning). Improve the social aspect.	no
2	Videos go too fast.	Good experience. Wish their knowledge could expand to teachers outside Panama.	Videos too fast.	Be good to share it with other people.
3	nothing	Hope the app continues and grows. Very useful.	No. easy app to use.	
4	Needs to be more Spanish friendly	Don't want it to end.	don't like waiting for translations	Would like to share it with other schools.
5	Music is disruptive.		Change the music.	Want notifications more specific and tell you what's new in the app and where to go.
6	Nothing. Its organised, quick simple, easy, love translations	Want the app to be shared with more professors and have a bigger coverage.	Put the daily thoughts into sections. Not just available daily.	App is good. Enjoy the quickness.
7	Should be expanded and available for all teachers.	Love it.	nothing	Should be shared with others.
8	That I have to open YouTube.	Want it to be shared. Would be useful for other professors.	Change the way to enter the videos	Add a note section in the app – or else a way to keep notes about articles

Paper 5: Phase Two: Discussion

Phase Two of the study investigated whether professional development delivered using a mobile learning application could have a positive impact on the self-efficacy of teachers in Panama. To accomplish this, research questions were developed to investigate teacher interaction, usefulness of the learning application, and impact of the experience on professional practice.

The findings in relation to the three sub questions can be summarized as follows:

How do teachers interact with professional development delivered through a mobile learning application?

- Not all elements of a mobile learning application are universally used.
- Short, simple, videos, are more effective than longer, more detailed ones.
- Interaction with a mobile learning application increases over time.
- Over time, comfort with all resources increases.
- Videos are perceived to be more popular, useful, and impactful than articles.
- Videos used to deliver professional development are consistently popular over time.
- Engagement and interaction with the application is critically important to a positive experience.
- Cultural and linguistic context is important in the success of mobile learning applications.

How useful is professional development delivered through a mobile learning application?

- Professional development delivered through a mobile learning application is perceived to be highly useful by participants.
- Articles become more useful over time after participants interact with them more.
- User satisfaction of mobile learning application increases over time.
- Notifications prompt use of mobile learning application
- "Daily Thought" videos are a highly useful way to present concepts regarding effective pedagogical practices.
- Usefulness of "Daily Thought" videos increased significantly over time.
- Convenience of use is important in participant engagement and interaction with mobile learning applications.

What is the impact of professional development delivered through a mobile learning application?

- Professional development delivered through mobile learning applications can have a profound impact on teachers' professional practices.
- Professional development delivered through mobile learning applications can change and improve instruction.
- Professional development delivered through mobile learning applications can have a profound impact on teacher confidence with instruction.

A more detailed discussion of the findings follows in concert with the literature review conducted earlier.

Interaction with the application

Perhaps the most apparent global observation of the findings of this phase of the study is that they were very much aligned with the key concepts discussed in the previous review of the literature. This is especially true in the case of delivering effective professional development to teachers. The findings of the study clearly establish the fact that not all elements of a mobile learning application are viewed as equal by users. Each user interacted with the application in a different way, depending on the context of their personal and professional lives and the importance therefore, of allowing teachers choices in what and how they learn was determined to be a significant finding of the study and of previous literature (Darling-Hammond et al., 2009). Participants interacted with the learning application at different times, in different ways, and using different elements. But given this flexibility, interaction with the application remained high and even increased over time, confirming the previous assertion that professional development opportunities that are directly associated with participant's interests and needs are perceived to have a positive impact (Müller & Papenkort, 2013).

Associated with these findings, the results also highlighted the critical nature of engagement and interaction with the application for participants to undergo a positive experience. Again, this is aligned with our earlier review of the literature where we affirmed the importance of active engagement in delivering change (Darling-Hammond, Hyler, & Gardner, 2017), especially when there is an added complexity to the process based upon specific cultural or contextual influences (Calvert, 2016). Interestingly, the study concluded that it was those who did not interact with the application that reported a negative experience, but we did not find the same relationship between those who interacted

with the application the most and positive feedback. This suggests that, provided users interact with the material on a regular basis there is not necessarily an increased benefit dependent on spending longer time of interaction for each visit to the application. Indeed, research has shown that there is no linear relationship between the success of professional development experiences and the time spent within them (Kalinowski, Gronostaj, & Vock, 2019).

Despite this reality, the overall duration of professional development does make a difference to participant benefit according to the study. While the 90-day length of the study was a relatively short interval, a universal review of the findings shows that virtually every measure improved over time. Interaction with the various elements of the application, comfort with the research articles, 'usefulness' of the videos, implementation of professional development 'tips', and participant instructional self-confidence all showed significant improvement as the study progressed, as did the popularity of the application more generally. For years, educational research has asserted that the more time spent in professional development training, the more likely there is to be a sustained impact on teachers and their professional practice (Whitworth and Chiu 2015). Given this fact, the importance of the previously mentioned findings that teachers should have choice involved in the way they interact with professional development content, and the need for sustained engagement with the learning materials is magnified. Indeed, the findings of the study posit that it is likely to be the combination of flexibility of approach, consistent interaction, and continuous exposure that results in a maximized benefit for participants. In this sense, this study affirms Lloyd, Cochrane, & Beames's Characteristics of Effective Teacher Professional Development outlined on page 139.

The last of the most significant findings regarding participant interaction was the power of video as a teaching tool. Throughout the study the use of video was seen to garner the most interaction, be more popular with participants (especially when compared to research articles), be described as more useful, and have a greater impact on participant confidence and professional practice. Such findings compliment the discussion of professional development and ICT in the review of literature where it was argued that video technology can increase teacher motivation and shape classroom practice (Gaudin & Chaliès, 2015). It must be noted, however, that not all videos within the application received the same effusive response from participants. In fact, while the ratings of the "Daily Thought" videos remained consistently high, as participants interacted with articles more, so they stopped viewing the supporting videos. At the end of the 90 days of interaction most participants were watching the "Daily Thought" video and then supplementing this with the supporting articles as much

as the additional supporting videos. These findings underline the research of Marsh & Mitchell (2014) that highlights the power of video as a tool illustrate highly complex concepts in a simple and easily understood format. Given the cultural norms and individual characteristics of the participant pool (discussed in the methodology), this result holds the potential to be of particular importance.

The usefulness of the application

The overall findings of the study regarding the usefulness of the professional development delivered was that it was perceived to be overwhelmingly useful. Several participants reported that the "Daily Thought" videos were particularly useful because, *"there's always something you're going to want to use from each little video. It may not be the whole thing but there's always something or a technique you're going to learn."* (Participant #3, 90-days). The study also indicated that this usefulness was dynamic in nature, varying my participant, element of the application used, content, and type of application use. This was not surprising, given that research has shown that participants benefit most from differentiated learning experiences where they can modify and adapt content to meet individual needs (Hoekstra, 2009). Participants specifically valued the fact that the learning could be accessed whenever convenient, and that there were varying degrees of depth available outlining the concepts discussed from the simplified "Daily Thought" videos to the more complex research-based articles.

It was not simply the convenience of the conveyance of information that was appealing however, but also that participants could interact with the material in the comfort of their own time and manner. *"I can watch or read when I'm in medical appointments or before sleeping, which works so well for me."* As discussed in the review of the literature, this is a critical factor in the successful implementation of worthwhile professional development (Kucirkova, Messer, Sheehy, & Fernandez Panadero, 2014), but it is especially pertinent in a study that is directly linked to teacher self-efficacy. In view of a participant profile where more than 65% have no formal teaching credentials, and where 25% of the group have no qualification beyond high school, it is understandable that being able to access materials and reflect upon professional skills, or the lack thereof, privately is likely to be appealing. This aligns closely with the concept of teachers benefiting from accessing video materials when in a "cold" more thoughtful state (Roth, 2014). It also suggests that for professionals who may lack strong efficacy, the ability to benefit from a consistent infusion of guidance of useful practices without the need to do so in a potentially emotional state is welcomed.

The need for participants to overcome any potential sense of self-doubt was also important from the perspective not having to worry about the possibility that the information shared might be too complex to easily understand. Research has shown that some teachers face considerable challenges to their professional self-efficacy when asked to embrace technology into the learning process (Philipsen, Tondeur, Roblin, Vanslambrouck, & Zu, 2019) and that adopting new professional practices cannot be separated from the teacher's emotions in terms of confidence. (Bruggerman et al., 2020). Given the participant profile of this study, especially the fact that 75% of participants were veteran teachers, taking the time to allow them to become truly comfortable with the application and gain confidence in being able to successfully manage the content was of particular importance. *"The 'Daily Thought' I find wonderful because there's so much information that is summarized into 60 seconds and you can benefit hugely from. It's easy to understand and not overwhelming."* (Participant #7, 90-days). Allowing participants to interact with the application at their own pace clearly diminished their level of intimidation towards the content covered and the process as a whole.

Mirroring the findings regarding how participants interacted with the application, the concept of longitudinal time also plays a pivotal role in the perceived usefulness of the application. Once again, participants consistently reported increased usefulness of virtually all elements of the application the longer they interacted with it. Over time, participants learned how to effectively use the materials available to them, and as they did their perception regarding the usefulness of the way that they interacted with the content improved. As a result, participants tended to be more selective about which components they used, and in doing so they refined the experience to include only the elements that they believed most useful. "*I love it because it keeps you updated with information on everything, and you can use it any way you want. You don't have to search for information and study if you want to watch it or read it you can, and if not then you don't have to.*" (Participant #7, 90-days). This feedback aligns with the current research on the need for effective professional development using technology to be contextually sensitive and not administered in a situation vacuum (Gaudin & Chaliès, 2015). Giving participants control over both the timing of their interaction and the frequency of it was central to their positive reaction. Several participants reported that the primary reason for their belief that the "Daily Thought" videos were highly useful was the speed and simplicity of delivery. *"It's very useful because its quick info and one can take advantage of how quick it is between classes to study. Just take 5 minutes to take advantage of it."* (Participant #6, 90-days).

For several participants, specifically those who have had previous pedagogical training, the usefulness of the application was not necessarily in that it served as an introduction to evidence-based practices for the first time, but that it served as a reminder of pedagogical practices that may have been forgotten over time. Even so, the idea that useful concepts could be shared without the need to add a considerable burden on participant time was well received. Participants valued the usefulness of the fact that they could use the application *"like a review, something that we need to we can remember and reapply in our daily teaching."* (Participant #7, 30-days), and that the tips could serve to *"remind me of practices I have to bring again. You start forgetting these little circumstances that can make the class more creative and engaging."* (Participant #8, 30-days). At the same time, the application served as a roadmap of new practices for those participants who were encountering new classroom experiences for the first time, *"sometimes us teachers… we don't know it all and we have different kids every year. Each time, the situations vary, and you don't know what to do. And when you go to try them, perhaps not all of them work for you but many of them do and it is very useful; it gives you options"* (Participant #2, 90-days). It was precisely this ability to cater to the needs of the individual that resulted in a steady increase of satisfaction with the application over time. These findings, again, confirm our earlier discussion of the literature that asserts the importance of choice and the elasticity of interaction with new concepts when developing impactful professional development (Harris & Graham, 2017).

In support of this finding, the study also discovered that participants integrated interaction with the application into their regular routine, valuing the consistency of the usefulness of interaction and the sense that it had the potential to develop good professional habits. Participants valued receiving the daily notifications when new material became available with close to half of participants accessing materials when they received a notification by the end of the study. Some even customized the notification to ensure that they were reminded to respond. *"I have a special notification sound for it [the application], and sometimes I see it and I think "Nah I don't want to read it" but then I get the sensation that I have to read it. I always find some time to read it which is a good habit to have."* (Participant #5, 90-days). This was an interesting and somewhat unanticipated finding, given our earlier reference to the literature suggesting that, in Panama an ageing and technologically insecure workforce often suffer from a diminishment of efficacy when integrating learning with mobile technologies (Fraillon et al., 2014). Such a finding appears to support the premise considered in our review of the literature that importance of participant attitude towards the implementation of

technology in teaching and learning (Acker et al., 2011), and that the ease of use of the mobile learning application holds the potential to enhance user confidence with regular use (Delialioglu & Yasaman, 2014).

The ultimate outcome of note regarding the usefulness of the application was that the supporting articles, despite being the least popular element of the application, showed the most significant growth in terms of popularity and use by the end of the study. Initial data collected after 30-days showed the supporting articles to be the least used and least popular element of the application by some measure. *"The articles I just open and skim it. The ones I have opened, have been interesting but they require more concentration and time and space. They are useful, they show studies and research. It gives good examples and alternatives. But it requires more of my time."* (Participant #8, 30-days). The more participants interacted with the supporting articles, the more participants found them useful, especially when the simplicity of the "Daily Thought" videos detracted from the complexity of the concept discussed. *"I think the articles were the most useful part of the app. I haven't read them all but the ones that I have read are designed for easy understanding and offers the tools that one needs for applying what they are explaining. The "Daily Thought" had left me confused and with the article I was able to understand."* (Participant #8, 90-days). This suggests that participants invested more time in following up on the concepts covered in the initial "Daily Thought" videos the longer they interacted with the application. This outcome was especially interesting as several of the articles were originally written in English and so the majority of participants had to use a translating tool before they could read them. Despite this barrier, participants still accessed the articles increasingly more often over time confirming that they were more impacted the longer they engaged with the professional development materials (Whitworth and Chiu 2015).

The Impact of the application

While the perceived usefulness of application was an important facet of the study, the real measure of whether the application was effective was found in the data collected regarding its impact. The study determined that professional development delivered through a mobile learning application has a profound impact on both teacher instruction and self-efficacy.   Confirmation of the supposition that participants were positive about the impact of the professional development on their teaching practice was aligned with the discussion in the literature review that there is a good potential for professional development delivered through mobile platforms in low-resource school settings

(Hennessy, Haßler, & Hofmann, 2016). Participants were virtually universal in their belief that interaction with the application had changed or improved their instruction, regardless of whether the participant was a veteran teacher *"As I mentioned, it helps remind me of things that I had forgotten and could reapply in the classroom as well as newer things, and you can see it work."* (Participant #7, 90-days) or were new to the profession, *"I think I have improved. My instruction has a pattern but it's my style that has improved. What I have done is develop my style with the strategies and improved and polished to make it more sophisticated"* (Participant #6, 90-days). It is notable that the question "Do you believe the app has helped you improve or change your instruction in any way?" was one of only two questions that resulted in an unanimously positive reaction from participants with 100% highly positive responses. Given the unequivocal nature of this finding, the notion that a well-designed mobile learning application has the ability to have a significant impact on professional practice seems definitive.

Perhaps less anticipated were the results surrounding the impact on participant confidence. While our review of the literature revealed that some studies suggest that mobile learning has the potential to modify teacher attitudes and even professional behaviours (Liaw, Hatala, & Mei Huang, 2010), it also highlights the reality "that teachers in Panama suffer from a lack of comfort in the use of mobile technology where teacher preparation programs often lack the ability to train pre-service teachers to integrate technology into teaching and learning" (Holden, 2021, p.134. It was unexpected, therefore, that the second question that produced an unanimously positive response from participants was when they were asked "Do you believe the app has increased your professional confidence with instruction?" This data was further supported with a variety of interview comments citing specific examples *"For example, I have become more comfortable with the class structure. The way of beginning, developing, and closing a class. The closing of a class is usually complex because it's really important to have a well-structured close to each class. I've had to be more committed to this to achieve it. Now I recognize the benefits and it has worked."* (Participant #5, 90-days). Once again, the cross tabulation of data from all sources (survey & interview questions and open-ended comments) plainly indicated that the perception of participants was that interaction with the application had a positive impact on their teaching confidence, especially when it came to instruction.

A more detailed examination of the specific comments made by participants regarding the impact on their professional confidence exposes an interesting connection between interaction with the application and the original premise of self-permission from Phase One. More than one participant

commented on the fact that they felt that they were encouraged to try new ideas in the classroom and that they felt an increased sense of permission as a result. *"I feel like I am allowed to try new ideas in the classroom and that it is ok to do that."* (Participant #1, 90-days). Interestingly, the fact that the application allowed participants to connect with the experiences of other teachers, even though this was primarily through video testimony, also seemed to boost levels of self-permission. *"Already with my years of experience I can evaluate what we have been doing and it's nice to hear the videos and other experiences of teachers, how they manage and use it in the classroom. It's interesting and practical. I can learn from them and be brave to try this in my own classroom. I would not do this before."* (Participant #4, 90-days). This finding appears to confirm the notion discussed in previous literature that teachers benefit from learning experiences that are cooperative in nature and especially when they can connect with others about common experiences (Darling-Hammond, Hyler & Gardner, 2017). What has not been discussed previously is the bearing that interaction with other teachers might have on teacher self-efficacy or even self-permission. It is apparent that in this study participants benefitted from the belief that interaction with the application and specifically hearing the experiences of other teachers gave them the confidence and permission to try the same strategies in their own room.

Professional development, mobile learning, and self-efficacy

Having considered the critical findings of each of the determined sub-questions, the discussion of the findings would not be complete without returning to the primary research question for this phase of the study: can professional development delivered to teachers using mobile learning improve the self-efficacy of teachers in Panama? Using the stated definition of self-efficacy in Phase One, that self-efficacy belief is dependent on the four interrelated sources of mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1997), direct connections can be made to the previously discussed findings. Each of these concepts within this definition can be directly associated within the data collected, namely that participants described gaining a sense of mastery experience from the "Daily Thought" videos, a sense of vicarious experience from the supporting videos and articles, a sense of verbal persuasion from the supporting videos, and a sense of emotional arousal from interaction with the application leading to a successful change in professional practice in their classroom. This progression of positive psychological development coupled with the fact that previous literature indicates a cyclical relationship between self-efficacy and innovative teaching

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practices (Kavanoz, Yüksel, & Özcan, 2015), led to an increasingly positive impact on participant levels of self-efficacy. In simple terms, participants gained useful tips from interacting with various elements in the application, implemented some of these practices successfully and as a result trusted that the same process had the potential to work well for them in the future. This repeating sequence resulted in enhanced levels of self-efficacy.

As discussed within the review of the literature in Phase One of the study, mastery experiences tend to be the most influential source of self-efficacy (Kang & Cavanagh, 2018), and as such formed a pivotal role in developing participant belief in both the application as a source of useful practices, and in their ability to convert concepts covered into real classroom practices. Participants consistently reported the "Daily Thought" videos as being the most useful element of the application, and a consistent source of practical tips that guided their instruction. *"Every time I see one, I learn or remember something."* (Participant #3, 30-days). They also indicated that many of these tips were then successfully implemented in one way or another, *"I put into practice the things that I had forgotten or stopped to do with the routines… They have worked. At times good at other times not so well but they have worked."* (Participant #5, 30 days). It is in this precise process that mastery experiences are created, and as a result, that the level of self-efficacy of those involved is positively impacted.

