The Effect of a Coaching Model on Developing an Active Learning Environment Using a Learning Management System

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Using a learning management system (LMS) to deliver robust content for K-12 students became an essential part of the discussion of technology's place in K-12 education when teachers were forced to teach online at the start of the Covid-19 pandemic. Teachers used an LMS to deliver content in various ways and as part of different instructional models. Transformative student-centered learning occurs when teachers design active learning experiences within an LMS with deliberate attention to how the lesson is delivered and the students' product or process to participate successfully. This study examined the effect of a personalized coaching model on an educator's technological pedagogical knowledge (TPK) when designing an active learning environment using an LMS. Using results from the district administered Technology Uses and Perceptions Survey (TUPS), baseline data guided the development of personalized professional development (PD) in the form of a one-to-one coaching cycle for teachers interested in designing a more student-centered active learning environment. The coaching cycle followed the Technology Integration Matrix-Coaching (TIM-C) cycle. Field notes from the coaching cycle and responses from semi-structured interviews were qualitatively analyzed using thematic coding. Comparing the results of the TUPS administration in conjunction with themes extracted from interviews highlighted a correlation among the TUPS needs assessment, the PD coaching model, and a teacher's TPK self-efficacy using an LMS to facilitate an active learning environment. Teachers that identified using an LMS as a highly useful tool in teaching stated they were highly skilled in using the tool.

Additionally, those teachers who participated in coaching sessions were receptive to trying new ways to design active learning lessons that included presenting content and activities in the LMS. They reported positive interactions with the coaching process. Teachers built confidence with each lesson that was transformed into a higher level of active learning through their work with the coach. Planning for transformational active learning lessons infiltrates teachers' pedagogical knowledge levels and improves their technological pedagogical knowledge in small stages.

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Preface

Completing a dissertation and subsequently, my Ed.D. program is certainly the greatest educational accomplishment of my career. Just as my position in education has changed over the past twenty years, so has the journey through writing this dissertation over the past four years. I could not have completed this work without people's unwavering support in both my personal and professional life.

I'd like to recognize the support of the district teachers and administrators who allowed me to collect and analyze data in my teaching position. I could not have completed this research without your approval and cooperation.

I also want to recognize the close and supportive colleagues who always kept me going even when I thought I couldn't do it. Lynn, Sarah, Danna, and Jana– I could not have done this without your friendship and guidance.

To my STEM Arco at Pitt– our lively text string always kept me on task and sane even when I questioned my purpose in this program.

My advisor, Dr. Cassie Quigley– thank you for showing me that research can be practical and purposeful to affect real change in K-12 education. You modeled teaching in such a way that made me realize the work in a classroom can be studied and shared through improvement science. I appreciate the endless hours of revisions and meetings it took to get this dissertation to where it is today.

I also want to recognize my editor, Sarah Dugan, for her help and support with reading my paper for clarity and asking me questions when my writing wasn't developed. You knew exactly how to get the ideas out of my head and onto paper. Your work is exceptional.

I am incredibly thankful to my parents for their support of my education and for encouraging me to follow my dreams to become a teacher. Although my dad won't be here in person to see me complete this process, I know his spirit is present. Thanks, Mom, for watching the kids when I needed to focus on writing or stay after school to carry out research.

To my children, Ashley, Joey, Beckett, and PJ– I appreciate your patience with me when I was buried in reading, writing, and coursework. I hope someday it will inspire you to follow your dreams and be the best you can be in your chosen career.

Finally, I want to thank my husband, Derek, for his constant teasing and comic relief when I was stressing about the quality of my work. He will be happy to know that the POP, PDSA, and ISDiP acronyms won't be used as frequently anymore when we are talking.

1.0 Naming and Framing the Problem of Practice

1.1 Broader Problem Area

With the abrupt shift to online learning due to the COVID-19 pandemic, I have faced new hurdles in my responsibility to educate students and support my colleagues' teaching as a technology mentor. I had to learn how to use a learning management system (LMS) effectively, but I also had to navigate how to design blended learning (BL) experience with available information and communication technologies.

Educators like myself have not had much guidance or experience with blended learning. Still, they are expected to teach effectively in a model that blends in-person, face-to-face (F2F) instruction with online learning. Although traditional teacher preparation programs may include some form of technology integration into their coursework, they have limited training related to the use of technological tools that support instructional design within K-12 classrooms (Graham, 2019). Historically, teacher preparation programs have neglected to include a substantial portion of their programs to teach instructional technology practices and explain the differences between in-person, online, and blended learning environments (Archambault et al., 2014). Access to technology training does not improve when a teacher begins working for a district (Rice & Dawley, 2009). Additionally, the National Education Technology Plan NETP (U.S. Department of Education, 2017) reports that the forty-one states, the District of Columbia, four territories, and the Department of Defense Education Activity (DoDEA) "that have voluntarily adopted the Common Core State Standards, there are more than 100 direct mentions of technology expectations."

Given the explosive growth of ed-tech products, programs, and accessibility, it is not surprising that teachers feel unprepared to use them in their teaching. Teacher preparation and professional development (PD) are important pathways for moving education forward using educational technologies. Marzano (2007) states, "the factor that surfaced as the single most influential component of an effective school is the individual teachers within that school" (p. 1). My problem of practice is centered on teachers lacking the skillset to engage in effective instructional design using technology tools in a student-centered, blended learning environment.

1.2 Organizational System

Hudson School District (HSD) is a suburban district in a mid-Atlantic state. It serves over 3,000 students from three communities. Students in the district are 95% White, 2% Black, 2% Asian, and 1% Hispanic/Latino. Over 86% of district households have internet access. Families without internet access were provided free hotspots as the district transitioned to online learning during the COVID-19 pandemic, beginning in March 2020.

In January 2017, Hudson School District's new superintendent conducted stakeholder focus groups with parents, teachers, community members, and students within the district, determined common themes from the meetings and used those themes to administer a climate/cultural survey for the district. The administrative team used the stakeholder survey results to create a set of personal and district core values (see Appendix A). Representations of Appendix A are located on large wall displays inside each of the schools in our district. The tone was set for streamlining the mission and vision. The values were cohesive throughout the district. The district had a common language with which to speak and follow where "the mission is to educate and

prepare all students to become active, contributing members of society by providing a challenging, innovative, and educational program guided by an exceptional staff in a safe, positive, caring environment, all of which promote excellence." This statement is the guiding language of HSD's mission, vision, and belief.

It is evident through the language of the mission statement that the district values an innovative educational program personalized for all students. Planning and delivering an effective educational program was identified in stakeholder interviews as a prominent area of focus throughout all district initiatives such as aligning curriculum, equity in the classroom, and incorporating 21st-century skills into educational programming. The district goals and 3-year strategic plan are the driving force behind personalized, innovative, and learner-centric initiatives.

The abrupt shift to online learning accelerated the need for the district to improve PD support tailored to the unique needs of designing and facilitating a blended learning experience. The HSD administrative team looked at new ways of offering teacher support asynchronously and altered the school day schedule to allow teachers more time for technological PD and working with children online. Including teacher leaders in decision-making processes and adjusting the school day schedule to offer additional PD and individualized time to work with students shows how the administrative team values district educators.

Despite the recent stress of the pandemic, the business of educating children remains a priority. Countless hours are spent planning and executing a solid curriculum offering, keeping children safe, and supporting our teaching faculty. HSD joined a consortium of local school districts to purchase access to a robust learning management system, Canvas, and share online teaching and learning resources. This initiative emphasizes the value and importance of training educators to teach effectively in a blended learning environment. I was hired as an instructional

technology coach for all district teachers as 'Teacher on Special Assignment' (TOSA). I was responsible for implementing the Canvas LMS and assisting teachers, students, and families as they used the platform.

1.3 Researcher's Positionality Statement

To better understand the lenses through which a researcher receives and processes information, one must understand a researcher's positionality. I offer the following beliefs and perspectives as the foundation of my core personality and viewpoints.

Growing up in a suburban middle-class home, I was influenced early on by my father's blue-collar role as a machinist for a small independent company. My parents impressed upon us the importance of education and always valued school. As a result of their influence, I strove to work hard in school, and it came quickly for me. I was determined to have the job security that my father did not have. His company was not a union shop. He often spoke about a brief stint working in a mill and how he was told not to work hard on the second shift because it would make the others look bad. I never forgot that. I just could not understand why someone would not want to work hard.