The supporting videos and to a lesser extent the supporting articles also proved to be good sources of both vicarious experiences and verbal persuasion for participants, two other key factors in the development of strong self-efficacy. Participants consistently reported the power of listening to their professional peers and how persuasive the recounting of their experiences were. *"I have seen all the supporting videos. The articles not all, but yes, the videos I do watch. I find them all super interesting. Each one has their own story - I love one where the teacher talks about giving each student a magical stone and it's a way that the students to work more quietly than others. I loved that tactic. It's almost like a game but really works!"* Similar to the "Daily Thought" videos, this testimony clearly encouraged participants to try implementing various strategies, and especially when this resulted in a successful teaching event, this also enhanced the sense of self-efficacy.

Lastly, the process of interacting with the application as a whole, was determined to be useful and worthwhile for participants and therefore created an overwhelmingly positive perception within the group. The preceding discussion of the research sub-questions consistently demonstrates that the vast majority of feedback was of a positive nature, and therefore participants described the process as encouraging and progressive in nature. The existence of this aura of affirmation and optimism was

contagious across elements of the application and members of the group over time, resulting in a very positive emotional connection to the application. This passionate association was evident in the comments of several participants eager, not simply to benefit from the application personally, but also to share it with others. "*Fabulous, I love it! I haven't just stayed with that I have read. I have shared it with other teachers; I show them and talk about how we are using it and how we can continue to achieve improved teaching.*" (Participant #4, 30-days). The lessons gained were also not limited to the classroom, *"it is very useful, I apply it, I apply it in a personal way with my son, I can say I love it and apply it."* (Participant #4, 90-days), but also expanded into the personal life and tutoring experiences of some participants. Again, it is in these authenticating comments that it becomes apparent that participants gained a sense of emotional arousal from their experiences with the application.

Given these conclusions, a strong argument can be made that the results of this study align precisely with each of the identified fundamental influences theorized posited by Bandura in the 1970's. Indeed, the preceding descriptive analysis confirms much about the concepts that serve as the foundation for what we have come to understand about self-efficacy. While the analysis of the data collected from the questions that specifically asked participants whether they perceived that their confidence with instruction had been positively impacted were unequivocal (100%), these indirect confirmations of the same findings serve as an important corroboration and add significant and independent credibility to the results. The ultimate conclusion, therefore, is that professional development delivered to teachers using mobile learning certainly has the potential to improve the self-efficacy of teachers in Panama.

Limitations of the Study

There are several limitations to this phase of the study.

The primary limitation of this phase is the small sample size. With such a small participant pool (n=8), the prospect of assuming a false premise is always legitimate. As a result, despite the best efforts of a well-designed methodology, the external validity of the results is limited, and the reliability of the findings should not therefore be generalized to a larger population without recognition of the fact that such assumptions could be problematic.

The fact that the participant pool was restricted to teachers form one school also potentially limits the validity of the findings for a broader context. Considering this narrow scope there is an increased possibility for the findings to be influenced by volunteer response bias, since each

participant had previously volunteered to be a part of the program and so may represent a skewed opinion of the overall experience. At the same time, even though the participant pool was the result of a thoughtful screening process, it is difficult to imagine that their lived professional experiences are representative of all schools in Panama. Consequently, any attempt to scale the findings to be representative of anything other than a small-scale Case Study would be unwise.

The geographical location of the study also has a bearing on the external validity of the findings. Since all participants live in Panama City, the capital city of Panama and certainly the most advanced urban centre in the country, the resources available to participants are unlikely to be equal to those in more rural or marginalized communities. As a result, challenges such as access to mobile technology, wireless coverage, available classroom resources, and even personal circumstances (travel time to work, financial ability to purchase data plans, etc.) are unlikely to be experienced in the same way. This is of particular importance given the initial intent of the study was specifically designed to consider teachers who work in precisely those communities. For these reasons, it would be unwise to assume that the participant pool should be considered typical of Panamanian teachers in general.

As mentioned in the introduction, the possibility of cross-cultural misinterpretation was another prospective limitation of the study. As the study was bilingual in design and important contextual data was collected verbally, there was the possibility of misinterpretation of comments, both in the process of recording the precise meaning attributed to remarks made, and the process of transcription. In addition to the possibility of this linguistic misunderstanding there is also the possibility of a cultural misreading of the intent and connotation of participants words. Significant measures were taken to mitigate this possibility using qualified Panamanian translators, working from actual recordings of each participant interview, nevertheless acknowledgement of the capacity for precise meaning to be lost in the process is very real.

Lastly, the fact that participants worked in the same school as the lead researcher also holds the potential for there to be an adverse bearing on the objectivity of feedback given. It is certainly conceivable that participants may have been influenced by the concern that there may be an undesirable professional outcome depending on the type and voracity of feedback given. As discussed earlier, several steps were taken to lessen the likelihood of this including a comprehensive selection process to ensure that no participants were in any way supervised by the lead researcher, that all data collection was anonymised, and that all data collection took place through a third-party proxy, known to participants. Safeguards were put in place to protect participant confidentiality, identity, and

privacy. Nonetheless, the potential of undue influence should be considered when contemplating the findings.

In the face of these limitations, the case study design, despite traditionally struggling with issues of reliability, validity, and generalizability, allowed the completion of a valuable insight into a real-life educational innovation. The ability to capture multiple sets of data from participants permitted the examination of the mobile application from a variety of perspectives to develop a well-rounded understanding of participant interaction and improved practice. Additionally, the scope and integrity of the analysis of the data added credibility to the findings discussed.

Since the research questions were infused with personal and professional opinion and perception, the study offers valuable and authentic insight into human behaviour and the breadth of the descriptive analyses allows for the development of a comprehensive understanding of the situational and cultural context of each participant and the manner in which they experienced the mobile application. Rather than serving as a scientific series of proofs, the value in this phase of the research lies in the detail of the multi-dimensional image created, and the ultimate value of the study is established in the application of the findings by those who read it.

Paper 6: Reflecting on the implications for future research

There are several areas of rich development using the research completed in this study that are dependent on the proposed motivation for further study. I would propose that additional studies would be well placed in seeking to expand the comprehension and validity of the present study, developing additional insights into the role that positive psychology plays in teacher quality and especially performance, and in more closely defining the key attributes of media use in mobile learning applications.

Arguably the most evident involves increasing the scope of the research to include a far larger and more diverse pool of participants. Considering the original inspiration for the study, the desire to determine whether mobile learning applications can effectively deliver professional development to teachers from rural and/or marginalized communities remains the foremost option. There is a natural progression, therefore, to confirm the findings with research of a much larger magnitude. Using the mobile application (or a similarly developed option) with a larger participant pool similar to Phase One of the study (500 teachers from 6 different regions of Panama) would allow for further and more generalizable research to be completed. While the findings of this study report the significant potential of using a mobile application to deliver impactful professional development to teachers, it is necessary to determine if these results are consistent when implemented on a far greater dimension and for teachers who experience vastly different teaching environments. The potential for comparative data to be collected from the size of the pool of teachers used in Phase One, would also allow for considerably more analyses to be completed, specifically researching the relationship between teacher experience or teacher qualification and impact of the application. Additional data could be analysed to breakdown understanding even further using the demographic categories of gender, age, nationality, etc.

In addition to the magnification of the scale of the research study, there is also more work to be done in terms of the scope of the data collected, if our original intent is to be fully realized. The findings of this study clearly indicate that, at least on a small scale, professional development delivered through a mobile learning application can have a profound impact on the classroom practice and on the self-efficacy of the teachers involved. Ultimately, however, this body of research does not measure any potential impact on the learning experience, nor any potential learning gained by the students of these teachers. Any definitive measure of success should also include a link to positive learning gains for students if the mobile application is to be seen as having the potential to result in an improved educational experience for students. Further studies that focus not only on teacher

perceptions of the value of the application, but also on student perception of what the delivered professional development resulted in for them as learners, would be an opportune extension of this study.

It is not simply the scope and quality of the research, nor the ultimate determination of the impact on student learning that hold promise for future study, but also the actual construction of the application itself and the conceptual framework that it is based on especially in terms of the understanding of effective professional development. In this sense this study serves as a starting point for the development of an effective mobile learning application though not necessarily a sustainable long-term, culturally integrated option. Throughout the study specific focus was placed on the importance of completing research that was culturally sensitive and that had genuine worth across the Latin American region, and in the country of Panama. From the detailing of the translation of all materials, to the development of two complete sets of "Daily Thought" videos (including regionally appropriate photos, language, and soundtracks), to the use of a Panamanian, native Spanish speaking proxy, every effort was made to diminish the limitations of me as a researcher who was not a native of the region or local culture. Given this importance, there remains a scope work to be done to ensure that the construction of the content and the development of each element of the application is similarly aligned.

The reasoning for the mobile application to be developed by an external team for this specific study is understandable given the specific context of the education system in Panama. Considering the earlier discussion surrounding the lack of quality teacher education programs and the statistics outlining that the limitation of expertise within the body of professional educators in Panama, the likelihood of a high-quality application being developed locally was clearly relatively low. As might be expected, the desire to ensure that the mobile application was constructed using Lloyd, Cochrane, & Beames's (2005) Guidelines for Effective Professional Development (page 125), led to the conviction that a controlled and expert-driven process was optimal in this particular context. This situation was further exacerbated by research indicating that many teachers in Panama lack both confidence and expertise in the use of technology within the learning process (OECD/Meduca, 2017). significantly increasing the possibility that the result might not be well-developed nor consistent in quality leading to a detrimental impact on participants (Tomlinson, 2014). Accordingly, a pre-packaged approach to the creation of the content of the professional development tool presented the greatest potential for success.

Despite this reality, such an approach is not generally ideal in the creation and delivery of high-quality professional development and, as such, this study serves as a springboard for a future design where the process is considerably more inclusive. Throughout the literature reviewed regarding effective professional development the importance of the process being teacher led was highlighted, stressing the fact that for effective learning to be consistently experienced material needs to be co-constructed with those who understand the purpose and contact of the professional development (Kalinowski, Gronostaj, & Vock, 2019). Ensuring that the content is designed from teacher-led initiatives also allows for the process to originate from a local level and therefore have a heightened relevance to those for whom it is designed (Lotter, Smiley, Thompson, & Dickenson, 2016). Additionally, such an approach increases the cultural connection and relevance (Calvert, 2016), as previously mentioned a critical component of a study of this type.

Consequently, there is solid potential for investigation of a mobile application like "An Apple a Day" where the specific content is co-created at the local level. This would be especially applicable in the creation of the "Daily Thought" videos as well as the supporting videos and articles selected as additional resources within the app. A study of this nature has the potential to provide an increased cultural integration into the material presented framing the focus for teachers by colleagues who are likely to have a better understanding of their real needs. The increased authenticity also has the capability to establish greater sustainability of the mobile application, especially if the images, text, and music could be shaped to be specifically representative of the schools in which participants work.

On a personal level, while I fully acknowledge that the study did not show the concept of self-permission to be of significant consequence to the teachers surveyed in Phase One, I remain convinced that it has the capacity to be a central element of future research in this area. In light of what is known about the role that self-efficacy (and associated concepts) has on teacher performance, and especially given the research on the significance of teacher attitude and belief set on the long-term effectiveness of professional development programs, the need for more data to be collected on the cultural and contextual influence on teachers is imperative. Having experienced a highly structured and hierarchical social construct for the past several years, there is little doubt in my mind that there are specific cultural factors that influence any attempt to improve teacher quality. Most notably, additional research into the role that cultural influences have on the positive psychology of teachers would be substantially beneficial to understanding how this could possibly be impacted using mobile technologies. It was not surprising to me that feedback from the participant interviews referred to

feeling that they were "allowed" to try new strategies in the classroom, and that identifying with the experiences of the teachers involved in the videos helped them be "brave" enough to adopt similar approaches. The use of such terms indicates a permission as much as they do efficacy and reaffirm the potential importance of self-permission as an influencing factor in teacher positive psychology.

Aligned with the notion of teacher self-permission, Claude Steele's research into the concept of stereotype threat holds equal promise in helping further our understanding of teacher quality in Latin American culture, and consequently how a mobile learning application might be of use. Indeed, in hindsight, stereotype threat may have been a better conceptual framework to have coupled with self-efficacy than self-permission in that it specifically focuses on the cultural factors impacting performance and acknowledges that situational dynamics are likely to amplify influence on professional performance. Moving forward there is a need for research designed to investigate how societal structure might be linked to the creation of a form of stereotype threat that impacts teacher performance in some communities. This, in turn, could then be the focus of the creation of a mobile application to address issues contributing to decreased teacher performance in the classroom.

Lastly, from the perspective of furthering awareness of the design of effective mobile learning applications, research that focuses on the specific elements of media and video that were so appealing to participants would be beneficial. The present study clearly demonstrates the effectiveness of using video to explain complex concepts with clarity and simplicity. It also highlights the potentially negative impact of using complicated written articles as an effective source of material for teacher professional development. If our findings are accepted at face value, the obvious extension in terms of the design of mobile learning applications is to determine the precise elements of the created videos that were impactful. In our study, each video was created with several key components - culturally appropriate music, images, simple text, quotes, references, etc. but no data was collected on which of these elements were perceived to be the most useful and/or impactful. A study that focused on which of these key elements, or which combination of elements, creates the best understanding and intellectual connections for learners would be of significant use moving forward.

Section Four: Epilogue

Paper 1: Reflecting on "An Apple a Day" and COVID19

This section reports on an unanticipated and exciting series of developments that followed up my research and extended its benefits and impact on educational practice on a much larger scale. On Wednesday, March 11, 2020, Maruja Gorday de Villalobos, Minister of Education for Panama, announced the temporary closure of all schools in Panama due to the COVID19 outbreak within the country. At the time, this unprecedented suspension of schools was anticipated to last until April 7, 2020, but as of the writing of this postscript (April 5, 2021), the Panamanian school system has remained totally closed. Indeed, at this time, Panama has kept schools closed for more days than any other country (UNICEF, 2021), a situation that has and continues to cause considerable challenges for the entire country.

The immediate issue facing the country in March 2020 was how to design, create, and implement a system of education that could be delivered virtually when little or no existing infrastructure was in place and where almost every matrix for efficient transfer of methodology was deficient. The fact that Panama follows a school calendar formatted for the Southern Hemisphere also added to the intensity of the problem. Students in Panama break for a summer vacation in mid-December and return to class to begin the new school year at the beginning of March. This resulted in students returning for the 2020 academic year for only eleven days before classes were suspended (It should be noted that this has caused a reality that has effectively required students to learn from home since December 2019 – more than 16 months).

As a result of these circumstances, and the fact that the Albert Einstein Institute has a reputation as a leader in Blended and Hybrid learning in Panama (I am the Executive Director of the Albert Einstein Institute), I was contacted by Dr Julio Escobar, the National Advisor of Education to the President of Panama, to discuss how the Institute was managing the delivery of online classes, the findings of my research surrounding teacher self-efficacy and the data collected as a result of the use of the "An Apple a Day" application. Dr Escobar was especially interested in whether or not the participant sample was representative of the teaching population in Panama, and therefore if the data could be used to support decisions regarding teacher comfort in working with mobile technologies. Subsequently, I was invited to become a member of the Ministry of Education Advisory Committee in

Pandemic Management and later named as a Special Advisor to the Minister of Education for online and digital learning (see Appendix K). In this role, I have spent the last 15 months leading several of the pilot programs used to define the parameters for the virtual operation of all public schools, leading a team reviewing the national synchronous/asynchronous learning guides for the country, and as a part of the working committee charged with the development of national protocols for the safe re-opening of school campuses.

While these opportunities for personal growth are a source of professional pride for me, they also afforded me the prospect of further developing my research, and especially in being able to extend and enhance the scope of the data collected in Phase 2. The most significant adaptation and use of the "An Apple a Day" application arose from the experience of leading two of the national pilot programs, designed to outline the challenges and opportunities with transitioning public schools to an online delivery system. This transition was especially challenging given the fact that at the beginning of 2020, 38% of the population self-reported not having regular internet access at home (Hootsuite & We are Social, 2020). Indeed, initial informal statistics suggested that 50% of students only had access to either television and/or shortwave radio coverage as a potential medium to deliver educational content. Mirroring this inequality, a parallel reality was evident in both the educational resources and teacher expertise between the most financially stable districts and those that exist in significant poverty. Similar statistics suggested that teachers did also not have consistent access to the internet nor the devices that were necessary to teach their classes remotely. Even in the cases where these resources were available, it quickly became evident that teachers lacked the confidence and skillsets to deliver high quality online classes. These numbers were also significantly imbalanced across the country with some rural populations, especially indigenous communities, relying solely on an often unstable shortwave radio connection and other communities with little or no reliable broadband coverage. It was apparent that any scalable plan could only be developed after the identification of the most critical factors in delivering education online within an individual community context. We therefore started several pilot programs that could be conducted across the entire country and encompassing each of the provinces.

National pilot programs for online learning

The two most significant pilot programs that my team led involved two separate school campuses. Firstly, we were asked to prepare the Instituto Profesional y Técnico Don Bosco for virtual

classes (Figure 31). This campus housed two technical schools with more than 2000 students, on a rotating schedule with one school community taking morning classes and the other afternoon sessions. Both schools taught secondary aged students and offered a regular core curriculum as well as a technical curriculum specializing in construction, air conditioning, plumbing, and auto mechanics.

Figure 31: News coverage of national pilot program at Don Bosco Technical School,

The school campus was situated in the district of Versalles, 29 kilometres east of Panama City, and had a total teaching staff of approximately 120. While the school had some access to technology it did not have a staff that was comfortable utilizing it in the learning process in their regular classrooms. Similarly, students did not use technology in their learning on a consistent basis, though the majority had access to one or more mobile technology device at home. As a result, the scope of the pilot design was to develop an online platform of learning for all grade levels, deliver professional development to the teachers regarding effective practices for synchronous and asynchronous learning, and incrementally opening the school for online education over the period of 4 weeks.

The second of the pilot programs involved the Escuela Manuel Jose Hurtado, a primary school in a highly economically challenged community of El Chorrillo in Panama City. This pilot primarily involved a very similar scope to the original but required the additional creation of an online school Moodle platform that could serve as a school template for classes and coursework that could be copied and edited for scalability with other similar schools across the country (Figure 32). In this pilot, given the economic challenge for most families, some students were provided access to affordable mobile devices to access their work, and several internet hubs were established in strategic locations to allow for students to connect and update their learning tablets at no cost, when necessary. Those students who were not able to access such devices were provided with printed materials that were distributed and collected via local community Tiendas (food markets).
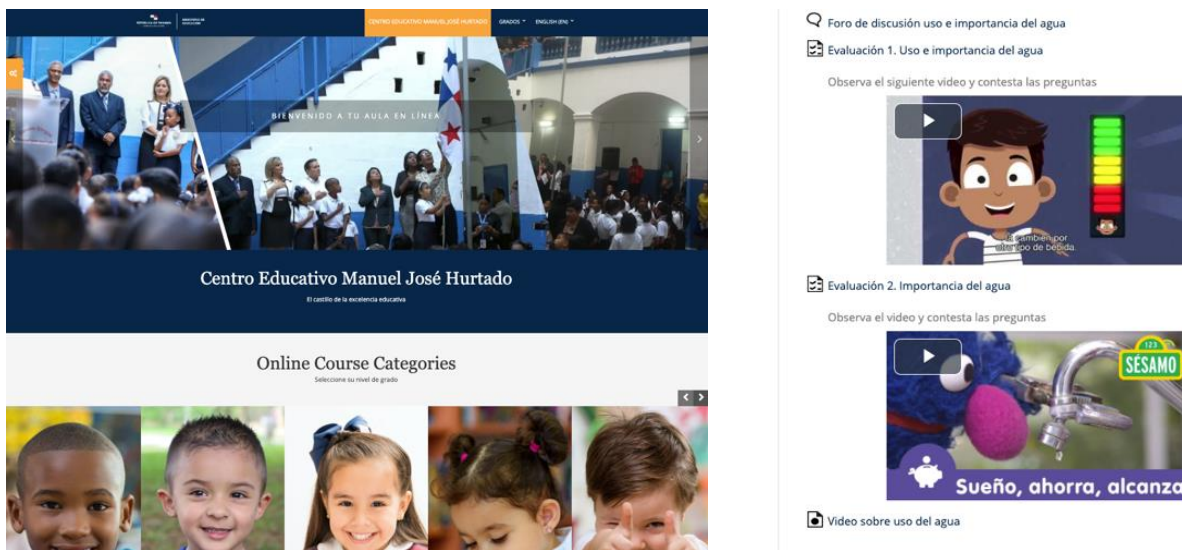
Figure 32: Moodle Mobile learning platform, Escuela Manuel Jose Hurtado school

Once again, the project required the professional development of all staff, not only in the practices of online teaching and learning but also in the platforms to be used and the best ways for teachers to plan, deliver and grade student work in both synchronous and asynchronous learning environments. The other significant element of this pilot was to determine whether the school could be opened after an intensive and immersive professional development program for teachers of only two weeks – in the hope that this process could then be replicated and scaled to allow for a rapid opening of schools for online learning. Given this reality, it was quickly determined that such a scenario provided a genuine opportunity to test the usefulness of the "An Apple a Day" application in an unfiltered and "real world" setting.

As a result, we decided to develop two more months of material for the "An Apple a Day" application, specifically to address issues surrounding teaching and learning in a virtual environment (Figure 33). The approach taken to create the materials for Phase 2 was replicated using "Daily Thought" videos, supporting videos, and supporting articles made available to teachers across both pilot programs in the first instance. The application was also utilized as a part of the professional development process for each program, both as a learning application available on mobile devices and accessible via the An Apple a Day website for integration into the actual instructional sessions by trainers as required.
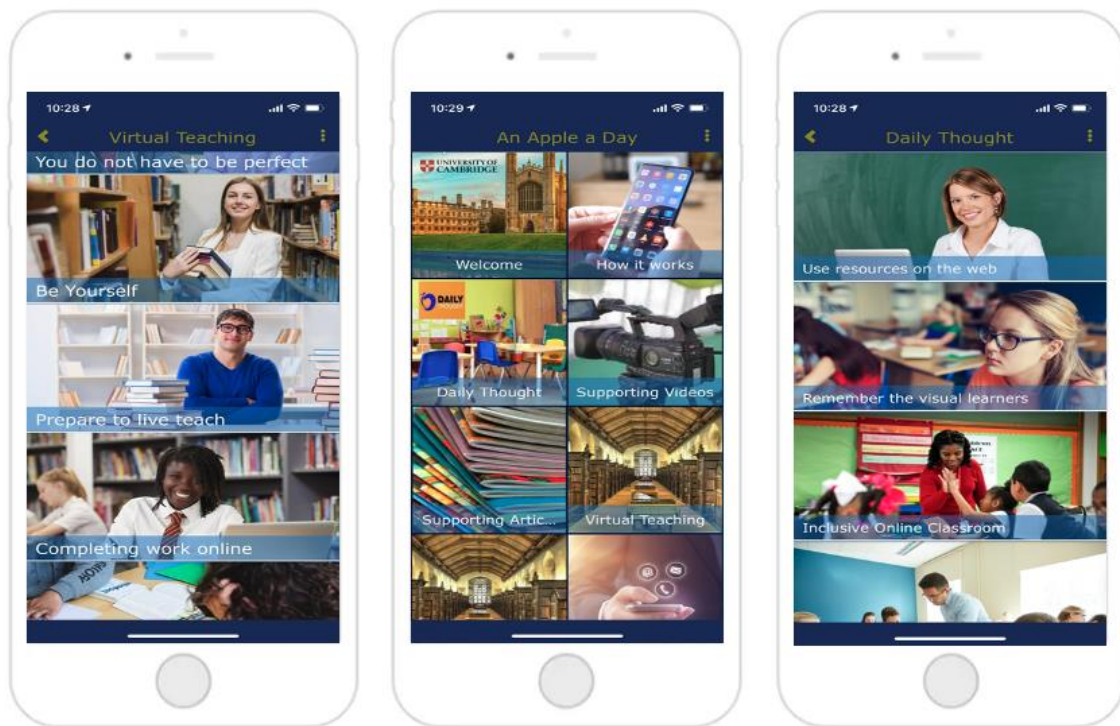
Figure 33: Additional "Online Learning" content – An Apple a Day.

The decision was made not to collect formal data from the new pilot programs in terms of completing participant surveys or interviews. At the time, it was determined that the learning curve for teachers in the pilots was already a significant cause of personal stress, and any additional burden that was not absolutely necessary should be avoided if at all possible. At the same time, there was a belief that being able to introduce the application as optional support for teachers without encumbering them with the need to become a part of the formal research project might allow for (unscientific)

observations to be made regarding interaction with the application that was not subject to some of the limitations of the original study. More specifically, we hoped that allowing the application to be used in this manner would add additional perspective to our initial findings, as the previous limitations regarding the small sample size, the fact that participants all derived from one educational institution, the limited geographical location of the sample, and the potential influence of the researcher, were all significantly diminished in this new context. Subsequently, the application was offered to all teachers involved in the pilot programs, with an explicit instruction that they would share the link with other professionals if they wanted to.

Perhaps the most pleasing aspect of integrating the application into these professional development exercises was that, unlike Phase 2 of the study, I was able to witness the application being used in a totally unfiltered environment, and with the group of teachers envisioned in my original motivation to conduct research. The group of professionals that we were able to work alongside in each pilot represented a defined microcosm of the larger population that served as the original inspiration outlined in the introductory section of this dissertation (Figure 34). The teachers were motivated and dedicated to the process of professional growth required to

Figure 34: Online teacher professional development using mobile learning techniques.

deliver a high-quality learning experience for their students but were hampered by many of the challenges outlined in Phase 1, including a lack of experience using mobile technology, inadequate availability of devices and internet access, low self-efficacy in online teaching, and a lack of formal pedagogical training.

Interestingly, the feedback received from those who used the application in these pilot programs, though nothing more than anecdotal and informal at best, echoed many of the findings of

Phase 2. Participants spoke to the fact that the "Daily Thought" videos were significantly more convenient and useful than the longer supporting videos and articles. Feedback to the team leading the projects indicated that the "Daily Thought" videos made teachers *feel* better about making a conscious effort to try to change or improve their teaching practice, especially when it came to the online delivery of content. Consistently, teachers spoke of the importance of the simplicity of the videos and the fact that they could access them at any time and as many times as they wanted/needed. Unlike the findings of Phase 2, teachers actively chose to use the videos as a prompt for further discussion with colleagues, of what and how to teach using mobile technology. Indeed, teachers reported that the information gathered from the "Daily Thought" videos became a source of cohesion, connecting teachers with a shared purpose and serving as a point of reference for further discussion and clarification. They also appreciated being able to get a quick review of key teaching practices for online learning to serve as an opportune supplement to the more robust professional development delivered in the intensive timeframe prior to the school opening in a virtual format. Many testified to the fact that they preferred to learn about what was important to know about virtual teaching using the application rather than to ask questions in the formal training sessions as they did not want to appear foolish in front of their colleagues. As previously mentioned, though only valid as a casual inference, this pragmatic use of the application certainly appeared to corroborate and even endorse the earlier findings on a broader scale.

In this sense, it was the unintended postscript to the study that has been the most fulfilling element of my research experience to date. To be able to observe cheerful, animated discussions and intrinsically motivated exploration of concepts introduced in a "Daily Thought" video was a genuinely uplifting experience. While these observations are nothing more than anecdotal, they served as a powerful endorsement of my original premise – that a well-designed mobile learning application can be used to infuse complex pedagogical practices in a simple and beneficial manner to professionals who may well be sceptical of the worth of such an endeavour and their own ability to grow professionally as a result.

Beyond the pilot programs

Following the completion of the two pilot programs in early June 2020, I was invited to give several presentations regarding the findings of the pilot programs, one of which led to a request for the application to be shared more comprehensively. Specifically, a couple of school districts in the United

States and several additional international school colleagues requested that they be able to use the application to share the resources regarding teaching and learning in a virtual environment. Even though there was no intention to update or add to the content of the

An Apple a Day – English application

Line Chart	Map Chart	Interaction by country (Total countries = 49)	
		United States	78
		Costa Rica	10
		Egypt	20
		India	26
		Panama	399
		United Arab Emirates	43
		United Kingdom	51
		Other	308
		Total	**935**

La Manzana del Dia – Spanish application

Line Chart	Map Chart	Interaction by country (Total countries = 9)	
		United States	28
		India	3
		Panama	786
		United Kingdom	6
		Other	176
		Total	**999**

Figure 35: An Apple a Day usage dashboard

application until such time as this dissertation was completed, the decision was made to grant access to anyone who desired to use the application provided they understood the incomplete nature of it.

To date the "An Apple a Day" (English version) application has been accessed by over 900 individuals from 49 countries around the world, and the "La Manzana del Dia" (Spanish version) application has been accessed by close to 1000 individuals from just 9 countries (Figure 35). Naturally, the vast majority of these users are from Panama (1185 users, 61%), but the extent of the global interaction was another benefit deriving from the extended use of the application – an occurrence that was never originally planned. Additionally, the An Apple a Day accompanying website has been accessed more than 500 times over the past 12 months from similar geographic regions of the world. In each of these cases the user traffic clearly indicates a tendency to interact

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primarily with the "Daily Thought" videos, and especially the archived materials from the original three-month development of content.

Finally, following my recent presentation at TEDxPUNTA PACIFICA (see Appendix L) I was approached by two separate organizations with a view to the possibility of creating a more comprehensive and expanded version of the application for teachers. While conversations are at an early stage there is good potential for at least one of these ventures to move.

Section Five: Conclusions

Paper 1: Implications and Reflections

Now that I have arrived at the conclusion of the research process reflecting on the strands that connect each phase, the significance of the academic journey taken has increased personal importance. In the introduction, I spoke of a personal paradigm of learning that separated, or at the very least, categorized, the various phases of study as "discrete academic progressions". This approach resulted in the production of a series of papers that, while aligned, tended to be self-contained in nature. Nevertheless, the connection between teacher perception of self-efficacy in Phase One, and the elements of the mobile application that were identified as both useful and impactful on professional practice in Phase Two is evident. As the study progressed there was a merging of the theoretical and practical aspects of the research journey. Subsequently, several global inferences can be made that highlight several key reflections and that have the capacity to shape future research in the field. These include the importance of the very structure of the professional degree process, the critical nature of cultural language in the development of successful professional development, the emergence of stereotype threat as a better alternative to self-permission in understanding teachers' perceptions of their own professional performance, and the potential power of the concept of the "An Apple a Day" application beyond the delivery of professional development to teachers.

The importance of a Professional Degree

One of the most compelling realisations following the completion of this research process has been the importance of the very configuration of the professional degree process. Aligned to the research paradigm for this study, the professional degree is founded on a pragmatic view of the world, where learning is embedded in real human experience and where dynamic learning activities lie at the heart of practical applications that are social and human. This paradigm served to support the study on a variety of levels most notably linking to the cultural context of Panama where the societal reality that teachers find themselves in often requires a focus on the immediate practical realities of any given situation. The design had both the notion of classroom application and the perceptions of professional teachers as central driving forces behind the shaping of both phases, rather than having an essential focus of research alone. Given this foundation, the power behind the research design was evident in

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that it allowed for meaningful research to be conducted in a culture where there is significant professional stratification, by ensuring that there was tangible relevance for each professional layer. In simple terms, the study positioned the highly contextualised needs and beliefs of teachers at its nucleus.

This was also echoed in the nature of the research construct itself, in that a professional degree places an emphasis on the development of studies that have direct relevance to the educational or workplace setting (Buss & Avery, 2017). The introduction outlined the inspiration for this study as being a desire to positively impact the complex and challenging issue of improving teacher quality, especially for those professionals who have not benefited from comprehensive pedagogical training. This was especially evident in Phase 2 of the study where there was a conscious effort to design an application that served as a conduit between the collection of effective evidence-based practices and the everyday reality of classroom practice. In this element of the design, importance was placed on ensuring that teacher perceptions of useful professional development were prioritised over the need to fully develop the full complexity of the concepts raised. The practical nature of classroom learning was the filter through which the more research-based practices were viewed. As a result, Phase 1 of the study was shaped by the perceptions of teaching professionals and not the known procedures that lead to good classroom practice. I would contend that this participant-led approach allowed for an increased cultural and contextual sensitivity, critical factors in developing successful teacher professional development programs (Haßler, Hennessy, & Hoffman, 2020). It was meaningful therefore, that the pragmatic and practitioner-based approach of the degree served as the catalyst for a design founded in realism and was a close reflection of the actual study itself.

As a direct result of this approach, this study serves as a reminder of the power of the professional degree. The need to seamlessly link academic theory with practical application has never been greater, especially in areas of the world where such evidence-based practices are lacking. This does not give a complete panorama, however. My journey through this research project also highlights the complexity of the challenges faced by those who seek to complete professional degrees while remaining active in the professional field. Finding the time, energy, and resources to maintain an appropriate academic space in which to learn, alongside and integrated into a professional working environment can be truly testing. Unlike its full-time PhD counterpart, the part-time EdD has the added dimension of being a body of work that is often completed in combination with significant other responsibilities and duties, and as such does not always allow for the consistent concentrated focus of

the researcher. There has been good movement toward a greater recognition of professional degree programs in recent years and, especially in diverse and economically challenged settings, where access to funding and time regularly discourages those with genuine potential from believing that they can successfully navigate such programs. A concerted effort must be made to continue to create such spaces for the profession to benefit from their expertise and talents. Only if this can be thoroughly achieved can we unlock the potential of the many professionals who do not feel that the world of advanced academic study is compatible with their personal circumstance and abilities.

The relationship between language and self-efficacy.

While the reasons for the divide between the pragmatic construct of professional teaching and the more theoretical environment of academic research are highly complex, they are often situated in academic language and, in the case of this research study, its impact on self-efficacy. This influence is heightened further when combined with an economically challenged cultural context such as Panama. Considerable work has been completed in recent years examining the important role that linguistic context and tone plays in the effectiveness of instructional communication. Perhaps, more importantly, this research has also exposed several powerful misconceptions regarding the perception of "academic language" required to be successful in the process of learning.

While recent studies have demonstrated that academic language is not a prerequisite for learning and that it is often established concurrently with learning rather than consecutively (Heineke & Neugebauer, 2018), there remains a strong conviction among professionals that is not the case. In fact, for many, academic language is deemed to be removed from the social language that permeates their daily lives, and as a result is often associated with professional academics – a category of learner that they do not immediately identify with (Heineke & Neugebauer, 2018). This study confirms earlier research suggesting that a deficit-viewpoint exists within teachers, especially in low-income communities, where there is the belief that a teacher's lack of linguistic resource and mastery leads to a diminishment of self-efficacy (Heineke & Neugebauer, 2018). The result is the development of professionals who do not feel that they have the depth of academic vocabulary required to complete advanced academic study. It also highlights the fact that teachers often feel that the vocabulary used in research does not easily relate to their own experiences. This perception, especially when coupled with the pressures of limited time, money, and resources discussed in the previous section, generates an

avoidance and procrastination towards continuing learning opportunities as professionals worry that they are not capable of, and/or interested in, benefiting from them (Choi, 2020).

It is important to remain cognizant of the fact that teachers, especially those with limited formal pedagogical training, are not always comfortable seeing themselves as academics. Accordingly, many do not connect easily with the technical and formal language often associated with professional development. These same professionals, however, do not shy away from learning experiences that are tailored to meet their specific needs, specifically when complex concepts are presented in a social context and non-threatening manner. Indeed, one of the most evident associations for future research is that the development of high-quality learning experiences delivered in a simple and convenient way, are universally described as useful and are embraced over a prolonged timeframe. Such a finding has significant implications for the design of professional development experiences moving forward.

Furthermore, there is clearly room for notable research into the effectiveness of presenting successful classroom practices, as well as the complex theoretical foundation that they are built upon, using an informal "Tik Tok" or Instagram style of delivery rather than a more formal and traditional instructional approach. Not only is there substantial influence in the use of video to stimulate professional reflection, but also in the use of mobile learning as an effective medium of challenging teachers to modify classroom practice. As a result, educational researchers would do well to consider investigating how to harness the intrinsic motivation of individuals who are likely to be influenced by the dominion of social media, and who report higher levels of self-efficacy when learning concepts introduced through a social and culturally sensitive linguistic paradigm rather than an academic one. In the same way that teachers must situate the learning process in the cognitive space that their students inhabit, so too must academics. The combination of the lessons learned from this study about teacher perceptions of self-efficacy and how a well-developed mobile learning application can help enhance them really do signpost the capacity of delivering academic concepts through a social rather than academic medium and language.

The role of self-permission and the improved consideration of stereotype threat.

Building on this understanding that effective professional development is more successful when it is rooted in the social and cultural comfort zone of participants, the study gives further context to the importance of positive psychology in the development of effective learners. While the review of the literature outlined how previous research has shaped understanding of the importance of

participant attitude toward professional development, this study sought to clarify these findings further by considering the critical nature of self-permission within the culture of the teachers involved. Given the arguments made in Phase One regarding the potential impact of teacher perceptions of self-permission on teacher quality, it was genuinely surprising that the findings did not support such a hypothesis. Of all research findings this was the one that was most troubling for me, a concern that was further magnified when the data from Phase Two clearly indicated that the most useful elements of the learning application were directly linked to participant confidence, especially when these were directly viewed as pertinent to their daily role as professionals. Obviously, it is quite possible that the survey design prevented the collection of valid data, and that self-permission remains a culturally relevant concept in the development of teacher quality. Alternatively, future research might be best served considering the role of stereotype threat in the development of teacher quality rather than self-permission.