On my journey to becoming a certified teacher, I attended a small, private college. I focused on how I could teach my specialty content area (science) to all students regardless of their background. I observed and worked in classrooms in city, suburban, and rural schools. I saw distinct differences in schools depending on their location. I spent time right after college teaching in a middle school with a vastly diverse and transient population due to a local military base and the families that worked there. I saw education from a different perspective. My classroom was a

safe space where I could teach my content while ensuring it was relevant to my students' lives. I craved their engagement with the lesson. If they were disinterested, I was bothered. I had to work harder to make my point or revisit my lesson. Was I teaching something that they needed to know? How could I connect it to their lives?

Most of my career has been spent teaching in a white, suburban middle-class school district. It was not until I began the doctoral studies that I focused on the struggles and points of view of different races and cultures and the impact public education has on their experiences. I used this experience to frame my professional development offerings and model inclusive design for lessons.

When working with the teachers in my home school district, I aim not only to share best practices for online design but also ideas for inclusive design for all learners. Teachers can build a community of learners in safe classrooms where students feel welcome and valued. Teachers must do more than simply impart their knowledge to students through lectures. We must communicate, collaborate with them, and value their voices. I believe that effective instructional design can encourage students to become self-driven learners who are confident in their abilities and strive to be better. Darling-Hammond (1999) notes that the success of a school depends on the educators who are in direct contact with students and on the administrators who support them. Furthermore, Darling-Hammond (1999) asserts "that the effects of well-prepared teachers on student achievement can be stronger than the influences of student background factors, such as poverty, language background, and minority status."

Given the importance of teachers in their students' educational experience, it is critical that teachers understand the instructional design models for online teaching and learning to provide a well-designed learning experience. Galanek et al. (2018) found that experience with or exposure

to a specific learning environment (i.e., face-to-face versus online) drives an educator's preference for a particular style of course. Specifically, how can we expect K-12 teachers to design and facilitate effective online courses when they have not been online students or exposed to training on best practices in online learning? This question drives my desire to pursue this research project and fulfill my innate drive to work as hard as I can for the best possible outcome, just as I saw my parents do during my life.

1.4 Stakeholders

Stakeholders have a vested interest in a teacher's ability and skills to teach effectively in a blended learning environment to support student growth. The stakeholders include the following:

- Teachers
- Students
- School-Level Administrators
- District-Level Administrators
- School Board
- Community-at-large
- Parents

To build on the initial list of stakeholders and their influence or interest in the research focus area, a Power versus Interest grid (Eden & Ackerman, 1998; Bryson et al., 2011) was used to analyze the stakeholders' relationship to the research focus area. Figure 1 reveals the outcome.

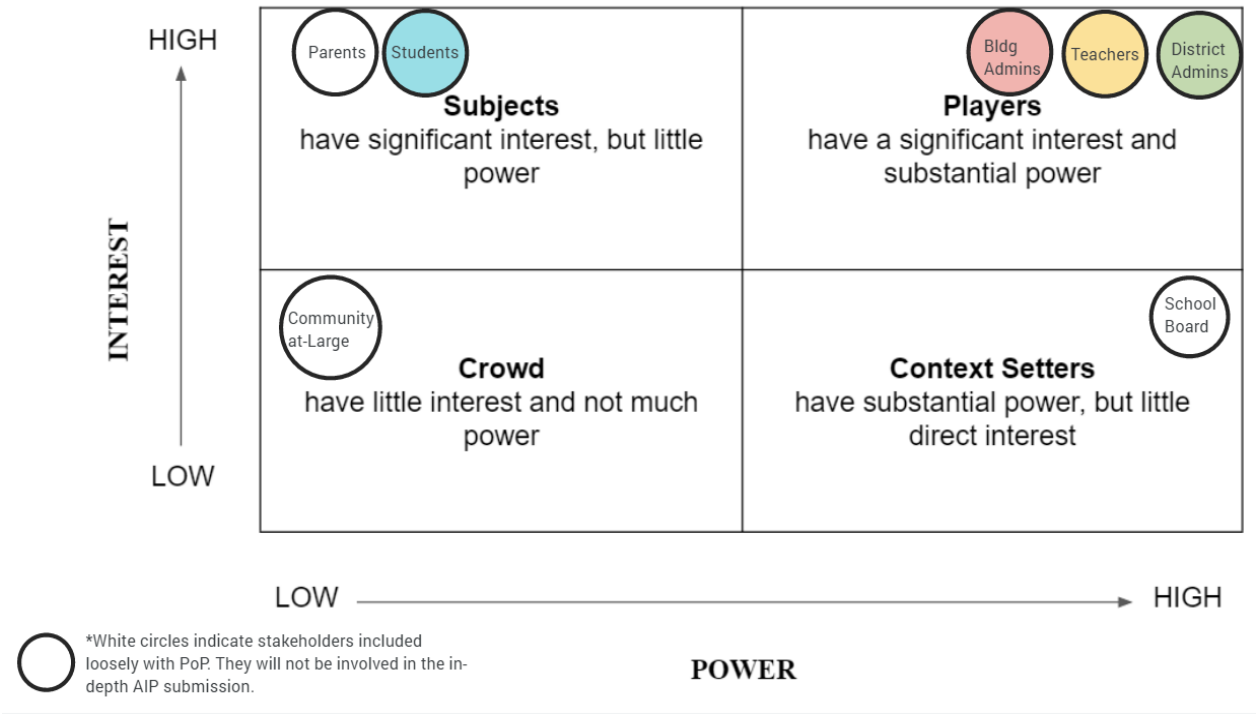


Figure 1. K-12 Teachers are not Adequately Trained to Design Blended Learning Experiences: Power Versus Interest Stakeholder Grid

Next, a detailed description of the stakeholders' demographics and key characteristics central to the problem of practice is provided.

K-12 Teachers are significant players in this problem of practice focus area. They are responsible for designing and delivering content regardless of the structure of the school day, that is, whether students are meeting face-to-face (F2F), synchronously online, or asynchronously online. Educators must be comfortable adjusting their content delivery to meet the ever-changing needs of students who may be unable to attend class as initially designed or for a district shift in educational models from traditional to blended learning. Understanding the difference between designing for online learning, in-person conventional classroom settings, or a blended model of the two is critical to a teacher's success in meeting student needs for demonstrating academic

growth. Classroom teachers are the primary intended users of the findings of this study. They hold great power over how the material is designed and presented in their classroom and with great interest and reason to want to be highly effective.

Students are directly influenced by the design of instructional tasks and the sequence of content delivery employed by teachers. Although engagement may differ among students because of developmental capabilities and environmental influence, the teacher's ability to design and facilitate an engaging course is the most critical piece of student growth, as noted in research (Marzano, 2007). Student interaction with course content and their performance on formative and summative assessments contribute significantly to their role in determining the outcome of this research.

School-level administrators can include building principals, vice-principals, or a dean of students that physically report to a specific building each day to oversee the daily operation of that school building. These administrators are responsible for the day-to-day interactions in teacher-student, teacher-teacher, and student-student relationships at the school building. They are responsible for disseminating information from the district-level administrators and carrying out district initiatives as stated in the missions and vision of the district. Although they may be included in disseminating district-level initiatives, they are often the purveyors of the ideas, not the originators. Their indirect relationship with designing district goals for student growth in learning is why I felt they had less power than a district administrator. They still have a high interest in student growth as their building and district state test scores are essential for their job evaluations and community status.

District-level administrators are another important player in the arena of teacher effectiveness. These administrator positions include superintendents, assistant superintendents,

curriculum directors, directors of special education, and technology directors. They supersede the role of a school-level administrator. These key stakeholders are in a primary position to affect what content is taught, how it is taught, and the availability of resources. They are responsible for clearly communicating an organizational mission and vision and directly relating district initiatives to those guiding tenets. They have great power in determining annual goals and forging a multi-year strategic vision and plan for the district. While our district administrators include a variety of stakeholders (i.e., students, teachers, parents, community members) in the strategic planning process, it is ultimately the district administrators who compile the data and construct the guiding documents. These stakeholders are directly responsible for the morale of the other key players in this problem of the practice focus area, most notably the teachers and students.