In reflecting on the research journey taken, perhaps the most significant frustration remains my decision to remain true to the original conceptual framework of self-efficacy and self-permission and not to pivot to the potentially more culturally aligned combination of self-efficacy and stereotype threat. It was not until the study had been completed that it became clear that the selection of the concept of self-permission was not truly aligned to the initial intent of maintaining the teacher's intrinsic conviction at the centre of the design. That is to say that the concept of self-permission assumes the teacher in a passive role, given that their ability to alter the permissions associated with their place in a hierarchical societal structure is very limited (in other words permission is something given *to* them and not something earned *by* them). Stereotype threat, however, speaks to the development of negative performance traits as a result of internally developed stereotypes, and as such is not a phenomenon imposed *on* an individual but developed *by* them.

Even though Steele and Aronson's (1995) ground-breaking work has prompted numerous researchers to investigate how stereotype threat influences the performance of negatively stereotyped individuals, understanding how stereotype threat affects learning is a relatively new focus (Rydell & Boucher, 2017). There is little doubt that "research on stereotype threat has the potential to provide useful information about how to improve skill acquisition and performance for negatively stereotyped individuals" (Rydell & Boucher, 2017, p.82). This is especially apt for studies seeking to understand factors influencing the development of teacher quality through effective professional development where there is likely to be a strong cultural stereotype present. As a result, a natural progression from

this study exists to determine whether the development of a mobile learning application such as ours has the potential to blunt the potentially negative impact of stereotype threat. It would be a good value to the profession to consider if the use of a professional development learning application of this sort not only has the capability to improve teacher self-efficacy and impact classroom practice, but also to diminish performance related issues that might arise from deep-rooted cultural or societal stereotypes.

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The power of the concept of "An Apple a Day"

As I have taken pause to reflect upon the contribution that my efforts may have to the field generally, and specifically around mobile learning, I have taken considerable satisfaction in the promise of the simple concept of the "An Apple a Day" mobile application. In line with the theoretical framework of the study, this contribution is firmly embedded in the practical realities of professional teaching and learning. At heart, and in its simplest form, this study is centred around the development of a mobile learning application that has the potential to deliver useful information in an effective and impactful manner. In doing this, the process distilled highly complex, evidence-based practices into simple, easily comprehended, soundbites that can be accessed in a convenient and non-intimidating fashion to those who, for whatever reason, would benefit from access to pedagogically sound practices. It also served as a conduit linking the best of academic theory to the pragmatic nature of daily practice. Such an application has enormous potential.

The principal premise of this study is predicated on the reality that the scope of technological progress made over the past two decades has been unprecedented. As a result, individual and institutional access to information has grown and continues to grow at a rate that was unfathomable at the end of the last century. While such access brings with it limitless potential to share information and to reach communities across the globe previously inaccessible, the enormity of the information available also has the ability to paralyze those who might benefit, especially if they lack self-efficacy or suffer from any type of cultural stereotype threat. As professionals, we no longer face the challenge of being able to share information, but the challenge of sharing so much information that the process is totally overwhelming. In this existence, an application that can help filter and precis effectively has great value, especially if the process can also present material using a method that can be tailored to the individual preference of the consumer.

In this context, an application of this design holds genuine promise. In a broader environment the application has potential in any situation where participants would benefit from a continuous drip-feed of relevant and filtered effective practices delivered conveniently over time. This is magnified even further if the mode of delivery is closely aligned with participants' social media use and so is not necessarily viewed as formal learning. Imagine, for example, a month-long series of tips for success shared with new undergraduate students over the first month of their adaptation to university life as a part of their onboarding process. While few might be specifically interested in repeated note taking regarding how to be a successful student, many might be willing to give 60 seconds-a-day to learn in a social context from the experiences of those who have gone before them. Similarly, the application has capacity in enculturing new employees in a new job placement, helping new drivers grasp the many "rules of the road", or even serving as an automated coach to help individuals stay on track: from diets to mental health. The ultimate potential of the application lies in its ability to distil and effectively present meaningful information, to those who might not otherwise be able or open to receive it. Especially when this information needs to be delivered in a manner that is both socially and culturally responsive "An Apple a Day" may well serve as a meaningful conduit.

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<h1 style="text-align:center">Appendices</h1>

Appendix A: Ethics Review Checklist

<p style="text-align:center">RESEARCH ETHICS REVIEW CHECKLIST FOR FACULTY OF EDUCATION</p>

The Faculty's Three Stages of Ethical Clearance

Stage 1 involves you in completion of this Ethics Review Checklist. This is the first stage of three. It will help you (and others) decide to what extent you need to become involved in the second and third stages. When you have completed it you (and the faculty) will be in a position to make this judgement.

Stage 2 will involve you in discussing any ethical dimensions of your research in some depth with your another 'knowledgeable person of standing'; this is a very likely outcome of completing the checklist. Further details are provided in Section C.

Stage 3 will involve you in obtaining formal 'ethical clearance' through the Faculty of Education's procedures; some projects will need to proceed to this stage. Further details are provided in Section C.

Most of the questions on this checklist deliberately offer you just two answers ('yes' or 'no'). You will probably find that you can answer many of the questions unequivocally one way or the other. However, sometimes you may wish there was an 'it depends' response category. If you find yourself in this position, please give the answer which suggests that, at this preliminary stage, there might be an ethical issue requiring more discussion at Stage 2.

Section A: Details of the Project

Student Name	Adam Holden
Email	Ah894@cam.ac.uk
Supervisor	Sara Hennessy
Supervisor email	Sch30@cam.ac.uk
Registration Report Title	The use of mobile learning to impact teacher self-efficacy and self-permission in Panama

Section B: Checklist

	Code of Practice relating to Educational Research	
1a	Have you read the *Revised Ethical Guidelines for Educational Research* (2011) of the British Educational Research Association (BERA)? (if you have not read it, the latest version is available at http://www.bera.ac.uk/researchers-resources/publications/bera-ethical-guidelines-for-educational-research-2011	Yes/No
1b	Is this Code relevant to the conduct of your research? If you have answered 'no', please briefly explain why:	Yes/No
1c	Do you agree to subscribe to the Code in carrying out your own research?	Yes/No
2	Are there any aspects of your proposed research which, in the context of BERA's Code of Practice, might give rise to concern amongst other educational researchers?	Yes/No
If you have answered 'yes', please briefly list possible causes for concern below:		
a		
b		
c		
3a	Will you be analysing an existing data set that has already been collected by someone else?	Yes/No
3b	If you answered YES: can you confirm that the data you will be using is *either* Already available in the public domain for anyone to analyse Or You have been given permission by the owner of the data set to undertake your own analysis and results[1]	Yes/No
4	Will you be collecting your own research data for the study (through such techniques as interviewing people, observing situations, issuing questionnaires etc)? **nb. If you have answered NO to this question, you may proceed to Section C and need not answer any further questions in this section.**	Yes/No

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[1] *this permission should only be given if the owner of the data can make it available for secondary analysis on the basis of the informed consent they obtained from their original participants*

	Obtaining 'Informed Consent'	
5	Are you familiar with the concept of 'informed consent'? (if you are not familiar with this concept you should first consult the following source: page 5 of the BERA guidelines above).	Yes/No
6	Does your research involve securing participation from children, young people or adults where the concept of 'informed consent' might apply? *Permission is likely to be needed to report any information about people or institutions that is not in the public domain, and which you have been able to obtain due to your privileged access to the research site(s) in whatever capacity [2]*	Yes/No
	If you have answered 'yes' to Question 6 above, please answer the following questions.	
7a	Do you believe that you are adopting suitable safeguards with respect to obtaining 'informed consent' from participants in your research in line with the Code of Practice?	Yes/No
7b	Will all the information about individuals and institutions be treated on an 'in confidence' basis at all stages of your research including writing up and publication?	Yes/No
7c(i)	Will all the information collected about the institution(s) where research is based be presented in ways that guarantee the institution(s) cannot be identified from information provided in the report? *Note: in a thesis written by a researcher about a research context where they have a publicly acknowledged role, it is difficult to disguise the identity of the institution whilst also providing the expected detail of the researcher's relationship with the research context.[3]*	Yes/No

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[2] *Professional work (such as teaching) can involve the collection of evidence to better understand problems/issues and to evaluate innovative practice - leaving practitioners with the question of when these activities become formal research requiring informed consent. This comment is meant to highlight how the collection of data for public reporting **beyond the institution** (e.g., **in a thesis**) should be considered as a key criterion for deciding when informed consent is required.*

[3] *At present the implicit assumption is that anonymity is always desirable*, and is always achievable. In many studies these assumptions are sound. However, a practitioner (e.g., teacher) reporting research into their own practice/institution in a thesis would normally need to be explicit about their professional relationship to the research context to give an authentic account of their research. As the staff lists of many educational institutions are in the public domain and often readily found by a web search, a thesis by a named member of staff allows the institution to be readily identified from the name of the thesis author.*
Given that an institution can readily be identified, this also has consequences for the degree of anonymity that can be promised to participants - for example those with named roles such as Head of Year 11, Student Voice Coordinator, Head Prefect, etc., or those identifiable from detailed reported characteristics.

7c(ii)	If not, has the appropriate responsible person given approval for the research on the understanding that the identity of the institution cannot be protected in the report of the research?	Yes/No
7c(iii)	Will all the information collected about individuals be presented in ways that guarantee their anonymity? *Note: a person with a named role or having a specific set of reported characteristics that is unique in the research context, cannot be assured of the anonymity when the identity of the research site cannot be protected.*	**Yes**/No
7c(iv)	If not, have these issues been explained to the relevant participants (and appropriate gatekeepers in the case of children or other vulnerable participants)?	Yes/No
The Involvement of Adults in the Research		
8a	Will your research involve adults?	**Yes**/No
If you have answered 'yes' to Question 8a above, please answer the following questions; otherwise move to Question 9.		
8b	Will these adults be provided with sufficient information *prior* to agreeing to participate in your research to enable them to exercise 'informed consent'?	**Yes**/No
8c	Will the adults involved in your research be in a position to give 'informed consent' themselves with respect to their participation?	**Yes**/No
8d	Will these adults be able to opt out of your research in its entirety if they wish to do so by, for example, declining to be interviewed or refusing to answer a questionnaire?	**Yes**/No
8e	Will these adults be able to opt out of parts of your research by, for example, declining to participate in certain activities or answer particular questions?	**Yes**/No
The Involvement of Children, Young People and other potentially Vulnerable Persons in the Research		
9a	Will your research involve children, young people or other potentially vulnerable persons (such as those with learning disabilities or your own students)?	Yes/**No**

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* Some institutions or participants may welcome being acknowledged by name in a thesis, and their views should be taken into account and balanced against other considerations.

	If you have answered 'yes' to Question 9a above, please answer the following questions; otherwise move to Question 10. In educational and social research 'informed consent' regarding access is often given by a 'gatekeeper' on behalf of a wider group of persons (e.g., a head or class teacher with respect to their pupils, a youth worker working with young people, another person in an 'authority' position).	
9b	Who will act as the 'gatekeeper(s)' in your research? Please list their position(s) briefly below and, where this is not self-evident, describe the nature of their relationship with those on whose behalves they are giving 'informed consent'. **The researcher cannot act as the gatekeeper (see 9g below)**	
i		
ii		
iii		
9c	Will you be briefing your 'gatekeeper(s)' about the nature of the questions or activities you will be undertaking with the children, young people or other potentially vulnerable persons involved in your research?	Yes/No
9d	If another person (such as a teacher or parent of a child in your study) expressed concerns about any of the questions or activities involved in your research, would your 'gatekeeper(s)' have sufficient information to provide a brief justification for having given 'informed consent'?	Yes/No
9e	If unforeseen problems were to arise during the course of the research, would your 'gatekeeper(s)' be able to contact you at relatively short notice to seek advice, if they needed to do so?	Yes/No
9f	Could your 'gatekeeper(s)' withdraw consent during the research if, for whatever reason, they felt this to be necessary?	Yes/No
9g(i)	Are you undertaking research into your own professional context/institution (e.g., with students in a school where you work)? If you answered 'Yes' then you should identify (in 9b above) a suitable senior person who has agreed to act as an independent point of contact for participants to act as the gatekeeper, and answer the following two questions:	Yes/No
9g(ii)	Will you ensure that other people in the research context are aware of the identity of the gatekeeper?	Yes/No
9g(iii)	Will you take reasonable precautions to ensure that research participants (and where appropriate their parents/guardians) know that they should contact the gatekeeper (and not you) if they have any concerns about the research?	Yes/No

	Other Ethical Aspects of the Research	
10	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g., covert observation of people in public places)	Yes/No
11	Will the research involve the discussion of topics which some people may deem t o be 'sensitive'? (e.g., sexual activity, drug use, certain matters relating to political attitudes or religious beliefs)	Yes/No
12	Does the research involve any questions or activities which might be considered inappropriate in an educational setting?	Yes/No
13	Are drugs, placebos or other substances (e.g., food substances, vitamins) to be administered to study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind? *If you have ticked 'Yes' it is vital to refer the matter to the Faculty Research Office for onward reference to the University Insurance Section.*	Yes/No
14	Will blood, tissue or other samples be taken from the bodies of participants?	Yes/No
15	Is pain or more than mild discomfort likely to result from the study?	Yes/No
16	Could the research involve psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	Yes/No
17	Are there any other aspects of the research which could be interpreted as infringing the norms and expectations of behaviour prevailing in educational settings?	Yes/No
18	Are there any other aspects of the research which could be to the participants' detriment?	Yes/No
19	Will the study involve prolonged or repetitive testing?	Yes/No
20	Will financial inducements (other than reasonable expenses or compensation for time) be offered to participants?	Yes/No

SECTION C: Interpretation of Results

If any of your answers coincide with the response options having a coloured background, then you should assume that further discussion involving Stage 2 procedures is required because some aspect of your proposed research is likely to be 'ethically sensitive'. In practice, many issues can be resolved at this stage. In practice, many issues can be resolved at this stage.

Members of staff should be especially careful about research involving their own students (question 9g).

*If you have ticked 'yes' in response to one or more of questions 10 to 20, both Stage 2 **and** Stage 3 clearance will definitely be required.*

Stage 2 Clearance

Any 'ethically sensitive' responses identified above should be discussed with a 'knowledgeable person of standing'. In the case of students within the faculty, this person will, in almost every case, be the person supervising your research.

On completion of the discussion, the 'knowledgeable person of standing' is asked to choose one of the following three responses, to delete the other two and to affirm their views by adding their signature.	
a	I have discussed the ethical dimensions of this research and, as outlined to me, I do not foresee any ethical issues arising which require further clearance.
b	There may be some ethical issues arising from this research. I think it would be prudent for the researcher to seek further advice and, possibly, Stage 3 clearance.
c	Ethical issues arise in this research which require further discussion; my advice is that Stage 3 ethical clearance should be sought.

Supervisor Name/ Signature	
Date	

Appendix B: Informed Consent Information Sheet

Participant Information Sheet

Introduction
Before you decide to take part in this study it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. A member of the team can be contacted if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Details of the research project
This research project is designed to determine the usefulness of the "An Apple a Day" application to practising teachers. The application explores ideas and concepts that improve teacher practice in a simple and convenient way.

The application is designed to share research-based practices in short, easy to understand "Thought of the Day" videos. Each video explains a practice that works in the classroom and gives helpful tips about how to improve the process of learning. They also connect to more detailed videos and articles that explain why and how each concept works in more detail if teachers want to learn more. The application also serves as a learning community where teachers can ask questions and share ideas with colleagues.

Each month the Thought of the Day will focus on a different element of teaching, building a library of videos for you to use.

The purpose of the research
The objective of this research is an attempt to improve the educational experience of Panamanian students from five to sixteen. This phase of the project is designed to explore whether or not teacher confidence and/or performance can be improved through the sharing of best practice ideas delivered in a simple digital format through mobile technologies.

It is hoped that any potential findings might have useful implications more widely across the northern region of Latin America where several countries share common educational and societal characteristics with Panama.

Participation in the study
The use of the application and the participation in the project is voluntary and you may decline to take part or withdraw as a participant at any time without negative consequences. If you wish to withdraw from the study at any time, you should contact Sara Cook at sara.cook@iae.edu.

Some personal demographic data will be collected from you such as your: name, email address, teaching status, age, gender, formal qualifications, level of experience, etc. Directly identifying information (e.g., names, locations, email addresses, etc.) will be safeguarded and maintained under controlled conditions. You will not be identified in any publication from this study. The information in

this study will be used only for research purposes and in ways that will not reveal your individual identity. Only the nominated researchers will have access to the data or materials provided by you, although there may be a requirement to show information to university or government officials who are responsible for monitoring the safety of the study.

Data will be collected regarding the analytics of how this application is used such as: types of materials viewed, frequency of visits, use of the chat function, etc. You may also be asked to complete feedback surveys regarding your use of the application and/or to be a part of a feedback focus group. Participation in this feedback is also voluntary and can be declined without negative consequences

Participant Selection
You have been invited to participate in this study as you have been identified as an individual who might be interested in participating within your school. All participants have been identified as having an active teaching schedule and being open to professional coaching. Once identified all participants were invited to the original informational meeting and your continued participation in the study beyond this point has been voluntary.

The benefits and disadvantages/risks of participation
You will not receive any specific compensation for participating in this study. Throughout the study you will be able to use the application freely and any of the material shared as a part of the application. You may use the information gained from the application to direct your own professional development as a teacher.

There are no specifically identified risks of participating in the study. You will maintain control over the level of your participation and whether or not this has any impact on your professional practice. No data will be collected regarding your personal teaching practice without your permission and no identifiable data will be shared with your supervisors or any school personnel.

Details of what will happen to the data collected and the results of the research
All data collected will be *kept in a locked file or secure computer with access only by the immediate research team. Your confidentiality will be protected at all times through the* de-identification of data and through the development of data security arrangements that result in a limitation of access.

The results of the study will be shared with you following the study in a meeting with the researchers. You will be able to request a copy of the final findings and discussion. *Results will be presented at conferences and written up in journals. Results are normally presented in terms of groups of individuals. If any individual data are presented, the data will be totally anonymous, without any means of identifying the individuals involved.*

The results of this study may be used in future research projects.

Further information
Should you have any questions or concerns regarding your participation in this study please contact Sara Cook at sara.cook@iae.edu. For more detailed information please go to https://www.information-compliance.admin.cam.ac.uk/data-protection/research-participant-data

Informed Consent Form

I have read and understood the Participant Information Sheet;

I have been given the opportunity to ask questions and have had them answered to my satisfaction;

I agree to take part in this project;

I understand that my participation is voluntary and that I am free to withdraw such participation at any time without giving a reason;

I understand that I may be asked to give feedback in the form of surveys or questionnaires and that I may be invited to be a part of a focus groups to give feedback regarding the application "An Apple a Day".

I understand that feedback may be recorded and transcribed for the purpose of this study.

I understand that the data collected may be shared internationally, specifically between the researchers in Panama and with members of the research team at Cambridge University in the United Kingdom.