The remaining three stakeholders identified in the power vs. interest grid: the parents, community-at-large, and school board members, also have a vested interest in developing blended teaching skills for teachers. However, their roles are not directly within the player portion of the grid. Parents are interested in their children's educators; however, they do not have much power or influence over how the content is organized and taught. Often, parents operate in a reactive position about their child's academic performance. For example, suppose a child is not performing well. In that case, a parent may explain the material or concepts outside of the classroom support provided by the teacher, or they may hire a tutor to offer additional support. A parent's lack of power over how content is delivered and taught is not unique to our district. Teachers and district administrators are trained with an advanced skill set tailored to educators. This highlights the need to place parents as 'Subjects.' Conversely, the school board holds great power over the decision to implement new curricula, obtain new materials and technologies, and guide the direction of teacher training, yet, they may have little direct interest if they do not have children currently in the system,

placing them in the ‘Context Setters’ quadrant. They may also see their position as a community member responsible for fiscal oversight.

The final group of stakeholders identified through empathy interviews is the community-at-large. Community members may involve business owners, resident taxpayers of a district, and anyone doing business within the geographical area encompassed by the district. While there may be a slight interest in creating relationships between companies, schoolteachers, and classrooms, the result is often short duration and little infiltration into the organization. I associated these stakeholders with the ‘Crowd’ quadrant. They usually have little interest in the overall operation and daily happenings within the district and not much power to effect change within the organizational system.

After identifying the stakeholder’s positionality in the power vs. interest grid, I was able to see that I equally valued input from all stakeholders. After looking at their bases of power, I realized the importance of educators and their direct influence on students as greater interest and power to my problem of practice than the interest parents have in their child’s education or even the school board’s power over the entire process. The school board and district administrators have a productive relationship in our district. The school board is supportive of administrators' suggestions. Their role is to oversee the administrators and allow them to do the work they were hired to do. Our board does not make suggestions for programming. They will enable the superintendent to fulfill those responsibilities, so I removed them from the ‘players’ quadrant in the power vs. interest grid.

As I narrowed my problem of practice, the clarification of this initial stakeholder identification and analysis activity provided the groundwork for investigating the research methodology and data analysis techniques to consider. This work influenced my problem of

practice because I saw how primary causes (see Figure 2) related to different levels of stakeholders and how to focus my research on the core player stakeholders, classroom teachers. I focused on the pedagogical responsibilities of educators to design a more student-centered, active learning experience using an LMS.

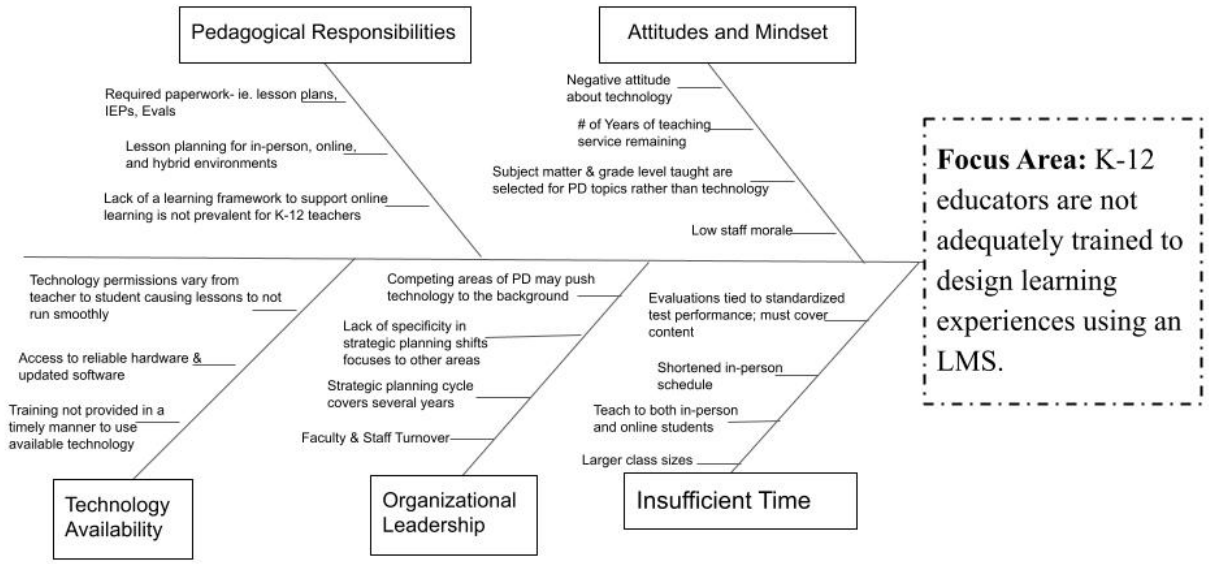


Figure 2. Problem of Practice Fishbone Diagram

K-12 teachers are not adequately trained to design and facilitate blended learning; the district's organizational system facilitated technology-related PD needed to support teacher learning during the initial school closure for the pandemic. Teachers also relied on peers and social media groups on the Internet, such as Canvas LMS Facebook groups, to gather ideas for blended learning instruction. Little attention was given to determining if the instructional strategy was vetted for creating an inclusive design for all student learners. One example of a blended learning instructional strategy that was adopted by many teachers but did not meet Universal Design for Learning (UDL) requirements or engage students in active learning is the use of the Bitmoji

classroom to present information to students. This example highlighted the need for additional PD that provided theoretical framework support to ensure lessons were fair, equitable, and engaging to students. The problem lay explicitly in disseminating best practices for designing blended learning instruction and ensuring that teachers addressed the unique needs of students learning in a blended environment.

Following this analysis, it was clear the administration had offered technology training for a new LMS, but what about training for an active blended learning environment? What continued to affect my problem of practice was the lack of empirical research in K-12 settings that supported the key competencies, or strategies teachers needed to engage students effectively in a more student-centered, active learning model using an LMS. Through interviews with teachers, students, parents, and administrators conducted as part of my job as an Instructional Technology Specialist, I realized the need for focusing on specific blended learning models.

1.5 Statement of the Problem of Practice

Educators are not adequately trained to design and teach in a blended learning model using a learning management system (LMS). The broad landscape of professional development offerings creates situations in which teachers do not receive technology-related training at the appropriate time or in the appropriate context. Often PD is decided for teachers within a district with little or no input from the teachers themselves. With the shift to using a learning management system to deliver personalized instruction that is utilized in both in-person and online modes, teachers need assistance in developing a new understanding of how teaching in today's digital age has changed since their undergraduate pre-service studies. The advent of new competencies utilizing

information and communication technologies for a blended learning environment are vastly different from what teachers may have experienced or learned about earlier in their teaching career. K-12 educators lack the skills and theoretical knowledge necessary to teach in a student-centered manner using an online learning management system that many districts now employ as part of their delivery of instructional services.

2.0 Review of Supporting Knowledge

2.1 Purpose of Review

My problem of practice is that teachers must design and teach within a blended learning model they are not adequately trained for, if at all. Despite having minimal or no experience as online or blended learners themselves, teachers are expected to effectively educate children using information and communication technologies they have had little experience using. I need to know how to support other educators in teaching within a blended learning model. The broad and changing landscape of the delivery of educational programming has resulted in the importance of defining the term 'blended learning' (BL) in terms of this research. According to Horn et al. (2017) the definition of blended learning is a formal education program in which a student learns

- at least in part through online learning, with some element of student control over time, place, path, and pace,
- at least in detail in a supervised brick-and-mortar location away from home, and
- the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience.

With that definition in mind, this research supports professional development for teachers who work within various BL models.

2.2 Roadmap

I focused my search on peer-reviewed research journals that describe general teaching models and strategies to integrate technology. Beginning with Lee Shulman's development of the Pedagogical Content Knowledge (PCK) model (1986), Mishra and Koehler (2006) explicitly stated that technological content knowledge (TPACK) was as crucial as pedagogical and content knowledge when developing the competencies of effective teachers. While it is essential to understand the theoretical relationship within a framework such as TPACK, teachers need to further an understanding of instructional design accessible to all people. Next, I identified prominent frameworks that guide the instructional design of materials that is fair and accessible to ensure all students can succeed. Those frameworks include the UDL and Technology Integration Matrix (TIM). Finally, I address teachers' key competencies to design fair and equitable blended learning lessons.

Search Terms: online learner, online learning, instructional design, hybrid learning, remote teaching and instruction, virtual school, K-12, equitable instructional design, professional development.

Key Scholars (and their areas of expertise) to investigate further:

- Shulman, Lee- Pedagogical content knowledge
- Mishra, Punya and Matthew J. Koehler – Technological and Pedagogical Content Knowledge frameworks

Key Organizations and Focal Journals:

- International Society for Technology in Education (ISTE)
- Association for Educational Communications and Technology (AECT)

- International Association for K-12 Online Learning (iNACOL)
- The Journal of Educational Technology & Society
- Journal of Educational Technology & Society
- Educational Technology Research and Development

2.3 What are the Guiding Standards for Learning and Teaching in the Digital Age?

Educational standards are what students need to know and be able to do. They are guidelines for educational entities to develop supportive curriculum materials teachers use in their lessons. Reed (2018) explains that many disciplines' standards explicitly state connections with technology over the past thirty years. Over the past ten years, rapid advances in and access to educational technology have led to technology-related standards for teachers and students. In addition to stressing the importance of what content students should know, the International Society for Technology in Education's (ISTE) standards and the International Association for K-12 Online Learning (iNACOL) frameworks address the importance of instructional design when planning for technology integration. Educators are the primary designers of lessons used in the classroom and should seek new trends in the delivery of educational materials. With a district-selected curriculum, teachers are tasked with determining pedagogical strategies and selecting tools for technology integration to guide what students should do. The use of instructional design strategies and their application of technology tools is essential for an educator's job description.

ISTE's vision states that technology is a way "to accelerate innovation in teaching and learning, and inspire learners to reach their greatest potential" (n.d.). The complete ISTE Mission Statement follows:

> ISTE inspires educators worldwide to use technology to innovate teaching and learning, accelerate good practice and solve challenging problems in education by providing community, knowledge, and the ISTE Standards, a framework for rethinking education and empowering learners. (n.d.)

ISTE has developed a series of ISTE standards for multiple audiences. Those audiences include students, teachers, and coaches. Although similar, the standards are written for a specific audience that addresses how the end-user will utilize the technology within learning. The different versions of the ISTE standards are written for students, teachers, coaches, administrators, and educational leaders. Looking at the standards for our primary stakeholders, educators, ISTE presents seven key roles teachers can emulate as they integrate the standards into their practice. As an 'Empowered Professional,' the teacher's role as a learner, leader, and citizen must be considered.

Additionally, teachers serve as a 'Learning Catalyst' as collaborators, designers, facilitators, and analysts. Thinking about this problem of practice and the desire to improve teacher education, we focus on two key roles. First, as a learner, educators should seek out the latest research from the learning sciences to leverage technology to support student learning. Second, as a designer, educators should seek out innovative practices related to instructional design that engage and support all learners.

Similarly, the iNACOL's blended learning teacher competency framework organizes 12 competencies into four categories: (a) mindsets, (b) qualities, (c) adaptive skills, and (d) technical skills (see Figure 3).

Figure 3. iNACOL Framework for Blended Teaching Competencies (2014)

The revised iNACOL framework (2014) highlights guidelines for online course content, instructional design, technology, student assessment, and course management within a blended learning model, all within the four main categories previously noted. The driving characteristics educators need to meet the changing demands of teaching regardless of what level of blended learning model their school or district implements are shown in Appendix B. For this literature review and research purposes, we focus on educators' adaptive and technical skills to address the district's characteristics of a selected instructional model and student-centered instruction.

Teachers should seek methods to continuously improve and provide innovative lessons that convey the district-adopted curriculum regarding adaptive skills. This aligns with ISTE's recommendation that teachers must act as learners. Additionally, technical skill development, including the management of a blended learning experience, is important for educators as districts

provide learning opportunities in multiple models that include a learning management system. Creating instruction online requires technical skills that align with the ISTE's call for teachers to embrace their role as designers (iNACOL, 2014).

Both sets of standards promise to help educators leverage technology for learning. Although the standards have undergone revisions, including ISTE in 2016 and iNACOL in 2011 and 2019, the end-user's connection to practice is interpreted. Specific strategies for aligning the standards are widely analyzed across research (Mishra & Koehler, 2006). Teachers must create their lessons in consultation with a well-designed set of standards to ensure they are meeting the needs of the students.

2.4 Technological Pedagogy and Content Knowledge (TPACK)

Lee Shulman (1986) identified pedagogical knowledge (PK) and content knowledge (CK) as equal parts of an educator's skillset, both necessary to create an effective teacher. He further clarified teachers' necessary knowledge base into defined, distinctive categories, pedagogical content knowledge, which explains how a teacher adapts and presents content to students (Shulman, 1987). Mishra and Koehler's work (2006) further developed Shulman's model to include technology as an additional aspect of the framework teachers need to execute successful teaching practice. Mishra and Koehler's (2006) TPACK (Technological, Pedagogical and Content Knowledge) framework (see Figure 4) illustrates the importance of adding elements of technological content knowledge and technological pedagogical strategies into an educator's repertoire of tools.

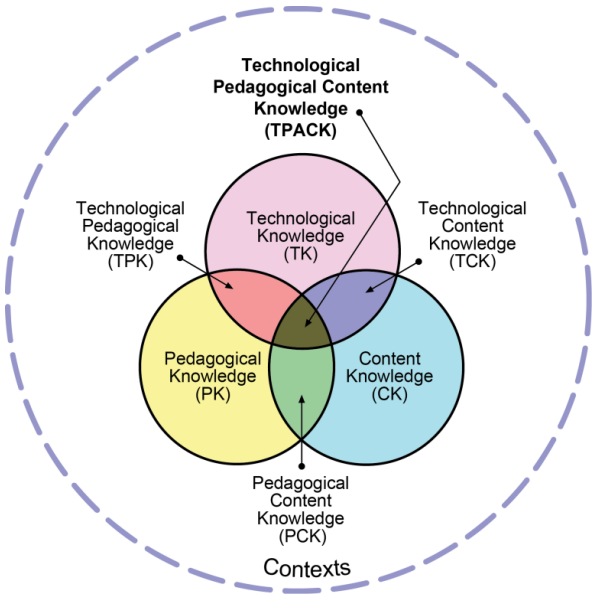


Figure 4. TPACK Framework (Mishra & Koehler, 2006)

The three aspects, technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK), are independent yet interconnected domains in their classroom integrations. Interconnections among the three types of knowledge create other associations teachers should consider when planning a practical lesson or unit delivery. In context, those areas represent Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Pedagogical Content Knowledge (PCK). Although a great deal of research is devoted to supporting the use of TPACK in teacher training, how TPACK applies to specific teaching situations lends itself to broad interpretation due to the multiple areas of focus and the new context created with overlapping concepts. It further allows teachers to apply different content knowledge and context areas as dictated by the educational situation they are working in. Koh (2019) suggests that lesson design can indicate whether teachers have developed the theoretical shift to enact student-centered learning design. This research focused on creating a teacher's TPK expertise when delivering content via a blended learning model using an LMS.

2.5 What are the Prominent Frameworks for Fair and Equitable Instructional Design?

Learning science research suggests four principles be considered to design effective learning experiences (Hirsh-Pasek et al., 2015). Those pillars include active learning (minds-on, interactive), engaging (through feedback and motivation with few external distractions), meaningful learning (connecting new learning to existing knowledge), and socially interactive (with the instructor and their peers) (Hirsh-Pasek et al., 2015). Active learning refers to physically active learning and mentally engaging with content (Barbour & Harrison, 2016; Hirsh-Pasek et al., 2015). For instructional design or design for learning to improve learning, teachers must strengthen their practice in the context of what they teach, be supported with useful, open tools, and understand that learning design is a design practice in which they can improve (Maina et al., 2015). These general principles are important to consider when designing instruction in the practice of teaching. Still, they do not describe specific techniques or strategies to ensure all students can access the instructional materials.

The Center for Applied Special Technology (CAST, 2018) has developed the Universal Design for Learning (UDL) framework through years of research and development. The UDL framework is based on neuroscience principles that suggest teachers design with three flexible paths in mind: engagement, representation, and action and expression to ensure student success. The UDL guidelines are represented in Figure 5.