I understand that the results of this study will be presented at conferences and written up in journals and that if any individual data are presented, the data will be totally anonymous, without any means of identifying the individuals involved.

Name: _____

Date: _____

Signature: _____

Appendix C: Self-Efficacy and Self-Permission Survey

1. What is you Gender?
   a. Female
   b. Male
2. What is your age?
   a. Under 20
   b. 20-30
   c. 30-40
   d. 40-50
   e. 50+
3. Where were you born?
   a. Panama
   b. Latin America
   c. Europe
   d. North America
   e. Other
4. Where do you work?
   a. Herrera
   b. Los Santos
   c. Panama Este
   d. Panama Norte
   e. San Miguelito
   f. IAE
   g. Veraguas
5. How long have you been teaching?
   a. Never
   b. Under 5 years
   c. 5-10 years
   d. 10+ years
6. What qualifications do you have?
   a. No formal qualifications
   b. High School Diploma
   c. Bachelor's Degree
   d. Master's Degree
   e. Other

For questions 7 to 27 please use the following definitions:
1	**Never**
2	**A little**
3	**Sometimes**
4	**A lot**
5	**All the time**

7. How well can you get the instructional materials and the equipment you need?

8. How well can you use a variety of assessment strategies?

9. How well can you implement alternative strategies in your classroom?

10. How well can you collect, analyse and report data on your student's performance inorder to improve instruction?

11. How well can you customize and personalize learning activities to addressstudents' diverse learning styles?

12. How well can you provide students with multiple and varied assessments that arealigned with both the content standards?

13. How well can you teach students to use digital tools to solve real-world problems?

14. How well can you do to get through to the most difficult students?

15. How well can you do to keep students on the task of difficult assignments?

16. How well can you do to increase students' memory of what they have been taughtin previous lessons?

17. How well can you motivate students who show low interest in schoolwork?

18. How well can you do to get students to work together?

19. How well can you do to get children to follow classroom rules?

20. How well can you do to control disruptive behaviour in the classroom?

21. How well can you assist parents in helping their children do well in school?

22. How well can you establish a classroom management system with each group ofstudents?

23. How well can you do to make the school a safe place?

24. How well can you do to make students enjoy coming to school?

25. How well can you help other teachers with their teaching skills?

26. How well can you do to reduce school absenteeism?

27. How well can you do to get students to believe they can do well in schoolwork?

For questions 28 to 35 please use the following definitions:

1	**Totally inaccurate**
2	**Partially inaccurate**
3	**Neutral**
4	**Partially accurate**
5	**Totally accurate**

28. I do not have permission to reach my professional goals

29. I am not permitted to pursue those things in my professional life that I really want.

30. I am not allowed to live up to my full potential.

31. I am not allowed to reach my professional goals.

32. I can have a successful and fulfilling professional career

33. I deserve to be everything that I can possibly be.

34. I have full consent to make the best out of myself as a professional.

35. I am free to live my professional life to the fullest.

Appendix D: Formulae for statistical analysis

The following formula was used for ANOVA test conducted in SPSS.
K = Number of levels in Factor A
L = Number of levels in Factor B
M = Number of observations within each treatment (i.e., number of people who took the survey)

Source of variation	df	Sums of squares	Mean square	F
Factor A	$k-1$	SSA	$MSA = \dfrac{SSA}{k-1}$	$F_A = \dfrac{MSA}{MSE}$
Factor B	$l-1$	SSB	$MSB = \dfrac{SSB}{l-1}$	$F_B = \dfrac{MSB}{MSE}$
Interaction AB	$(k-1)(l-1)$	SSAB	$MSAB = \dfrac{SSAB}{(k-1)(l-1)}$	$F_{AB} = \dfrac{MSAB}{MSE}$
Error	$kl(m-1)$	SSE	$MSE = \dfrac{SSE}{kl(m-1)}$	
Total	$klm-1$	SSTo		

The following formula was used for the test statistic for Levene's Test.

$$W = \frac{(N-k)}{(k-1)} \cdot \frac{\sum_{i=1}^{k} N_i (Z_{i\cdot} - Z_{..})^2}{\sum_{i=1}^{k} \sum_{j=1}^{N_i} (Z_{ij} - Z_{i\cdot})^2}$$

where

- k is the number of different groups to which the sampled cases belong,
- N_i is the number of cases in the ith group,
- N is the total number of cases in all groups,
- Y_{ij} is the value of the measured variable for the jth case from the ith group,
- $Z_{ij} = |Y_{ij} - \bar{Y}_{i\cdot}|$, $\bar{Y}_{i\cdot}$ is a mean of the i-th group,
- $Z_{i\cdot} = \dfrac{1}{N_i} \sum_{j=1}^{N_i} Z_{ij}$ is the mean of the Z_{ij} for group i,
- $Z_{..} = \dfrac{1}{N} \sum_{i=1}^{k} \sum_{j=1}^{N_i} Z_{ij}$ is the mean of all Z_{ij}.

The following formula was used for the Independent Samples T-test.

t = test statistic
$x_{1,2}$ = mean of each group
$s_{1,2}$ = standard error of each group
$n_{1,2}$ = number of observations in each group

$$t = \frac{(X_1 - X_2)}{\sqrt{\dfrac{(S_1)^2}{n_1} + \dfrac{(S_2)^2}{n_2}}}$$

Appendix E: Phase One Survey: Original Dataset

The raw data for the survey administered in Phase One was collected in Google Forms and then automatically transferred into Google Sheets. The original dataset can be viewed using the following link: [Phase One Survey: Original Data](#).

Appendix F: Semi-Structured interview questions

1. How useful is the "An Apple a day" application for you as a teacher?
2. How useful were this month's "Daily Thought" videos?
3. How useful were this month's supporting videos?
   a. How many did you watch?
4. How useful were this month's articles?
   a. How many did you read?
5. Did you implement any of the strategies in the thought of the day videos?
6. How successful were you in implementing the strategy?
7. Do you believe the application has helped you change or improve your instruction in any way?
8. Do you believe that the application has increased your professional confidence with instruction?
9. If you could make a single change to the application, what would it be?
10. Have you gone back to look at the "Daily Thought" videos from the earlier months?
11. Anything else would like to share?

Appendix G: Phase Two Participant Survey (30 and 90 days)

1. Did you read the welcome page and information about the research project?
   a. Yes
   b. No
2. Was the 'How it works' video to be informative?
   a. Yes
   b. No

For questions 3 to 24 please use the following definitions:
   6   Never
   7   Rarely
   8   Sometimes
   9   Often
   10   All the time

3. How often did you watch the "Daily Thought" videos?

4. Did you find all the "Daily Thought" videos useful?

5. Did you find you implemented tips from the "Daily Thought" videos in your classroom?

6. Did you learn something new after watching the "Daily Thought" videos?

7. Did you feel more confident walking into a classroom after watching the "Daily Thought" videos?

8. How often did you watch the supporting videos?

9. Did you find the supporting videos helpful?

10. Did you find watching the supporting videos increased your confidence level in class?

11. Did you implement tips from the supporting videos in the classroom?

12. How often did you read the supporting articles?

13. Did you find the supporting articles helpful?

14. Did you find reading the supporting articles increased your confidence level in class?

15. Did you implement tips from the articles?

16. How often did you find yourself using the chat feature per week?

17. Did you open the application when you received a notification?

18. Did you access the application during work hours?

19. Did you explore the application during your free time?

20. Did you explore different features of the application (daily thought videos, supporting videos, articles) everyday?

21. Did you find yourself exploring different features of the application (daily thought videos, supporting videos, articles) every week?

22. Did you feel the application has provided helpful information for you to implement in the classroom?

23. How oftendid you find yourself going to app per week?

24. Did you discuss the application with other professionals?

25. What element of the application did you access the most?

    a. Welcome Page

    b. How it works

    c. "Daily Thought" videos

    d. Supporting Videos

    e. Supporting Articles

    f. Archives of "Daily Thought" videos

Appendix H: Phase Two Survey: Original Dataset

The raw data for the Phase One survey was collected in Google Forms and then automatically transferred into Google Sheets. The original dataset can be viewed using the following link: [Phase Two Survey: Original Data.](#)

Appendix I: Transcripts of participant interviews after 30 and 90 days

Transcripts of interviews conducted by research proxy with participant following 30 days of interaction with the "An Apple a Day" application.

PARTICIPANTS

PERSON 1 - Master's Degree, 5-10 years' experience, No teaching license (English)

PERSON 2 - Bachelor's Degree, 10+ years' experience, Teaching license (English)

PERSON 3 - High School Diploma, 10+ years' experience, No teaching license (English)

PERSON 4 - Bachelor's Degree, 10+ years' experience, No teaching license (Spanish version)

PERSON 5 - Bachelor's Degree, 10+ years' experience, Teaching license (Spanish version)

PERSON 6 - Bachelor's Degree, No experience, No teaching license (Spanish version)

PERSON 7 – No Formal Diploma, 10+ years' experience, Teaching license (Spanish version)

PERSON 8 - Master's Degree, 10+ years' experience, No teaching license (Spanish version)

Person 1 – Interview in English

How useful is the Apple a day App for you as a teacher?
It's very useful, the most useful thing for me is the Daily Thought videos.

Just getting a quick idea of things that work well in the classroom. For me, that's my favorite part.

How useful were this month's thought of the day videos?
They were good. The new daily though videos were well guided towards instruction which was helpful. I found it to be more helpful but if you were to ask me at the beginning of the year, I probably would have said the other ones were more helpful.

I think that at the beginning of the year it is more about establishing control and setting good habits in the classroom for better maintenance so at this time of the year the ones about structure we're very useful for me.

How useful were this month's supporting videos? How many did you watch?
There were also useful. They were very useful. It shows you other people in the field talk about it (the subjects covered). I'd say I watched a little more than half not all. I watched the ones I was particularly interested.

How useful were this month's articles? How many did you read?
The articles were useful. Maybe I'm a victim of my era since I'm more inclined to watching a video. I read less than half of the articles. Probably of the articles, I read the ones the ones that kind of tends off. I definitely looked in a few that called my interest.

Did you implement any of the strategies in the thought of the day videos?

A few of them. Unfortunately, this month wasn't instruction heavy. I was gone for 10 days myself. I wasn't here. I wasn't exactly teaching that month. So, the timing was a little bit off. We've been preparing for the different activities in the school. We had explicit instructions to not give homework. And we were close to final exams. We had been giving a lot of reviews.

To implement this stuff, it was poor timing. And I don't think it's anyone's fault. So, I did get to try a couple of things. Not as much as much as I would've liked to.

I'd say maybe 2 or 3 or 4, I did a little bit of differentiating instructions. I can't remember exactly but there were a few that I liked and made a note and tried to work on with different kids.

How successful were you in implementing the strategy?
I was successful. I felt more confident. At least knowing that what I'm doing is research backed.

Do you believe the app has helped you change or improve your instruction in any way?
Yeah, a little bit, I feel like I'm not guessing as much as what's incorrect and correct. I feel like I have a little bit more support.

I think going back into the classroom management stuff and trying to implement those strategies, handling discipline situations. I can't think of another example. I'm kind of removed of the academic side at this moment.

Do you believe that the app has increased your professional confidence with instruction?
Yes, just kind of the recycling some things I've said with students. Thanks kind of alarm into recycle bin students as individuals what they might need is different based on who they are and where they are going it's kind of getting to fix, a chance to step back and take a look at myself and how I'm interacting with the kids

If you could make a single change to the app, what would it be
I like how its setup right now. I'd make it more click-friendly for different sections. Click here to get to the next thing, things that are related. Maybe that's just me being lazy. You would have to be jumping back and forth in a different part of it. I would definitely like it to start in a different time of the year, perhaps at the beginning of the school year. I would want to get the time and maybe try to improve the social aspect of it so how to make people really interested in it by communicating about it, talking about it.

Have you gone back to look at the Daily Thought videos from the first month?
No

Anything else would like to share?
N/A

Person 2 – Interview in English

How useful is the Apple a day App for you as a teacher?
I found some website that let me do some research about growth, they help me see what kids really need in the classroom but wouldn't start fast, andalso about how to develop their motivation in order to reinforce their development like writing. That's why I use An Apple a Day.

How useful were this month's thought of the day videos?
It is more useful. The last time there were things we already knew about which helps to review things we are doing in the classroom. This time, things that made me think about what I was doing in the classroom. As I said before I mainly go to the internet to have a little bit more of information. You have the articles which sometimes I read but sometimes I have to open and need my glasses, because I have to use glasses, so I went to the internet and investigated and researched and I tried to apply a little, not everything, to see what works for me.

And we're doing different things, like the teaching from the beginning of the year. At the beginning of the year, this would've helped me with processes and seeing what those are. But it has really helped me. It has very interesting articles that I would like to continue to read.

How useful were this month's supporting videos? How many did you watch?
It was useful even though the videos slides are a little bit too fast, but it's good to see others. I'm a visual person, so it's good to see and hear what they are doing. It goes along with the articles and myself.

Well, I watched all the supporting videos. This month opened my mind and see other aspects and areas of teaching. I decided to watch some of them daily when I'm free from classroom, I like to go over again to see what I can apply with my students.

How useful were this month's articles? How many did you read?

It was really useful because one of them was talking on how to motivate the kids and how feedback and giving feedback helps them grow and these kids are so special, you sometimes give them a project they don't like but when they see the teacher is giving them feedback and it aims to show them where they are, where they go and where they are at, that motivates them You see them go elaborate what they have in mind. And those tips helped me. It checks out, they go "I can do this teacher! This was so hard" and it helps them a lot. So you see, they do the project and before they know it the project has ended and they present it and go.

I read 3 articles. I went over it. I haven't seen all of them because I have been watching the videos and I'm very visual. I'm slow reading with the articles because I go from internet to article. My goal is to read all the articles.

Did you implement any of the strategies in the thought of the day videos?
Oh yes. I have. I've implemented 2 necessary for that project with the students. During the contest, reading contest, the feedback and motivating and letting them think and think over, and help each

other. Active Teaching. Interacting with each other to make their point and turn one and just be guiding.

How successful were you in implementing the strategy?
Well, at the beginning it's kind of hard to do with those beautiful teenagers but at the end of the day before they leave they see they are trying and working and you just show them what they have to do.

It has been successful. An Apple A Day is a great tool. sometimes you don't know which strategy to use or what strategy is best to apply in a situation, from what you recall, what you say what you heard, because they go forward. We need this in order to go through the day.

Do you believe the app has helped you change or improve your instructions in any way?
Of course! I love it! Improving in strategies how to approach my kids, mostly in active learning. Remember we as teachers we are more in front and facilitating the communication. Giving in feedback having a mini lesson and having a moment and bringing them forward

Do you believe that the app has increased your professional confidence with instructions?
Oh yes. Yes. Because it came in a moment when we got the Lucy Calkins program and the training we had with this is similar to Lucy Calkins instructions. I feel more confidence in the classroom even though I have some experience and we continue to learn something new. And by learning we grow and improve. We can't say we can have all the staff doing over and over. It makes you change it makes you think and go beyond what we do. Sometimes this doesn't work but I can change around it in a moment. This app is really good and I hope we keep it.

Have you gone back to look at the daily thought videos from the first month?
Well really no, I haven't. It's something fresh in my mind as I've told you before. The majority of the videos it was kind of like training with our superior. This second part is very, very interesting. Speaking about the mind. I'm interested in more intellect.

If you could make a single change to the app, what would it be?
The videos go too fast. It made me stop to go back to read. But nothing else.

Anything you would like to share?
It would be good to have other people to talk with. A community-based research. If we could have a community where to share and a reference from this, it would be nice. Having teachers to come over to share. A community in person. Discuss all the aspects on how it will help. Teachers with other teachers.

Person 3 - Interview in English.

How useful is the Apple a day App for you as a teacher?
It's very useful Very useful. I'm just going to talk I take little bits and pieces of what I've learnt. So the app is awesome because you find real tips and tricks that you implement to teaching.

How useful were this month's thought of the day videos?
They're always useful but then again you get bits and pieces that you implement to your teaching there's always something useful. More or less I couldn't really say because there was always something you're going to learn no matter if it's alone make sure there's always something you could use to use I would say comparing to last month very useful

How useful word this month's supporting videos? How many did you watch?
I will say useful. I watched just two and I just got a new phone.

How useful was this month's articles? How many did you read?

I can't say I use any I wouldn't say I probably came through some at least two

Did you implement any of the strategies in the thought of the day videos?
No

How successful were you in implementing the strategy?
Thanks pretty successful one of the charges that I used was that way you have limited your action teaching I can't remember which one it was to be honest

Do you believe the app has helped you change or improve your instructions in any way?
Definitely because I never had something useful at the touch of your fingertips every single day it's useful it's like having content that you can watch and learn every single day that's awesome there's nothing else like it.

Do you believe that the app has increased your professional confidence with instructions?
For sure, for sure. 100%. Do you know who Lucy Calkins is? I have to do Lucy Calkins program every single day how can you go wrong it's awesome just to have it every day because the color something annotation start today it's a good thing to have it's yours they're not really that long

If you could make a single change to the app, what would it be?
I can't think of anything I would change here. I can't just single something out. it's a pretty easy app to use it's nothing of clusters to you

Have you gone back to look at the daily thought videos from the first month?
No

Anything else would like to share?
Will there ever be a time that we're not going to have video? Will there be more?

Person 4 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?

Fabulous, I love it. I haven't just stayed with that I have read, I have just shared with other teachers, and show them and talk about how we are doing well and how we can continue to achieve. The tips are really good that push you forward and says to do well. There is no discrimination with age.

How useful were this month's thought of the day videos?
For me, all have been useful because I see the way that it can be applied and take it to function in integration. It leaves no child behind. I share it and wish I can talk to all of the teachers of all the sections on how great it is. For me, they are all good.

How useful word this month's thought of the day videos? How many did you watch?
To say the truth, I have seen them and read them, but me personally, it hasn't been the practice. I have read the articles more. I watched 3 videos.

How useful was this month's articles? How many did you read?
For me, very beneficial, useful and I have shared them. We barely have time but we take some time to read it. I've read 3 or 5 of this month. Last month not so many.

Did you implement any of the strategies in the thought of the day videos?
I like the videos and I like to go back for the past ones to apply it with the little ones. Between one class and the other, I give the class with music, to keep them organized. There are moments that the program is so established. It has been useful, and to review past practices.

How successful were you in implementing the strategy?
Yes. Very successful. The children are not the same as 20 years. These ones now require more strategies and attention.

Do you believe the app has helped you change or improve your instructions in any way?
Yes, because every day you learn. There are times that some of the things I have learnt before and it's like a review and I try to improve it.

Do you believe that the app has increased your professional confidence with instructions?
Yes. I say yes because I'm the adult, the teacher, integrating all the students to feel good in their environment.

Have you gone back to look at the daily thought videos from the first month?
Yes! I wish we could have them always, so I can watch or read. So I can do so when I'm in medical appointments or before sleeping. And if all of them in archive I would prefer.

If you could make a single change to the app, what would it be?
Sometimes I have to wait for the translations.

Anything else you would like to add?

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I would like to have in physical with other schools. To share some tip so it Doesn't seem like I'm the one saying it, and instead it comes from research.

Person 5 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
Well, it has been useful for refreshing or reviewing the things one has learnt along the way and might have forgotten and acquired some new info or ideas.

How useful were this month's thought of the day videos?
They have been more useful. The problem for me has been that the music is a bit distracting for me. I do not associate it with the subject at hand.

How useful word this month additional videos the supporting videos? How many did you watch?
Very good. While the Daily Thought has been like a quick info, these gives more info and helpful tips. I have seen all the videos. I don't see them at the moment they come out at the moment but sometimes I sit down and watch various in one sitting. I watched all the supporting videos and articles.

How useful was this month's articles? How many did you read?
The first article was amazing. The ones after have been in English and I haven't checked if they are fixed. They are all related with Daily thoughts opening the curiosity. These days the articles came in English.

I have only read 1 article. The other ones I haven't been able to read. From the moment they came out in English I have stopped checking. The other day I sat down to watch the last two of the Daily Thoughts.

Did you implement any of the strategies in the thought of the day videos? How many did you get to try?

Yes, especially with the 7th graders. I put into practice the things that I had forgotten or stopped to do with the routines. I have placed into practice and nice.

How successful were you in implementing the strategy?
They have worked. At times good at other times not so well but they have worked.

Have you gone back to look at the daily thought videos from the first month?
No. I didn't know I could go back and watch them.

Do you believe the app has helped you change or improve your instructions in any way?
Yes, they always help. For example, this way of making the introduction of exploring the past knowledge. I'm always doing it at the beginning of the class. I start making questions to test their knowledge and later reinforce what they know already.

Do you believe that the app has increased your professional confidence with instructions?
There are things reinforced. One does not have much time on this and thinks they know everything but there's always something you have to remember.

If you could make a single change to the app, what would it be?
I would change the music. Definitely the music. I don't like it at all and doesn't help me relax but might be my own personal opinion.

Is there anything else you would like to share?
Not really. I'm being calm with the app. Sometimes the notifications of new it shows up but it doesn't read. I click and I hope to read the rest of the message but instead it sends me directly to the app. I would like the message to know if it's a video or article or daily thought, and I enter the app without knowing where to go and I have to click each box. I would prefer the notification would tell me where to go.

Person 6 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
For me, the most useful thing of the app has been the quickness of it. Watching videos quickly, going quickly to read articles. The information that you can find the internet and google you can find it quickly, but when you enter google one has to write what has to be searched. Here is the fastest way of information you want to know. It is useful.

How useful were this month's thought of the day videos?
More or less the same. The same usefulness. It's depending on each video and situation that one can be at and the video that can be applied. It depends on which moment you are teaching and how useful it can be.

How useful word this month's supporting videos? How many did you watch?
They are useful. What I noticed is that these videos versus the daily thought videos is that the daily thoughts are super summarized while the supporting ones, the teachers talk a huge lot about their experience. I prefer daily thoughts because they are more direct. I have watched two supporting videos.

How useful was this month's articles? How many did you read?
I focus more on the daily thoughts above all. I have only read one article.

Did you implement any of the strategies in the thought of the day videos?
Yes, I have. I don't have a precise number on how many. But I have done especially transitions. I've done more than 5.

How successful were you in implementing the strategy?

I might say around an 8 because the strategies are good but it depends on the reality of the moment like we can plan the strategies with studies but in the culture there can be things that can influence in a not expected way.

Have you gone back to look at the daily thought videos from the first month?
Yes, I have. Daily Thoughts are interesting. I can see the titles of the Daily Thoughts and if it applies in the moment because of an experience in the class I can go back and do so and use it for the class.

Do you believe the app has helped you change or improve your instructions in any way?
Yes, I feel so. I have many examples. Like transitions from one subject to the other without the class getting lost.

Do you believe that the app has increased your professional confidence with instructions?
Yes. One feels more confident when the experience as the professor can talk with other about the hardships of teachers and in those moments you can take to check the app and review and think about what can help or what can be applied.

If you could make a single change to the app, what would it be?
If I could change anything…. I would make the Daily thoughts in sections. In this applies for these subjects, these others for these other. That way teachers can be more directed to those subjects they get help. It's good that is daily but would be nice.

Anything else you would like to add?
Just say that the app is good! The thing I liked the most is the quickness you get the information. IT's the fastest way to acquire teaching information

Person 7 - Interview in Spanish

How useful is the Apple a day App for you as a teacher?
In reality, I can see that they have a lot of great ideas and obviously as a teacher we have to apply but sometimes we forget. This works as a review, something that we need so we can remember and reapply in our daily teachings. Like I said before, I couldn't see the article of the third month because I was falling asleep. I just saw the video, the supporting video. Yes, these are things that are super useful and interesting.

How useful were this month's thought of the day videos?
Last month's videos were more about how to control groups and the talking, but this month is the learning process. They are both useful in their own way. They are not the same. They are things completely useful in their own way.

How useful word this month's the supporting videos? How many did you watch?
The thought of the day you can see it once, but in supporting videos is like a direct contact with a teacher and you can see how you can manage. There was this video that I believe it was the first month, that it was how to lower the voice in the classroom and the teacher wasn't talking. Just looking

at his face and how he looked at the students. I think it's different. it's different from just having something written, than to how you can do the practice.

I have seen all the supporting videos. The articles not all. Yes, the videos. I find them all super interesting. Each one has their own. I love one of a professor that says I will give each student a magical stone and it's a way that the students can be more silent than others. I loved that tactic. It's almost like a game.

How useful was this month's articles? How many did you read?
I liked them too but the articles I read them but not all. I can't say I have the time to see them all. But you can feel like it expands the information more. It confirms what you are watching in the videos and in the daily thought. I could say I read like 15 articles. Not all.

Did you implement any of the strategies in the thought of the day videos?
Various. I loved the one of talking in whispers. As a preschool it is crazy sometimes and if you raise your voice, it's not good and calm your energy so the kids take this also. I whisper to them and they all lower their voices and they listen. When one screams, it's worse. This is one of the ones I implemented and have been successful. Also, the part of talking positively and a recognition, the transitions are a bit complicated when kids come in from other activities or home. Wait for them to sit down and to put their backpacks can take some time it is a transition part. I have achieved the part that I congratulate the ones that sit down. "Congrats boy, congrats girl," and you can see them all running to take their chair. It gives results. And it's like why I have to tell them all over. They like this. It makes a positive environment.

How successful were you in implementing the strategy?
Amazing The ones that I have put into practice have given me great results. I can feel more secure.

Do you believe the app has helped you change or improve your instructions in any way?
Yes, because first, the time of the attention of the students, you give the lessons short version because of their attention since they are young. I try to focus on what is more important and show them an ability that they can do and they can learn and I feel not only the time of the lesson if not, the differentiated lessons have resulted well because you put by table the children that might have difficulty in writing or reading and I feel it is much easier to work and more productive.

Do you believe that the app has increased your professional confidence with instructions?
Yes, 100%. Especially with the past example.

Have you gone back to look at the daily thought videos from the first month?
Yes. Sometimes I go back and I even have a notebook where I write what I find is useful.

If you could make a single change to the app, what would it be?
I think that this month it is much more developed compared to the first month. I noticed a difference in the redaction. It has been improved this month and no, the rest, I wouldn't change anything. Last month yes I noticed that in the supporting videos there were some redaction but this month nothing wrong.

Anything else you would like to add?

The experience I have had with this app, as I've mentioned, I have applied to various things to practice and have been successful. This has been great and it should be shared with other teachers and people.

Person 8 - Interview in Spanish

How useful is the Apple a day App for you as a teacher? What specifically did you find useful?
The reality it is very useful because the tips are concise and it goes directly to what it wants to say and what it is needed. It is useful because it is a review and reminds me of practices I have to bring again. From that point of view, it is useful. You Start forgetting these little circumstances that can make the class more creative and engaging.

How useful were this month's thought of the day videos? Did you find it more or less helpful than the first month?

This month's videos have been more focused on how to carry out the class and this have been more interesting than before. It's things that I have done before and it gives ideas on how to carry out. Like the mini-lessons. We know how to do them, but suddenly the daily thought gives you new ideas in my case instead of teaching in quickly a lesson and a student gets overwhelmed, a mini lesson teaches to just sectioning what is the main thing and they can stay with this teaching. It is directed in how to carry out a lesson. The last month was also good, but this one was better.

How useful were this month's additional videos the supporting videos? How many did you watch?
I have to say, I have barely entered to see the supporting videos. I may have watched maybe 2 only. And each time they enter the daily thought it tells you which supporting videos and articles are the ones tied. I have read some articles but the videos take a bit more of my time and concentration. I have watched like 2, and one was about mini lessons, that the idea that was given there it was a practice that interesting for me and applied it.

How useful was this month's articles? How many did you read?
The articles I just open and skim it. The ones I have opened, have been interesting but they require more concentration and time and space. That space I haven't had the chance. They are useful, they show studies and research. It gives good examples and alternatives. But it requires more of my time. I have seen 3 articles approximately. I read one that was about one of the first daily thoughts of the second month, about the active learning when students are working how to go close, not giving the answers, making them think. How to organize yourself when you are giving the lesson. There was another one I opened that was about the daily thought of projects on how to make projects for the students in class.

Did you implement any of the strategies in the thought of the day videos? How many did you get to try?

Yes, I have. And linked the doing in the classroom. With the creativity of the students on what they have worked in the classroom. With what is creativity. The last project I did with the students they had to do, to create and do and applying what they have done during the year and technology. To apply their creativity in the work. For me, the result was great. When I got close to them, I would ask how was the project, I received a lot of positive feedback on what it was. It was a bit complicated, with the thinking and investigation but the creativity part was good and fun.

How successful were you in implementing the strategy?

There are many strategies that I have taken and implemented like the project evaluations. The way they can feel engaged in the work. The mini lessons, the ones to be integrated in the class and give individualized needs of the students. It has been productive. To continue to work. In that aspect I can give review of my opinion. I can make sure they are working and doing what they have to do.

Do you believe the app has helped you change or improve your instructions in any way? Can you think of any examples?

Yes, and not just only in the instructions and classes, but also to wait for them at the door, we have always done that but it is important to not just do that, but to await them with their ways of being. How they say good day, good morning, hi, with their names. Since that opportunity it has been useful because it makes you see them as people that you have to connect and be nice with them and give them the feel they are important.

Do you believe that the app has increased your professional confidence with instructions?

Well yes. Before I used to be so strict and without smiling. I thought that if I were nice or give a smile or any affection that showed I was relaxed I thought that I would incite the students to be disrespectful to me. But it's not like that! You don't have to be that strict. Now I feel like I show myself more real. I'm strict if I need to be. From that point of view yes. If you forget something, you can go and review again.

Have you gone back to look at the daily thought videos from the first month? Can you think of a specific example?

Yes, there are some that I have gone back to, like the greeting. I've gone back to a supporting video from a Spaniard on how to bring the attention of the students and I have loved it. Something like being present at the moment and the students react to this is satisfying.

If you could make a single change to the app, what would it be?

Well, the only thing I would change is the way to enter the videos. I have to go to YouTube, wait for it to run, and then enter watch the video. It takes time. (Huawei phone).

Anything else you would like to share?

I would like to have more time to be able to write. I entered the notes area and with the school email I got to make some notes about one of the articles and I think it is so attractive that way, outside of school I don't like to use my phone. I use it for what I have to use. To use the Notes section is a bit friendlier and it stays with the school's email.

Transcripts of interviews conducted by research proxy with participant following 90 days of interaction with the "An Apple a Day" application.

PARTICIPANTS

PERSON 1 *- Master's Degree, 5-10 years' experience, No teaching license (English)*

PERSON 2 - *Bachelor's Degree, 10+ years' experience, Teaching license (English)*

PERSON 3 - *High School Diploma, 10+ years' experience, No teaching license (English)*

PERSON 4 - *Bachelor's Degree, 10+ years' experience, No teaching license (Spanish version)*

PERSON 5 - *Bachelor's Degree, 10+ years' experience, Teaching license (Spanish version)*

PERSON 6 *- Bachelor's Degree, No experience, No teaching license (Spanish version)*

PERSON 7 *– No Formal Diploma, 10+ years' experience, Teaching license (Spanish version)*

PERSON 8 *- Master's Degree, 10+ years' experience, No teaching license (Spanish version)*

Person 1 – Interview in English.

How useful is the Apple a day App for you as a teacher?
It's very useful. There are good resources for ideas on what to do in the classroom and how to carry them out with suggestions from other teachers and scholarly based research as well.

How useful were this month's thought of the day videos?
They were really useful because there was a lot of factual application stuff in regards to assessments to class activities, online stuff which was a really nice detail I really liked there was an angle towards that digital stuff. I think it was a bit more practical for me with the use of classroom activities among other subjects.

How useful were this month additional videos the supporting videos?
It was good. It is always good to hear the opinion of other teachers. I watched half of them, the ones that I was interested in. Like the journaling one, where you can have all the kids write in class, and not just anything, but with a bit of guidance.

How useful were this month's articles? How many did you read?
They were good. They were surprisingly good. I thought they were very current and not old ideas in education. They are scholarly but they don't feel like a boring scholarly research. I read about half of them. The ones I was interested in.

Did you implement any of the strategies in the thought of the day videos? How many did you get to try?
I did a little bit. The assessments and the group projects, have them work together and kind of assist them a little, let them work as a group. I used maybe 2 or 3 since it's the end of the school year and it's not a great time to start new things but I still used some and it was great.

How successful were you in implementing the strategy?
With the strategies that I tried I would say I was successful with switching up assessments and successful with special groupings. Those two sticked out for me.

Do you believe the app has helped you change or improve your instructions in any way?
Yeah, it has me thinking about things. It kind of gives me a connection to teachers because I know we are receiving the information input from other professionals, if nothing else, it's a nice reminder of strategies of work I can do. What I'm thinking about is the technology stuff because next year we're getting more technology incorporated into our classrooms and right now I'm just trying to get new ideas on how to integrate that and there was one article that had 10 to 12 websites that you could use and that you can have the children use for activities and also assessing their work, and exit tickets to try and figure out where they are at and for me that's very useful.

Do you believe that the app has increased your professional confidence with instruction?
Yes. I feel like I know more about the job. I can't think about anything specific that shows things that are proven to work for people and I can do more things in the classroom besides what I'm doing and in education it's great to have as many possible things with your students to make it more interesting for everybody and for new types of learners a chance to learn in the way they do and fairly assess students.

Have you gone back to look at the daily thought videos from the past months?
No, I haven't gone back to it.

If you could make a single change to the app, what would it be?
I would say the videos in the morning or during working hours.

Anything you would like to share?
Nope. It's a good experience and I wish we had the app for next year.

Person 2 – Interview in English

How useful is the Apple a day App for you as a teacher?
It has been very useful because it gives us strategies to follow. Sometimes us teachers we don't know it all and we have different kids every year. Each time, the situations vary that you don't know what to do. And when you go to try them, perhaps not all of them work for you but many of them do and it is very useful; it gives you options.

How useful were this month's thought of the day videos?
It was great. I find that the rubrics are important. These are essential in a way because the students can see their developments; in what they are lacking at, what they have improved, how they can improve it. Teachers can evaluate them with an important and honest feel (way). IT's really useful. I don't evaluate between month; I think all information is useful. Each month was very useful.

How useful were this month additional videos the supporting videos?

It was really useful because you could see or hear or read about what these teachers really think no matter what they talk about. If they talk about exit tickets, if they are talking about portfolios; not many people know how to use portfolios. And you have to master it so it was really useful to see what perhaps they are lacking at if they are using portfolios or if they are preparing portfolios what can they do. I watched all the videos. I'm a fan now. Coming in the car, or in the bus I watched those videos. And sometimes I go over them.

How useful were this month's articles? How many did you read?
The articles are very important, I read them more than the videos. But I take my time to read and investigate and read and look up. I believe that doing this, even (be better) for next year when I have new students. The articles are so much more detailed than the videos for example for me I love to read, I read, I investigate, I look further on what they are saying and on what others say. I read like 2 articles in a week but it depends if they are talking about what interests me. They are really useful.

Did you implement any of the strategies in the thought of the day videos? How many did you get to try?
Yes, I have. This month is really short we were doing projects. Perhaps on classroom management, but since they were doing projects, we couldn't use portfolios. The exit tickets yes, I used it at the end with things like "tell me what you have learnt, whatsoever, what you saw today, what you would've liked to learn?" because they were finishing their projects.

How successful were you in implementing the strategy?
Well, it worked even though it wasn't the beginning of the year. You see, the children have to receive the instructions from the beginning and routine is what forms to this. So I couldn't implement it as a routine. I tried so I could experiment with it. In some ways it worked but it wasn't a routine and they couldn't grasp it as something "Oh this is something the teacher is trying to implement". At the beginning of the year I will try to implement it on my kids and see what and then say, "his worked, this did not work".

Do you believe the app has helped you change or improve your instructions in any way?
Oh yes. I have been a teacher for 23 years, ans I believe we can grow. We don't know it all. What we have is information and valuable information from this, from teachers that have gone through the same situation and feedback on what to do and what we are doing and I have improved. And when we improve we grow. That's it.

Do you believe that the app has increased your professional confidence with instructions?
Oh for sure. Certainly. When we are talking about strategies for classroom management. These 2000 kids are different to the ones I've had years back. And what I have seen is changes in their behaviors. The kids are not the same. And I understand that they learn differently. Some learn kinesthetic, some are visual, some are…, to blend all of that, you have to have a blended classroom and what they talk about in the video and in the articles I've been reading it was to use in order to achieve my goals before even though I have planned before the videos. I could just go ``plan B", and so I go into the classroom and I change it around. It has been really helpful to my teaching to use on my kids.

Have you gone back to look at the daily thought videos from the past months?

Not really because those videos were really awesome but it can help teachers that come in. Many of them we have practiced before with our supervisor, those techniques. We were trained. They were more like reviews and feedback. Our supervisor had required. The second month were great but I haven't gone back.

If you could make a single change to the app, what would it be?
Sometimes in the videos they go to fast. And I read, and I love to read, but it goes too fast for me. It has to be a bit slower. The timing in which the paragraph leaves it's too fast. But I can't say what I can change. These people are experts they're doing their investigation and their research and they know what goes by.

Anything you would like to share?
No, it's really awesome and I'm grateful to be part of the research. It was a good experience. And teachers sharing their knowledge. I wish that in this institution we could share our knowledge with other teachers abroad and outside of Panama. And that we aren't just enclosed in our classroom and our teachings.

Person 3 – Interview in English.

How useful is the Apple a day App for you as a teacher?
Very useful.