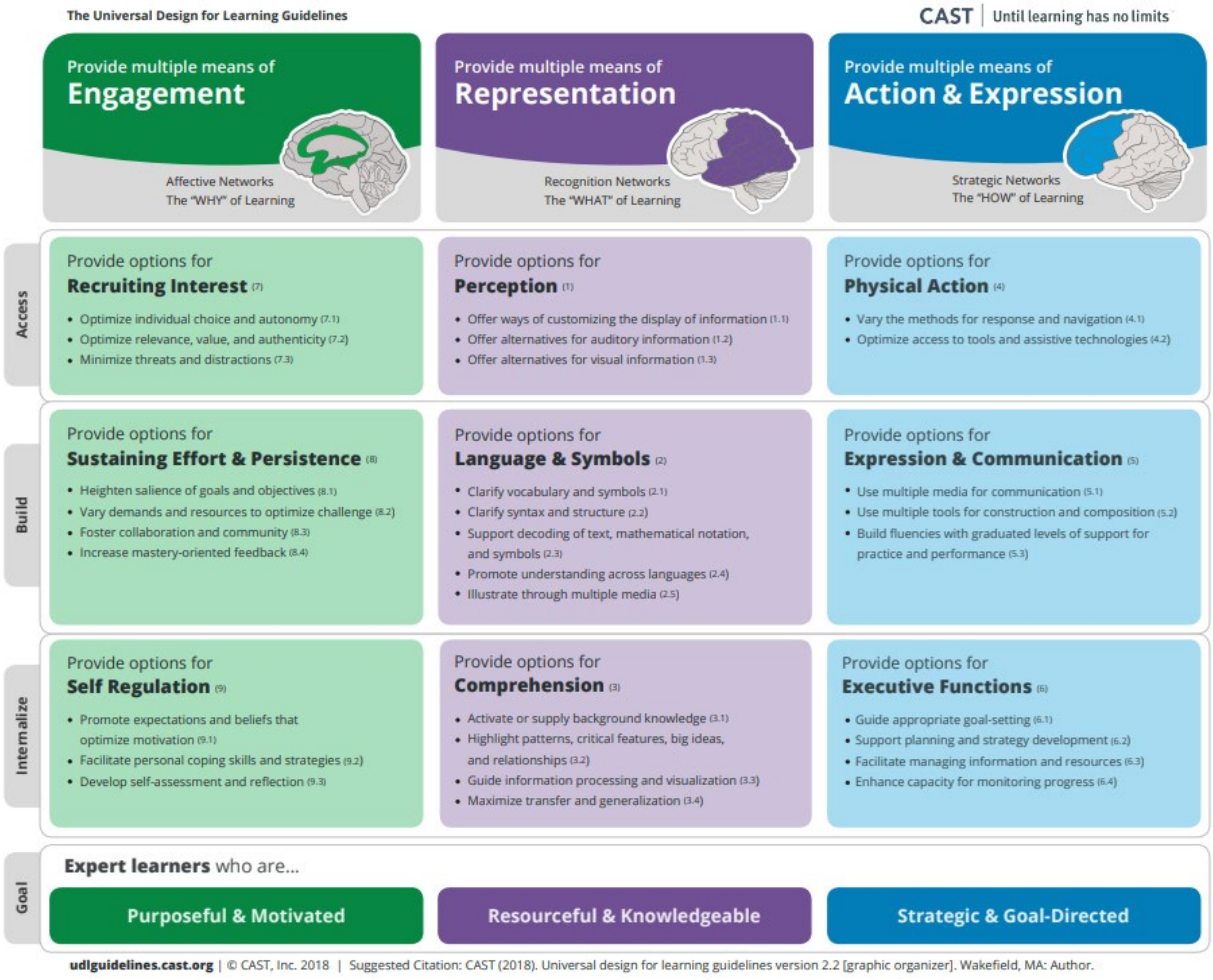


Figure 5. CAST (2018), Universal Design for Learning Guidelines Version 2.2

The three paths identify building strategies (i.e., learning design) for teachers to provide inclusive or accessible lessons to all students regardless of disability. The Universal Design for Learning framework encourages educators to consider several key reflections when planning lessons. Teachers should reflect on how learners will engage with the lesson, how the information is presented to learners, and how they are expected to act strategically and express themselves (CAST, 2018). The strategies highlight much of what is described as active learning components

by Bonwell and Eison (1991) and are discussed in greater detail in the next section regarding competencies.

In a narrower focus on instructional strategies, the Technology Integration Matrix (TIM) developed by the Florida Center for Instructional Technology (FCIT, 2019) provides a framework for identifying levels of technology integration across characteristics of five common features of the learning environment with particular attention to technological pedagogical strategies. The strategies are written in terms of what the teachers should do, what students can do, and the characteristics of an instructional setting that exemplifies each of the levels of technology integration across the matrix from a more teacher-centered environment to a more student-centered, active learning environment. A detailed version of the TIM that includes complete descriptors for teachers, students, and instructional settings is in Appendix C. A summary version of TIM descriptors is in Appendix D. A detailed description of the Active Learning characteristics portion of the matrix is in Table 1.

Table 1. Technology Integration Matrix: Active Learning Teacher Descriptors

Entry	Adoption	Adaptation	Infusion	Transformation
The teacher may be the only one actively using technology. This may include using presentation software to support delivery of a lecture. The teacher may also have the students complete "drill and practice" activities on computers to practice basic skills such as typing.	The teacher controls the type of technology and how it is used. The teacher may be pacing the students through the project. Making sure that they each complete every step in the same sequence with the same tool. Although the students are more active than students at the Entry level in their use of technology, the teacher still strongly regulates activities.	The teacher allows for some student choice and exploration of technology tools. Because the students are developing a conceptual and procedural knowledge of the technology tools, the teacher does not need to guide students step-by-step through activities. Instead, the teacher acts as facilitator toward learning, allowing for greater student engagement with technology tools.	The teacher guides, informs, and contextualizes student choices of technology tools and is flexible and open to student ideas. Lessons are structured so that the student use of technology is self-directed.	The teacher serves as a guide, mentor, and model in the use of technology. The teacher encourages and supports the active engagement of students with technology resources. The teacher facilitates lessons in which students are engaged in higher order learning activities that may not have been possible without the use of technology tools. The teacher helps students locate appropriate resources to support student choices.

According to *Design Justice* author Sasha Costanza-Chock (2020), "the use of digital technology . . . often unintentionally reproduces inequality, in large part due to institutionalized and unconscious bias and social distance between developers and those they seek to serve" (p. 206). The shift to a more student-centered, active learning approach supports the development of key characteristics highlighted in UDL and Design Justice principles. Those lesson characteristics involve developing self-regulation through opportunities for reflective practice, individual choice and autonomy over project detail, and customizing the presentation of content to suit the needs of all learners. Design justice critical pedagogy focuses on fair and meaningful participation in design decisions (Costanza-Chock, 2020). When students participate in a democratic design process for

lessons, consequently, they develop a critical analysis of the design itself. Teachers can use their students' input to shift the power dynamic in a classroom from teacher domination to an inclusive, empowered community of learners.

The theoretical frameworks provided in this section illustrate the need for teaching to move beyond simple parallel pedagogical and content knowledge practices from decades past. There must be additional professional and personal growth amongst teaching professionals to create the blended educational experiences all students need not only to survive but also to thrive in today's technological world.

2.6 What Key Competencies do K-12 Teachers Need to Teach Effectively in a Blended Learning Model?

Competencies are the possession of sufficient knowledge or skills to do something. Traditional teacher preparation and Professional Development (PD) generally emphasizes content-specific and pedagogical practices. While these categories of competencies are still crucial to effective teaching and learning, another category of competencies must include technology. With the addition of technology as a tool to learn with and from, the need to provide educators with detailed Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) when using technology to teach in effective ways with their students has emerged as an important competency as noted by the TPACK model by Mishra and Koehler (2006).

2.6.1 Blended learning

A blended learning model requires teachers to design learning activities that can be completed in various ways depending on the specific mode of delivery to a student. Teacher competencies to develop such involved lessons must include elements of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK) to build student learning experiences with an effective repertoire of technological pedagogical knowledge (TPK). The blended learning model within the K-12 environment has generated the push for a new set of specialized skills educators need to be successful. Davis et al. (2007) discovered that "effective virtual teachers have qualities and skills that often set them apart from traditional teachers" (p. 28). An overlap of certain competencies exists when comparing in-person and blended teaching; however, not all competencies are enacted in the same way within each learning model. In a 2018 literature review comparing K-12 online and blended teaching competencies, Pulham and Graham (2018) noted seven global themes that emerged from their comparison of eight different sources highlighting blended teaching competencies. Those themes include (a) pedagogy, (b) management, (c) assessment, (d) technology, (e) instructional design, (f) dispositions, and (g) improvement. Learning management system (LMS) usage was the top technology skill across the technology theme category. While it is an extensive list of global themes, it is important to keep in mind that the manageability of supporting teachers and the value of LMS usage serving an overlapping purpose were identified in multiple thematic concentrations (i.e., pedagogy, technology, instructional design).

2.6.2 Active learning

John Dewey (1938) noted the importance of students creating their knowledge through doing. His theoretical framework for constructivism focuses on actively engaging in tasks that build learning experiences. Bonwell and Eison (1991) describe the relationship between passive and active learning as a continuum. Activities falling near the passive end of the continuum require little more than listening on the part of the student. Activities classified on the active learning end involve higher-order thinking skills such as analysis, synthesis, and evaluation. They engage students to explore ideas and concepts and then think about their learning journey.

3.0 Theory of Improvement and Implementation Plan

3.1 Theory of Improvement and the Change

Hudson School District teachers design instruction for a blended learning model that requires technological pedagogical knowledge (TPK), as Mishra and Koehler (2006) described. My theory of improvement aimed to improve HSD teachers' technological pedagogical knowledge self-efficacy through the Technology Uses and Perceptions Survey (TUPS) and the TIM-C Coaching Model designed by the University of Southern Florida's Center for Instructional Technology (FCIT). Using the Technology Integration Matrix (TIM) as an implementation framework, I modeled active learning strategies in the instructional design of lessons delivered in a blended learning model of instruction to improve teacher TPK. The instructional approach included administering a pre-PD TUPS in conjunction with personalized professional development in one-to-one coaching for teachers to acquire blended teaching competencies outlined in the TIM and grow their technological pedagogical knowledge expertise.

A learning management system (LMS) is an integral part of the modern-day K-12 teaching and learning experience. As schools operate in various models, teachers must provide course content in various ways to meet all learners' needs. This research examined how coaching tailored toward technology and active learning influenced teacher technological pedagogical knowledge self-efficacy and its influence on teachers implementing active learning instructional methods in a blended learning classroom.

3.1.1 Inquiry questions

The inquiry questions guiding my research included the following:

1. How do teachers relate their level of technology skills to the perceived usefulness of the technology?
2. How do teachers describe the ways the coaching model supported them in designing and implementing an active learning environment?
3. To what extent did teachers implement an accessible and equitable active learning environment?

3.2 Aim Statement

Using the TIM-C coaching model and UDL design guidelines, I aimed to improve four HSD teachers' levels of technological pedagogical knowledge self-efficacy by the conclusion of the 2021-22 school year. The teachers' TPK self-efficacy was measured using a pre-PD administered TUPS and semi-structured interviews.

3.3 Driver Diagram

Perry et al. (2020) define the driver diagram as an improvement tool to depict the researcher's belief of potential areas for improvement related to a specific aim. In Figure 6, the primary drivers are ideas that can signify that an improvement occurred when change is introduced

and measured. Secondary drivers are related but carry a more actionable description. The change ideas presented in Figure 6 proposed an idea that could be implemented as part of a Plan-Do-Study-Act (PDSA) cycle of improvement science (Perry et al., 2020). A PDSA cycle is an iterative process educators engage in to test their own change efforts (Langley, 2014). Hinnant-Crawford (2020) suggests that Langley's PDSA cycle framework focuses on answering three questions to guide the improvement science process in concert with the PDSA cycle as a Model for Improvement.

- What are we trying to accomplish? [What is our aim?]
- How will we know that a change is an improvement? [What are our mechanisms for feedback?]
- What change can we make that will result in an improvement? [What change can be introduced in our system to move us closer to our aim?]

Hinnant-Crawford (2020) suggests that an iterative PDSA cycle involves opportunities for inductive and deductive learning. The Plan and Do phases employ a deductive approach to inquiry where a theory is developed and tested, while the Study and Act phases analyze observations and data to create a revised theory using inductive practices (Hinnant-Crawford, 2020).

The highlighted primary driver, "Blended Learning Instructional Model," was selected as the focus for this research study.

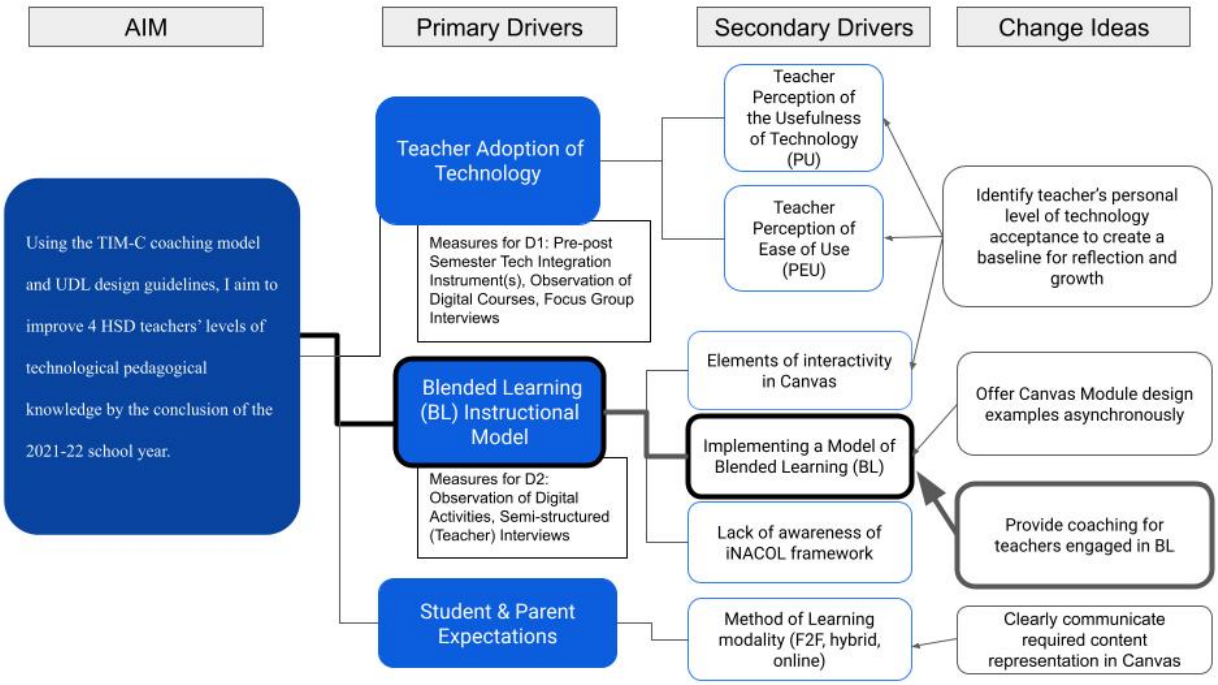


Figure 6. Aim Statement and Driver Diagram

3.3.1 Driver descriptions

As noted in this AIM statement, three primary drivers relate to improving TPK. Teachers' perception of the usefulness and the ease of use of technology, directly and indirectly, affect the degree to which they adopt technological innovation. In this study, the technological innovation was using the LMS Canvas to deliver course content. The PD design focused on highlighting and explicitly stating the LMS's characteristics that encouraged teachers to view the LMS as more beneficial for their job and improve their confidence in their abilities to use the technological innovation, Canvas.