How useful were this month's thought of the day videos?
It was very useful. There's always something you're going to want to use from each little video. It may not be the whole thing but there's always something or a technique you're going to learn. In conclusion, it is very useful. I can't compare them because I always find something I like, even if it's small. They aren't different.

How useful were this month additional videos the supporting videos?
Very useful. I watched more than 10 or 15. I try to keep up with it because I knew I was going to be interviewed.

How useful were this month's articles? How many did you read?
The articles are useful, but I can't say I read them all. I can say more than 10.

Did you implement any of the strategies in the thought of the day videos? How many did you get to try?
Yes. I must say at least 5 strategies.

How successful were you in implementing the strategy?
I felt I was successful. Very successful

Do you believe the app has helped you change or improve your instructions in any way?

Definitely. This is one of the best things I've ever had because I see it as a teacher assistant always there assisting you. I'm happy with the program that started with us. It's a big plus.

Do you believe that the app has increased your professional confidence with instructions?
Yes. There was one when I started, a technique that the student's attention span in the room is very short, so you have to get your point across very fast. So you don't have time to flow away because they have a short attention learning time. It was in alliance with that, to show you what you had to do. You have to go in, take your timing, and you had to execute the lesson plan fast so that you don't lose them and the kids don't go to lala land. You have to go in and timing is everything. Because you only have so much time in the classroom and to do the lesson. You have to execute the plan with perfect timing, otherwise you lose them and that was awesome to learn. I was glad to learn this because I didn't learn that in college. This program is great, it's awesome.

Have you gone back to look at the daily thought videos from the past months?
No, I haven't to be honest.

If you could make a single change to the app, what would it be?
I wouldn't change anything. I can't find anything that I don't like.

Anything you would like to share?
I just hope it continues and grows. Any teacher from any college, will find something along the way and like I said, you take whatever is useful for your classroom and there's going to be a segment that you will use. I find it very useful and it's great. Glad to be a part of it.

Person 4 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
Very useful. Independently that we are in the third month, you can go back and review with how the year started and how we are now. We can see how the students are doing since they began, it is very useful, I apply it, I apply it in a personal way with my son, I can do this balance of this. I can say I love it and apply it.

How useful were this month's thought of the day videos?
Those are the main that are short and you go from there to the supporting videos and articles. From the start I love them because you can always watch them and I keep notes on it and watch them. It's great that you can apply it to all. This is the section I love the most and rewatch it.

How useful were this month additional videos the supporting videos?

This month, I haven't focused much on the supporting videos and I might have watched 2. This month hasn't been that easy. It has been complicated for me to watch them so I have to say no more than 2. Only saw the ones that interested me.

How useful were this month's articles? How many did you read?

Those yes. I love the articles. It's the ones the daily thought suggests for expanding your knowledge. And not only there, I have searched on YouTube to get more instructed. The daily thoughts, that interaction, is real. I would like to have it to share it! It's valuable. I have read no more than 3 in this month.

Did you implement any of the strategies in the thought of the day videos?
Yes. Especially, because of the time, I could go "I haven't had the time since the first day, I can use it this way". Even when planning with my partners, and they sometimes go "Yes we used to do that before!" but yes, we have forgotten to use them in a while. But with music, with instruments, we have to be prepared with the instruments in the area.

How successful were you in implementing the strategy?
Very well, because we have a group of 17 kids that while they were 3, and now closing the year, they are four, and we can see the progress after using this project. We have more emphasis in being more innovative and dynamic classes for them. They share. There is time for everything. Not only for the teachers but also for them to learn between them. And listen and learn from them.

Do you believe the app has helped you change or improve your instruction in any way?
Yes. Not necessarily with the years of experience, if not that there are innovative practices and other places and teachers that can they apply with. I keep that urge of sharing the "look, this is another way how it can be done" not to do it the same way as we have done it. That there are more ways to develop and continue to take things further.

Do you believe that the app has increased your professional confidence with instruction?
Yes, in some way or another, and to share it. Already with my years of experience I can evaluate what we have been doing and it's nice to hear the videos and other experiences of teachers, how they manage and use it in the classroom. It's interesting and practical. Since it's the moment of the student and the teacher that there are other strategies and abilities earned.

Have you gone back to look at the daily thought videos from the past months?
I have rewatched from the first month to the ones now. There are many that I like and stay in the archives and some that have been useful now for the end of the school year for the evaluation. On a personal note, it is very enriching. Maybe another group can see the innovative things we do and each day we can do better.

If you could make a single change to the app, what would it be?

I would do everything in Spanish. Sometimes some of the things show up in English and I have to ask someone to translate the things. And to have concrete papers of these things. To help me in planning

Anything you would like to share?
I just want to say that I'm very happy and that I'm sad it has to end and I don't know if to say it ends, but it's a love for learning and that you can share and use. Maybe not just in Preschool but other sections share it with their experiences and improve the process.

Person 5 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
It has helped me to review and acquire new information to use in my daily work. Mostly to review, it has been useful.

How useful were this month's thought of the day videos?
Well, I comment again, the rubrics, the exit slips that I associate with the closing of the classes, to do it every day, it's mostly what we've been doing is strengthening (our teachings), and for me, in a way it has been a way of learning. I've had to unlearn to relearn or readjust what I had as information to a bit different way of teaching, that at some point it links. And it has benefited me for this.

How useful were this month additional videos the supporting videos?
Same as before, some videos, I've had some trouble to be able to watch them, like they don't load. I haven't been able to watch it with a routine. I even think that some videos got skipped, because, when they don't open for some reason, I had some problems with the phone for two days, I have a data plan that's limited but really, when I was outside Wi-Fi coverage, I thought it was something about the data plan and then it resulted as a problem of the platform, just a bit disorganized. But I did watch some and they strengthened what was taught. Gives much more information. Of the last videos, the 13th or 14th, I started taking some notes in my work schedule. Because I might take time between one video and the other and I would forget things. So I started making sort of a diagram to be able to remember.

I'm not sure how many I watched. I might say 90%, because of the situation I lost the sequence, but I think I watched them all.

How useful were this month's articles? How many did you read?
The articles, the same. I didn't read them all. Same as the supporting videos. Sometimes they would be translated, other times they weren't and then some days passed, well. I kept trying to go to the articles. Because they strengthen what is taught in the Daily Thought and in the supporting video. I might have read almost all, I might have missed one or two, and if so, because I've forgotten or thought I read them, but I think all.

Did you implement any of the strategies in the thought of the day videos?

Well on these days I haven't. Relatively no. Since the last few weeks have been closing of projects and the classes have been more concrete towards something specific. So I haven't been able to implement any strategy. Sure, I'm using the rubrics always. I strengthen a bit the use of rubrics, for me to use, them to know and understand, and of course it called to my attention that it also mentions that this evaluation instrument is not only to evaluate the student, but also evaluate strategies and the design of the class, and it has been headed towards this.

How successful were you in implementing the strategy?
The times I've done it and, in the past, yes. It has worked. Every time I apply for something, it works.

Do you believe the app has helped you change or improve your instruction in any way?
Yes. As I mentioned, it helps reminding things that I had forgotten and reapply it to the newest things and you can see it work. Recently I was evaluating the grades of a grade. And the last semester I didn't use the rubrics in the evaluation, and this time, I placed the rubrics in their evaluation so they can see what I was evaluating so they know what I'll be looking for. It worked so much easier because that way, I was correcting what was beyond the rubrics. It was excellent.

Do you believe that the app has increased your professional confidence with instruction?
Yes. For example, the class structure. The way of beginning, developing, and closing. The closing of a class is usually complex. Because once you close for them the class has ended and to try to keep that structure I've had to be more committed to this to achieve. Recognizing the benefits and it has worked.

Have you gone back to look at the daily thought videos from the past months?
No.

If you could make a single change to the app, what would it be?
The music. Definitely the music is too disruptive for me. Like the claps. It distracts me too much. I don't know. The music doesn't go with me.

Anything you would like to share?
In reality, I'm taking it as a daily read in the free time. I have a special notification sound for it, and sometimes I see it and I think "Nah I don't want to read it" but then I get the sensation that I have to read it. I always find some time. I always arrive very early, and I read it in that morning, I'm already familiarized with it.

Person 6 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?

Very useful because its quick info and one can take advantage of how quick it is between classes to study. Just take 5 minutes to take advantage of it.

How useful were this month's thought of the day videos?
Super useful. I loved the ones of this month. I loved the most the evaluation ones, that at the end of the day if you don't evaluate the students, you won't see progress. The students need to be evaluated and most of all receive feedback. And the children need feedback. Since this month is a different subject, it can't be compared if it's more or less good than the other ones.

How useful were this month additional videos the supporting videos?
I barely see the supporting videos. Maybe 2. I only see the daily thoughts videos.

How useful were this month's articles? How many did you read?

The articles of this month are very interesting. They are longer than the Daily Thoughts but I really loved the articles of this month, especially the backwards design one because the teaching has to be with the goal in mind from the start. I think it was the highlight of the month, the article and the Daily Thought. One has to prepare the lesson with the objective in mind and not give a lesson imagining it's a puzzle that you go mounting along the way. I read like 3.

Did you implement any of the strategies in the thought of the day videos?
I have implemented before reading the backward design one, but the article reaffirm that it is a great technique to use. Very valuable technique. That is the one I liked the most.

How successful were you in implementing the strategy?
I think I have been 100% successful because the articles and Daily Thoughts are a construct of a lot of experiences and tested and once you apply it, you are successful.

Do you believe the app has helped you change or improve your instructions in any way?
I think I have improved. My instruction has a pattern but it's my style what I have done is feed my style with the strategies and improved and polishes, makes it more sophisticated

Do you believe that the app has increased your professional confidence with instructions?
I think yes. I think it gave me more support in understanding situations that you might have doubts and this will clear.

Have you gone back to look at the daily thought videos from the past months?
The past months yes I've gone back but this month I haven't. I can go back any time. It's fast information which I love.

If you could make a single change to the app, what would it be?

 I think at the moment I see it perfect. The past interview I said to reorganize, but now I see it very organized. It's quick, simple, easy, I love that the translations are in one click, it's quick in doing the translations. It responds quick. It's only to have good connection

Anything you would like to share?
No, just that I wish that the app is shared with more professors and have a bigger coverage for more teaching necessities.

Person 7 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
For me, the three months have been very useful because it's different information and I think I have benefited from them all. To link the practice to the instruction because the information we receive is of investigations that are approved and tested and works, right? In the day to day we might have forgotten but then when I watch the video I go "Right! I had forgotten about it, I have to put it into practice!" and it's the same, we might be so used to giving the class a certain way that when you get this opportunity you have to take this in the moment that is in your disposition and receive it and

see how well it is going, if it works, etc., and helps change the practice for the students. We benefit from this as professionals but the students benefit more.

How useful were this month's thought of the day videos?
Just like the ones before, each month has had a specific subject on what to focus, first one was about classroom management, the second month everything about instruction, and the third month also is about how to evaluate. I can't say I liked one more than the other because all are related and they are all important. The articles and videos strengthen the Daily Thought that I find wonderful because it's an information that is summarized into 60 seconds and you can benefit hugely from.

How useful were this month additional videos the supporting videos? How many did you watch?
I loved one that is about how to start with the end, in education as backwards. One has to know what we want the students to learn in knowledge and abilities, and later see how you will evaluate, and then how you're going to do the class this way. I think this is the correct way. Many people do it the other way. Sometimes knowing what the goal or objectives you want to achieve, one can have things clearer and the rest comes. I love they gave the example how to go to California, and she mentions the book of the 7 abilities to be successful. And it's true! If you don't have the goal and the objective clear, it's hard for everything, even losing weight, it's for everything that one decides to use on in life, not only in education. It's not the same. How are you going to do to lose weight? What process? It's completely different. There are always some ideas that work.
The videos, this week, I think I watched about 18, more than last month. But yes, all related to education.

How useful were this month's articles? How many did you read?

The same. They help and justify the video on what is the information and the theory, goes much further. With the videos you go to other videos. I saw another video that didn't have to do with evaluation but about neuroscience and it opened up much more of my mind. I read about 14 articles this time. I didn't get to read them all. I read the ones that interested me.

Did you implement any of the strategies in the thought of the day videos?
Yes. In the three months, this year I wasn't a teacher but more as an assistant. I loved it. My partner used the formative assessment and I loved that part because you see the performance difference from the beginning and in the end we even made a paper that when they entered how they wrote their name and in the end. When they entered it, they began doing whatever they wanted, at the end they gave details. You can see how much they have advanced.

How successful were you in implementing the strategy?
What I love about this is that it works. It's not only a theory, it's not a concept. It shows you, it gives you examples like collaborative work I loved that video. It has the practice. We have to put it into practice. It helps you to be updated. I know there are some people that once they have their degree they don't care, but this help to advance. This is proven and shows what works. In a very practical, very convenient, you have access to the video way even when planning. It's only 60 seconds, you watch it, you go back, refresh it, put it into practice and go back!

Do you believe the app has helped you change or improve your instruction in any way?
Yes, fully. Because of what I have mentioned. There are things that as a professor you know, but over time you stop using or applying, and once the app, you remember or are things you haven't seen before and this works. And things you haven't used before you have to adapt, and it helps and it improves the education and benefits the students.

Do you believe that the app has increased your professional confidence with instructions?
Yes, fully. I haven't been able to give class per se. But the teacher has been proceeding, I'm covering for a teacher but I have applied some techniques with the students to keep them organized and it has helped. It works.

Have you gone back to look at the daily thought videos from the past months?
Yes, in some occasions.

If you could make a single change to the app, what would it be?
I think that it's so useful that it should be expanded and to last more, have more information. That it can be for all the teachers. That the endgame is that all teachers use it.

Anything you would like to share?
I love it and I'm glad that I was useful for this study, I love it because it keeps you updated with information on everything. You don't have to search for it and study. The app gives you the information already and it has to be shared with others.

Person 8 – Interview in Spanish

How useful is the Apple a day App for you as a teacher?
Well, it has been very useful for me. First because it has emphasized on things clearly that I wasn't aware of from education, not because I didn't know about it but because I didn't have the mechanisms to carry it out. In this last month, there were some videos of the Daily Thoughts that some premise was given, and then I watched the supporting video and read the article that gave the mechanisms so I can achieve certain objectives. From that point of view, it has been very useful.

How useful were this month's thought of the day videos?
There are some videos of the Daily Thought that, yes, they have been useful, about authentic assessment. That made me remember that I have done this before with students to evaluate them from a context perspective of real life. I didn't know that was an authentic assessment, and later found out and how this helps them be creative and achieve the objective, more than a standardized teaching would've taught them. I noticed that from the video and the article, the students in fact are more creative and more capable of accomplishing. For example, there's a Daily Thought that I watched about the essential questions and it gave examples about how to give questions and how to do questions for the students. Many of the students ask "how does this helps me in life?". The article says that these essential questions, the students answer these questions while you keep the main question open during the year and they keep changing the answer as they change perspective. Instead of letting them ask "Why do I have to learn this?" you give them the question from the start and during the year or lesson they keep answering themselves and encourages them to keep making questions. I loved that

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Daily Thought subject because there are examples of why we have to read. And in the article, there was an information that says why and how does art reflects society. And this is the focus about the society we live in that we have to have that curiosity in life.

How useful were this month additional videos the supporting videos? How many did you watch?
The supporting videos give some more information than the Daily Thoughts, I watched almost if not all the videos. Of those, I have acquired the recommendation to go to the articles. They reinforce each other. I like the videos because a professor gives great examples in focus of some activity like the one of the backwards designs. The girl that explained it was super dynamic about how to do it. I was explained about this before by the supervisor and I used to do it, but I needed to polish it. The girl from the video she actually explained in detail and the article is much more detailed. At the end, they had a links to further explain how to do the backwards design and how to design them.

How useful were this month's articles? How many did you read?
I think the articles were more useful above all. I haven't read them all but the ones that I have read those that have called attention to me and they are designed for easy understanding and offers the tools that one needs for applying what they are explaining. There's one I liked the most, about essential questions and the other one is the exit slips, because I didn't know what they were. The Daily Thought had left me confused and with the article I was able to understand. A tool to keep the students remembering and engaged. Not something complex, something simple that they can respond and understand what they have learnt.

Did you implement any of the strategies in the Daily Thoughts videos?
My students finished classes in November, in the last week of November I only had the special program students, and with them I was able to implement some of the strategies. With two of them I worked the formative and diagnostic evaluations, to see how much we have advanced. We kept it in a group way.

How successful were you in implementing the strategy?
The backwards design before reading this when I used to do it, I wasn't that successful. I didn't understand it as I do now. It was very general and not deeply. The formative and diagnostic assessments, we have always done that here in the school, at the start and at the end, and the formative at the end of each lesson. The summative are also done every lesson or so. The authentic assessments I didn't know about them and I have applied it and the results have been good. For example, they were reading some novels and from there, they made a frame. At the end, I would give them a chapter and they would have to explain it to me, and they would all do their drawings and a draft. They later made it in their canvas and they later presented them. The reality is I feel super proud of what they have achieved. The Last project that was a travel magazine. They each made something different and the result was positive.

Do you believe the app has helped you change or improve your instruction in any way?
Well yes. Because first, I acquired knowledge I didn't understand. Second, When I review the past videos, like how to implement classroom management, it helps for evaluations and now it is something we see the way they can be more conscience of what they want to achieve to later design. This app would be useful for all professors.

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Do you believe that the app has increased your professional confidence with instruction?
Yes. Fully. As I mentioned in the first month, like receiving the kids with smiles and appear as someone that is open and has discipline in the classroom but not in a negative but a positive way without looking like an ogre, because kids can take this perception that one is an ogre and it's not that! It's just that sometimes one has to take a similar stance because without discipline one can't advance in the context, and then you can't produce, and without product, you don't learn.

Have you gone back to look at the daily thought videos from the past months?
Yes.