3.4 Methods and Measures

3.4.1 Outcome measures

Two types of outcome measures, lagging and leading, determine if a change idea is enacting change in a system (Perry et al., 2020). A lagging outcome measure for this research was that 75% of teachers involved in a BL model PD will show an increase in their levels of technological pedagogical knowledge as determined by the administration of the TUPS at the end of the school year. This lagging outcome may be accomplished within the stated time frame or more prolonged. It is viewed as a long-term goal. Further data could be collected following subsequent semesters or school years and analyzed as a lagging outcome. An earlier leading effect desired after the 2021-22 school year's fall semester involved increased active learning lessons designed and implemented within a course in Canvas.

3.4.2 Driver measures

Driver measures identify if the change idea is making a difference or impacting the primary or secondary drivers (Perry et al., 2020). The observable change for this research project was to identify the instructional design of activities created by teachers during the coaching cycle. Where the activities fall in the passive-active learning continuum determined if teachers enacted the strategies suggested and modeled by the coach.

3.4.3 Process measures

Determining the effectiveness of the active learning and technological pedagogical knowledge coaching PD was important in knowing how the research progressed towards outcome measures. Preliminary data collection and feedback from initial administration of the TUPS and coaching PD session notes and semi-structured interviews indicated gaps in the delivery of the technological pedagogical knowledge strategies and the creation of active learning Canvas lessons. If there were no gaps, then the PD plan remained unchanged. If teacher lessons were not geared towards active learning, PD selection and delivery of content for teachers changed.

3.4.4 Balance measures

Reviewing the effect of a change idea on other areas of a system can determine if the introduced change is an overall positive or an improvement with a cost (Perry et al., 2020). It is important to consider the burden on teachers' time and availability at the beginning of a school year. Adding extra informal questioning in the form of surveys and PD sessions could add stress and affect the other measures within this improvement process. I monitored this closely and adjusted the length of the PD sessions as needed. This was one reason I chose to offer 1-to-1 PD sessions as required. Not receiving enough participants or teacher volunteers could be another indicator that the balance within the system was not supportive of participation in the study; however, this was not the case. Teachers eagerly agreed to participate.

3.5 Plan for Data Analysis

3.5.1 TUPS survey

As explained in the review of supporting knowledge and theory of improvement, the Technology Integration Matrix (TIM) is a helpful framework for teachers to identify a lesson's level of technology integration in concert with characteristics of five common learning environments using a consistent language. Teachers draw on their previous lessons and experiences to plan for the current year. It is up to the teacher whether they reuse a lesson as initially designed, modify it somehow, or replace the class with a different one. Within the category of Technological Pedagogical Knowledge (TPK) from Mishra and Koehler's TPACK framework (2006), teachers may recognize a context of teaching (TPK) they should address but may be unsure how to integrate technology. TIM offers teachers practical advice for integrating technology into their existing lessons.

The change idea for this research began with introducing the TIM to district teachers through the Technology Use and Perceptions Survey (TUPS). All teachers completed the digital survey online. Data were collected and stored by the Florida Center for Instructional Technology (FCIT) at the University of South Florida. In a study exploring the validity of the psychometric properties and appropriate uses of the TUPS, Ritzhaupt et al. (2017) recommend that the "data from individual items on the revised TUPS be used on their own as descriptive information about the behavior or perception that was directly measured." In this study, the TUPS provided insight into how technology is used in the classroom and how a teacher values a particular technology. This first step of the PDSA cycle included a brief presentation for all HSD teachers during faculty meetings at each building that explained why the TUPS is useful and how their responses would

be used. Each teacher was given a username and password to complete the TUPS. The survey took approximately twenty minutes to complete. I downloaded the data in an Excel spreadsheet from the TIM administrative center website following the survey. I predicted that most teachers would undervalue the 'usefulness of an LMS technology' line item and consider their 'level of skill in using an LMS' inadequate in relation to the technology.

To answer the first inquiry question, *How do teachers relate their technology skills to the perceived usefulness of the technology?*, TUPS provided baseline data to determine how teachers related the use of technology to their work. Teacher response data was exported as an Excel file and imported into a TUPS workbook format spreadsheet created by the FCIT. A quadrant analysis diagram was generated to understand how the respondent skill scores contrasted with respondent usefulness scores for each technology. The perceived usefulness of a given technology was plotted along the horizontal axis. The perceived skill level of the same technology was plotted on the vertical axis. The coordinates fell within one of four quadrants which describe the combination of skill and usefulness for each response, as shown in Table 2.

Table 2. Skill and Usefulness Quadrants

Usefulness	Skill	
	Low	High
High	Quadrant I	Quadrant II
Low	Quadrant III	Quadrant IV

Next, a chi-square test of independence was performed to determine if a teacher's self-reported skill level depended on their self-reported use of technology in teaching. A chi-square test

is used to determine if the difference between observed data and expected data is due to chance, or if it is due to a relationship between the variables of usefulness and skill using the data collected from the TUPS survey.

3.5.2 Coaching cycle

Following the TUPS administration, I was contacted by several teachers looking to transform their active learning environment from a teacher-centered to a more student-centered environment using the coaching model and the Canvas LMS. In this intervention, I worked with teachers using the TIM-C coaching model developed by the Florida Center for Instructional Technology (FCIT). The steps of the TIM-C are shown in Figure 7.

Figure 7. TIM-C Coaching Cycle (FCIT, 2019)

By encouraging teachers to re-design for a more student-centered active learning environment, teachers transformed student learning instead of just enhancing it with technology as a direct substitute for an existing way of teaching without technology. Using the FCIT's TIM-

C framework as a guide, I followed a series of five steps in this PDSA cycle. To complete Phase 1: Set Goals, I asked the teachers to explain their plans for a unit. I recorded the notes manually. Once I understood the unit content, I asked about the teachers' current level of LMS use. I took notes regarding the teachers' current unit designs in Canvas and noted any requests for how they wanted the unit to appear for students. In Phase 2: Plan Activities, the document 'Key Questions to Consider When Planning Lessons' (CAST, 2020), as seen in Table 3, was used to guide coaching sessions. Rather than asking the questions on the document in order, I used it as a guide for follow-up questions once a teacher finished explaining their ideas for a lesson. Not all questions were posed to each teacher in a coaching session. It was important to consider which questions were already answered when the teacher provided their initial goals and plans for the unit so as not to ask the teacher repetitive questions and build rapport between the teacher and coach.

Table 3. Key Questions to Consider When Planning Lessons

Prompt	Questions
Think about how learners will engage with the lesson.	Does the lesson provide options that can help all learners: • regulate their own learning? • sustain effort and motivation? • engage and interest all learners?
Think about how information is presented to learners.	Does the information provide options that help all learners: • reach higher levels of comprehension and learning? • understand the symbols and expressions? • perceive what needs to be learned?
Think about how learners are expected to act strategically and express themselves.	Does the activity provide options that help all learners: • act strategically? • express themselves fluently? • physically respond?

Coaching sessions were held in a variety of ways. Initially, I (i.e., the coach) met in person with the teacher to set goals and plan activities. The first session involved listening to the teacher and understanding their level of technology use in Canvas and with their content. We worked collaboratively to state goals for the collaboration. For example, the second-grade teacher's goal was to "Design an interactive unit where students could learn about Greek gods, goddesses, monsters, and heroes, on their own and at their own pace in preparation for a 'wax museum' presentation on one of the characters." I offered suggestions to integrate and elevate the level of active learning within the unit design. Typically, an initial meeting with a teacher lasted thirty to forty-five minutes. Additional planning activities continued after the initial meet. The teacher and

instructional technology coach used emails, texts, and Google Meets to discuss lesson design. These interactions were shorter in length, sometimes only lasting for five minutes with a quick check-in to see how planning was progressing. Each interaction was noted in writing and added to the file for that coaching sequence.

In Phase 3: Monitoring Progress, the coach was present in the classroom for the majority or all of the project. The coach provided support in many ways. Depending on the teacher's level of confidence, the coach and teacher worked together to determine who would present instructions for the students. Four teachers requested that the coach present the technology instructions to the students. For example, the English grade eleven teacher requested the coach present information to students regarding how to search and access databases to locate sources and cite them properly using MLA format. The English grade nine teacher asked the coach to present the steps of using an online citation generator to properly cite sources for their hero research project. Both the teacher and the coach were present in the room during the lesson when the coach presented instructions to students. Following the in-class lesson, the coach asked follow-up questions to the teacher to identify the alignment of the lesson to the initial goal set at the start of the coaching process. These questions were often in person during or at the end of that class lesson. The coach also followed up with texts if the teacher client used that form of communication with the coach prior to the lesson.