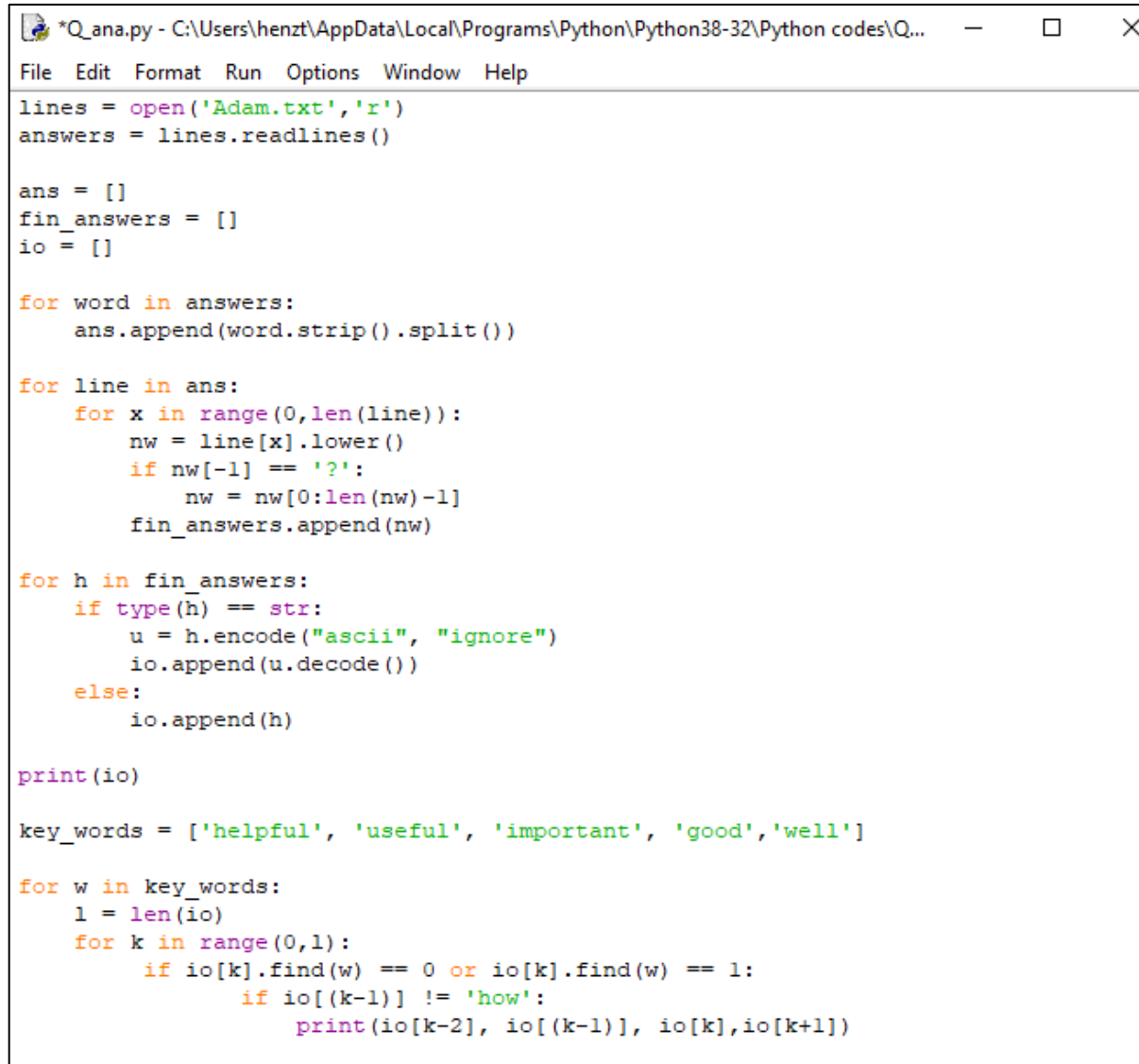**If you could make a single change to the app, what would it be?**
Just that, I have to open YouTube and that at the end, I have to go back to the app for the daily thought, because then I can't open it.

Anything you would like to share?
I wish this app can be shared. It will be very useful for other professors. It would help a lot. I say it from my experience, like backward design, it's not easy to sit down and plan out because there are a lot of materials, but if you have the tools and the articles or video says, "If you want to teach this exercise you want to do, and based off from that, what do you want them to learn?" then you can design. It's small details but it's the required steps to teach. It is something that is highly needed.

Appendix J: Python/MATLAB Code for Interview Transcripts

The following Python Code was developed to determine the usefulness/positivity of the transcribed interview responses.

```
*Q_ana.py - C:\Users\henzt\AppData\Local\Programs\Python\Python38-32\Python codes\Q...   —   □   ×
File  Edit  Format  Run  Options  Window  Help
lines = open('Adam.txt','r')
answers = lines.readlines()

ans = []
fin_answers = []
io = []

for word in answers:
    ans.append(word.strip().split())

for line in ans:
    for x in range(0,len(line)):
        nw = line[x].lower()
        if nw[-1] == '?':
            nw = nw[0:len(nw)-1]
        fin_answers.append(nw)

for h in fin_answers:
    if type(h) == str:
        u = h.encode("ascii", "ignore")
        io.append(u.decode())
    else:
        io.append(h)

print(io)

key_words = ['helpful', 'useful', 'important', 'good','well']

for w in key_words:
    l = len(io)
    for k in range(0,l):
        if io[k].find(w) == 0 or io[k].find(w) == 1:
            if io[(k-1)] != 'how':
                print(io[k-2], io[(k-1)], io[k],io[k+1])
```

The following Python Code was developed to determine the word frequency within the transcribed interview responses.

```
stat.py - C:\Users\henzt\AppData\Local\Programs\Python\Python38-32\Python codes\stat.p...    —    □

File   Edit   Format   Run   Options   Window   Help

words = open('Adam.txt','r')
lyrics = words.readlines()
new_ly=[]
final_ly=[]
for word in lyrics:
    new_ly.append(word.strip().split())


for line in new_ly:
    for m in range(0,len(line)):
        final_ly.append(line[m])



while len(final_ly)>0:
    diff=final_ly[0]
    num_occur=final_ly.count(diff)
    print(diff,' = ',num_occur)
    for a in range(0,num_occur):
            final_ly.remove(diff)
```

The following MATLAB code was developed for the linear regression analysis

```matlab
function[]=regression(x,y)
m=length(x);
x_bar = sum(x)/m;
y_bar = sum(y)/m;

s_XX = dot(x,x)-(m*x_bar^2);
s_YY = dot(y,y)-(m*y_bar^2);
s_XY = dot(x,y)-(m*x_bar*y_bar);

a_hat = s_XY/s_XX; disp(strcat("a_hat is ",num2str(a_hat)))
b_hat = y_bar-(x_bar*s_XY/s_XX); disp(strcat("b_hat is ",num2str(b_hat)))

regression_line = @(k) a_hat*k + b_hat;

correlation = abs(s_XY/sqrt(s_XX*s_YY));
if correlation > 0.8
    disp(strcat("The correlation is ",num2str(correlation)," so this is fit for a
linear regression line"))
else
    disp(strcat("This data is not suitable for a linear regression line because
the correlation is ",num2str(correlation)))
end

residuals=zeros(1,m);
for i=1:m
    residuals(i)=y(i)-a_hat*x(i)-b_hat;
end

error_varience = (1/(m-2))*(s_YY-(s_XY^2)/s_XX);
disp(strcat("The error varience is ",num2str(error_varience)," which is small"))

v=find(x==max(x));
u=find(x==min(x));
plot(x,y,'o')
hold on
plot([x(u) x(v)],[regression_line(x(u)) regression_line(x(v))])
%plot(x,residuals,'.')
hold off
end
```

Appendix K: Letter from the Minister of Education, Panama

REPÚBLICA DE PANAMÁ
— GOBIERNO NACIONAL —

MINISTERIO DE
EDUCACIÓN

D.M/0635/2020

Panama, June 18th 2020.

The Ministry of Education certifies that Dr. Adam Holden, Executive Director of the Albert Einstein Institute currently serves as the advisor to the Minister of Education overseeing the process of virtual education for the country due to the suspension of classes as a result of the Covid-19 pandemic in the country.

We express our deepest gratitude for his important help.

MARUJA G. DE VILLALOBOS

Ministra

Appendix L: Culture, plane crash theory and the power of 60 seconds

In November 2020, I was invited to present a little about my research project at TEDxPuntaPaitillaED an independent TEDx event in Panama City, Panama. Given that I was already in the process of submitting an article outlining the methodology and findings from Phase One for the study, I elected to take a slightly different approach to the presentation. Rather than focus specifically on the findings of the study, I chose to use an overview of the project and the data collected to discuss the challenges that arise from culture and language when it comes to effective communication. I then connected this to one of the primary functions of the "An Apple a Day" application, namely the ability to present complex theory and best practice in a simple and applicable way.

For more than half a century, research has linked language to cognitive development (Vygotsky, 1962). It is through language and social communication that individuals share intentions, share thoughts and suggestions, and manage relationships (Kanki & Palmer, 1993). The presentation focused on how the application worked as a tool for cross cultural connection – specifically addressing the cultural divide between the abstract language of academic and the practical language of the teaching profession in Panama. It is even more critical that communication be effective and even efficient especially in moments of stress or when conditions are time sensitive (Fischer, Orasanu, Davison & Rosekind, 1996), an environment experienced in many Panamanian classrooms.

TEDx online presentation

[Culture, plane crash theory and the power of 60 seconds TEDxPuntaPaitillaED](#)

Transcript

Close your eyes for a moment and picture scene from the 1920s. It can be any scene. Now imagine it today.

Over the past hundred years we've seen advancement in almost every facet of life that we know. Cars, streets, houses, technology.

And none more so than in the field of medicine.

Look at an operating theatre today and compare it to what an operating theatre looked like one hundred years ago. It would be almost unrecognizable! There's a reason for this. It's because the advancement in the medical field percolates immediately into the system.

But that's not the case for education.

If you look at classrooms from one hundred years ago and compare them to classrooms today, whilst there's newer furniture in the pictures, the structure is the same.

And schools tend to be the same.

We have homework, tests, quizzes, marching bands, sports teams… None of these have changed.

So, we have to ask ourselves, why? And in order to answer that question, I want to talk to you about the theory of plane crashes.

Malcolm Gladwell, in his 2008 book, "Outliers", devoted an entire chapter to the ethnic theory of plane crashes. And what the chapter shared with us is that rather than one single catastrophic event being the reason for most plane crashes, it's a small series of accumulating errors that causes planes to crash.

And the chapter talks specifically about two of these incidents. Firstly, Korean Air Flight 801, which was flying into Guam in 1997, and which went down killing 229 people. And when the crash scene investigators had finished, the result was that the belief was that it was the role of cultural hierarchy that had caused the problem.

Because in Korea there's a significant social hierarchy, and it's inappropriate to speak to somebody who's in a social capacity that is greater than yours in a non-respectful way. The captain flying the plane had more than 9,000 hours of flying and his first officer did not and so, as is traditional in Korea, rather than actually talk in alarming terms, the first officer really gave a series of hints to the captain. A captain who was exhausted and who didn't pick up on the hints.

In the case of Avianca Flight 052, which was flying into JFK in 1990, 65 people died. This plane had been held in three holding patterns above New York for close to two hours, when it failed to land 15 miles short of the runway because it ran out of fuel!

How can a language problem cause a plane to run out of fuel?

Well, the plane was being crewed by a Colombian aircrew, and the air traffic controllers in New York are notoriously rude and so when the Colombian crew attempted to communicate that they were "running out of fuel" a phrase that was used three times, by the way!

The air traffic controllers thought to themselves "we hear this all the time, if there's a problem they'll use the word 'emergency'."

The word 'emergency' was never used.

How can such a communications failure actually take place? I would imagine that I would be jumping up and down in the cockpit screaming that there's an emergency if I thought the plane was going to go down!

But the Colombian crew didn't. The difference is social context.

And when we look at social context in education, and particularly in educational research, we see clear parallels. Educational research comes from some of the brightest minds in the world. It comes from our greatest institutions, and these institutions are significantly hierarchical. When you work in a great institution you talk about whether you're a full professor or an associate professor. You talk about the quality of where your work's being published. You talk about where you are on the tenure process. You talk about where you got your degrees from. You live in a world that is academic. That

uses theoretical language and the more complex the language is the better it is. There's a pride taken in complex abstract scientific theory.

Now, compare that to the life of a teacher which is vastly different.

Teachers live in a world of practical application not abstract life. They find themselves at the sharp end of a pencil on a daily basis, and they're not always used to the language that they're asked to understand.

In 2017, just three percent of teachers in the United States had doctorate degrees. Circling back to the medical example, compare this to the fact that 100 percent of doctors (doctors by definition), have doctorate degrees. They're far more comfortable with complex language.

Besides which, the practical teacher certainly doesn't want to admit to the fact that they don't understand what they're being asked to read. So, we see that these cultures are in fact, opposing.

They're opposing hierarchically and linguistically.

Teachers are no different than the Korean Air pilots who are nervous about saying things. About the language being used. Who at the same time, don't want to admit that they don't understand and can't communicate effectively - just the same as those who are sitting on Avianca Flight 052.

And given this cultural divide it's not surprising that only a third of teachers describe their professional development as useful. Two-thirds, therefore, describe it as not practical. As not being meaningful for them. Why would they listen to a speaker when they really want to be getting their classrooms ready?

Again, compare this to the roles of a doctor. Doctors spend eight years studying and then a further three to seven years in a residency coupling that with practical application. So, there's no cultural divide in the medical model in the same way that we see in the educational model.

Well, we wanted to change this paradigm so time to develop a research the question!

We had to ask ourselves how do we take centuries of educational research and efficiently share it so that it's linguistically clear?

Now we know we have the expertise. We know what learning is. We know about the process of learning. We know about cognitive functioning, multiple intelligence theory, emotional intelligence, motivation. We know about all these things. The question is, how can we serve as a conduit from the abstract academic to the practical practitioner?

So, we embarked on a piece of research that had two steps to it. The first part was for us to find out what the teachers thought, and so we asked them a series of questions. We surveyed more than five hundred teachers across six different areas within Panama and we asked them specifically about their self-efficacy and their self-permission. Let me explain those terms to you. Self-efficacy means a person's belief that they can actually accomplish a task. The belief that I can actually do my job well.

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And self-permission? Well self-permission is the belief that I'm allowed to do my job well. Am I allowed to make the decisions I need to in order to be successful?

The idea was that once we collected this information, we would then try to design something that would be culturally appropriate, that would be able to share with teachers the research that they need in a very simple form to improve their efficacy and or their permission.

And here's what we found out. We found out that a teacher's confidence, or their efficacy, is linked directly to their experience. And we would expect that. The longer time a teacher spends in the classroom, the more they believe they can be successful in the classroom. They learn practically.

But we also found out that self-efficacy was not impacted in any way by the level of qualification that a teacher had. Having advanced degrees did not make a teacher feel that they could do their job any better.

And when we asked the questions about self-permission, we actually found the reverse to be true. We found out that teachers who had high levels of self-permission had higher qualifications. If they had more degrees, they believed quite clearly that they had more permission to make decisions in the classroom. The level of education that they had did not actually impact their confidence levels to be a good teacher.

Again, this makes sense, right?

The hierarchical determination of a level of a degree will share with you the ability that you're allowed to make your own decisions. In many senses, we believe that advanced degrees equals more intelligence, right? That's a whole other Ted talk by the way!

What we attempted to do then, was to take this information to put it together into a package that would work for teachers. We needed to ensure that whatever technology we chose to use would actually speak to the teacher the way they wanted to be spoken to.

Imagine then, our planning team attempting to take the volumes of decades of educational research and to be able to put it into simple tik-tok videos!

We needed to be able to share evidence-based practice. We needed to make it completely simple. It had to be convenient. It had to speak to teachers in their own language. Had to be shared over time and had to be creative so that teachers would be motivated to watch.

We created the "An Apple a Day" application. What was this?

It was a simple application that we built and gave to a small group of teachers. We let them try it out for 90 days and then we gave them interviews and surveys to find out what they thought of it. The application was totally bilingual in design - it was created in Spanish and in English. It was culturally appropriate - we paid close attention to teacher's cultural legacy making sure that music and photos appeared in the ways that they would expect to

The app started with a daily thought video, A 60-second video involving music, pictures and written text, where we could take very complex theory and present it to teachers in simple entertaining sound bites. We then had a section of supporting videos, where teachers, if they were interested in the concepts that they had just seen, could actually watch more detailed informational videos. Ten-to-twenty-minute videos concerning the same subject area.

Lastly, we created a section of supporting articles. The very research-based articles that teachers said that they didn't like to read. They could go in and take a look at these if they wanted to genuinely find out more information. We were interested to see whether or not teachers, when invited to try, would actually take a look at those articles. We organized this information into monthly themes. Classroom management was the first month, instructional strategies the second, and planning and assessment the third. All of the videos were then archived into libraries, so teachers had access to all of these resources twenty-four hours a day, seven days a week.

What did we learn from the experiment?

Well before I share the results with you what I'd like to be able to do is to show you what I mean by this social experiment. I'm going to start by actually reading for you a little part of the results section of the dissertation write-up for this project.

"The independent between groups ANOVA yielded a statistically significant effect. Thus, the null hypothesis of no differences between the means was rejected and the 4.3 percent of variance of SES was accounted for. The levels of experience. To evaluate the nature of the differences between the four means further the statistically significant ANOVA was followed up with the tukey's post-hoc test. The difference between the 'never' teaching experience group and the over ten years teaching experience group was statistically significant. The difference between the under five years of teaching experience and the over ten years of teaching experience was also statistically significant. A visual depiction of the means and the 95 percent confidence intervals is presented in figure 2."

So, that makes perfect sense if you're an academic. If you live in the world of quantitative research, you understood what I said.

For the rest of us, we just got heartburn!

What if I add a couple of visuals for you? Take a look at these two images. Here's a descriptive analysis table and a box plot chart.

Does it help you? Not really!

Now let's try it in "An Apple a Day" language.

Our participants reported very clearly that they absolutely loved the 60-second daily thoughts. They watched them all the time. In fact, all participants watched all of them. Not always once a day - sometimes they would go to the app at weekends or in the evenings and watch multiple videos.

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Sometimes they would watch them multiple times, but they found them to be useful one hundred percent of the time!

Not so the articles!

In fact, at the end of thirty days teachers were barely using the articles at all. They reported them as "boring" and "I didn't read beyond the first page".

We were seeing, in real time, exactly what we thought we might when they were asked about the thought of the day video compared to the supporting videos and the supporting articles. There was a clear distinction in what teachers were excited to see and what they were not. The term most often used in feedback was "useful".
94% of teachers who were interviewed said that they believed that because of the videos they saw there was a direct improvement in their instruction

100% of them claimed that it actually increased their professional confidence in instruction!

Their self-efficacy - the one thing we were trying to improve had improved significantly.

But not because they'd read research articles, but because they'd watched our 60-second simple videos

87% of those who watched said it should be shared more broadly with other teachers

Now, when we entered into this project, we had no idea that COVID19 was coming. This gave us the chance to test our theories further, because as you will know in many parts of the world entire counties have shut down. Schools had to immediately move to online learning and teachers are not experienced in online learning and don't necessarily understand the complexity of it.

So, we created two more months of material. We created two months of virtual learning. Of online learning. And we shared it with teachers across pilot programs in Panama and the United States.

And when did, we see, we saw exactly the same usage. We saw that regardless of where it was being watched, or how it was being seen, the 60-second sound bites were of much more use than the academic research that took much longer to understand.

And there were significant cultural implications. We realized that this could work on a cell phone in remote locations. That it could be used for teachers who have very little formal training. That it could be used beyond education - imagine that you are bringing on board a new employee into your company and you want to share the culture of a company?

Imagine that culture being shared one video at a time - sixty seconds at a time, over a period of a month or more.

We know as a result, that provided we're aware of the concept of cultural legacy,
and as long as we know our plane crash theory, we really can make a difference, sixty seconds at a time. Thank you