The final parts of the coaching cycle, Phase 4: Recording Outcomes and Phase 5: Reflection were accomplished during post-lesson conversations and a semi-structured interview that allowed teachers to share their thoughts on the project, share student feedback, and provide suggestions for future improvement. The flexibility of the coaching model allowed for the coach

and teacher to adjust their meetings as needed to fit changing teacher schedules, technology availability, and other outside forces affecting the daily schedule.

Interviews were recorded and transcribed using Google Meet voice-to-text transcripts. Transcripts were read immediately following their availability to ensure accurate portrayal of the language between coach and teacher. Minor editing occurred to remove repeated words and separate the interviewer's questions or prompts from the response. Transcripts were printed and pre-coded by highlighting and underlining participant quotes related to the use of an LMS and the types of learning students were involved in. Pre-coding field notes and transcripts provides separation before coding and analytic review (Saldaña, 2021). The first cycle of coding methods involved descriptively coding participant comments into one of two categories to determine which part of the inquiry question *How does a coaching model influence an active-learning focused digital learning environment?* is addressed. To answer the inquiry question, comments related to (a) any element of the coaching cycle or (b) the type of learning environment created by the lesson design can be used to generate discoveries related to the inquiry question. The use of in vivo coding resulted in three categories in which to discern participant quotes: (a) coaching, (b) active learning teacher descriptors, and (c) universal design for learning descriptors.

3.5.3 Qualitative coding

The *coaching* code applied to any comments related to working with a support whether that is a personal coach, online resource such as YouTube or a Facebook group, and highlights information related to "How-to" implement a certain technology such as designing a page in Canvas. Table 4 details coaching related codes. Interview comments related to seeking technology

support were analyzed to determine if they fell into a category of synchronous (i.e., real-time, live interaction) or asynchronous (i.e., not live).

Table 4. Coaching Related In Vivo Coding Descriptors

Code	Description and example
Synchronous	Personal and live coaching experience: "You [coach] gave me new ideas and a different look at things . . . I probably would have figured it out, but it would've taken me longer to do it."
Asynchronous	Independent, not live-supported: "A lot of learning new skills was Googling and following what I saw in YouTube videos."

The *teaching and learning* code applied to comments related to how a lesson was designed, what students did to complete a task, the structural considerations for a lesson, or how the lesson provided for Universal Design for Learning. The Google documents for each interview were parsed into meaningful units or quotes and organized using priori codes. The three UDL paths: engagement, representation, and action and expression (see Figure 5) along with FCIT's stages of the active learning continuum were used as codes in the qualitative data thematic analysis. Table 5 further describes the codes used to differentiate the type of coaching and the type of UDL and active learning intended in the example.

Table 5. Description of Active Learning Teacher Descriptors

Code	Example or description
Entry	"Anything [in an LMS assignment] that's all multiple choice will obviously self-grade."
	"I might teach a lesson and there's a passive element [to the presentation], but then students create for the final project."
Adoption	"I use exit tickets on canvas, so that it's just a lot of recall of information or key points that I want them to know."
Adaptation	"Technology . . . as a collaborative piece so it's so easy to share the information whether they're working on a project or we're utilizing canvas, or even just the sharing of a doc for peer editing, that's just so much easier now for them to communicate with each other."
Infusion	"They [students] got to kind of choose their own path for that specific character or those specific characters, which was pretty cool."
Transformation	Students use technology tools flexibly to achieve higher order learning activities.
	No examples of transformation were identified in the coding of participant interviews.

In addition to aligning lessons to levels of active learning, the technological pedagogical elements of assignments were categorized into certain levels related to the Universal Design for Learning framework's three main categories (i.e., engagement, representation, and action and expression) as seen in Table 6.

Table 6. Description of Universal Design for Learning Descriptors

Code	Example
Engagement Provides options for: • Recruiting interest • Sustaining effort and persistence • Self-regulation	"It more or less wasn't us teaching content. It was us teaching them how to use the resources. But once they figured out how to use resources, it was like they were just absorbing all sorts of information." "Using a shared space [Google site or docs] allows students access to collaborate."
Representation Provides options for: • Perception • Clarifying language and symbols • Guiding comprehension	"[Students] researched a different group or organization and created a presentation to share with the class and they pulled in a lot of really cool other elements . . . learning about the music, the language, you know. Traditional dance even, and you know, also identifying archetypes as well."
Action and Expression Provide options for: • Physical action • Expression and communication • Executive functions	". . . that's when I shifted it. It's their turn and they are able to create projects and presentations." "[Canvas] provides me a way to communicate easily with those students that are missing an assignment. [setting message parameters] allows the teacher to send communication to students more easily through the LMS."

District teachers rated "frequent use of the LMS" in their TUPS responses as a useful skill that promotes professional development tailored to enhance pedagogical content knowledge within LMS course and assignment design. I was regularly contacted to provide LMS support in module and lesson design. I used the TIM-C coaching cycle to guide the professional development experiences for all teachers with whom I worked. Once the first three phases of coaching were completed, I conducted semi-structured interviews with teachers to understand the. These interviews were conducted via Google Meet. Interview questions encouraged teachers to reflect

on their understanding of technological pedagogical knowledge and how it translated into their course design and delivery. Interviews were transcribed using Google Meets transcription services. The interview protocol is outlined below.

3.5.4 Semi-structured interview protocol

Semi-structured interviews were conducted with participating teachers. These interviews were conducted via Google Meet. Interviews questions encouraged teachers to reflect on their understanding of technological pedagogical knowledge and how it translated into their course design and delivery.

1. What types of active learning have you implemented that includes instructional technology (at any level)?
2. How did the coaching model influence your lessons?
3. Describe the types of support you need or would like to have when planning with instructional technology as part of your lesson.
4. How has technology changed the way you teach so far this school year?
5. Is there anything you would like to add?

3.5.5 Inquiry questions and protocol questions alignment

The inquiry questions and protocol questions alignment are detailed in Table 7.

Table 7. Inquiry Questions and Protocol Questions Alignment

Inquiry question	Collection protocol	Protocol questions
How do teachers relate their level of technology skills to the perceived usefulness of the technology?	Technology Uses and Perceptions Survey (TUPS) by the Florida Center for Instructional Technology; Survey administered pre- and post- PD coaching cycle	The survey included 200 items in seven categories and provided data to guide school- and district-level decision-making. The survey sections included: • Technology Access and Support • Preparation for Technology Use • Perceptions of Technology Use • Confidence and Comfort Using Technology • Technology Integration • Teacher and Student Use of Technology • Technology Skills and Usefulness
How do teachers describe the ways the coaching model supported them in designing and implementing and Active Learning environment?	TIM-C Framework to use with coaching (Also developed by FCIT): Phase 1: Set Goals Phase 2: Plan Activities Phase 3: Monitor Progress Phase 4: Record Outcomes Phase 5: Reflect on Coaching Cycle Semi-Structured Interview	1. What types of active learning have you implemented that includes instructional technology (at any level)? 2. How did the coaching model influence your lessons? 3. Describe the types of support you need or would like to have when planning with instructional technology as part of your lesson. 4. How has technology changed the way you teach so far this school year? 5. Is there anything you would like to add?
To what extent did teachers implement an active learning environment universally designed for all?	Semi-structured Interview	Same as above

Teacher responses to the interview protocol questions were analyzed and matched to themes using both categories of qualitative coding described previously that include *coaching* and *teaching and learning*.

4.0 PDSA Results

4.1 Findings

One hundred and twenty completed TUPS survey responses were received out of a possible 244 district teachers resulting in a 49% response rate. In the TUPS section 'Teacher Uses of Technology,' 86% of respondents self-reported a high skill level in using an LMS and a high level of use regarding the LMS technology. Additionally, 85% of teachers reported they used an LMS daily as illustrated in Quadrant II in Figure 8. At the same time, only 73% of students are prompted to use the LMS daily according to teachers. Sixteen percent of respondents said that using an LMS was not a helpful skill related to their position. The outcomes were unexpected. I predicted the majority of teachers would rate the usefulness of an LMS as low and consequently, rate their skill level as low. The opposite of both was true.

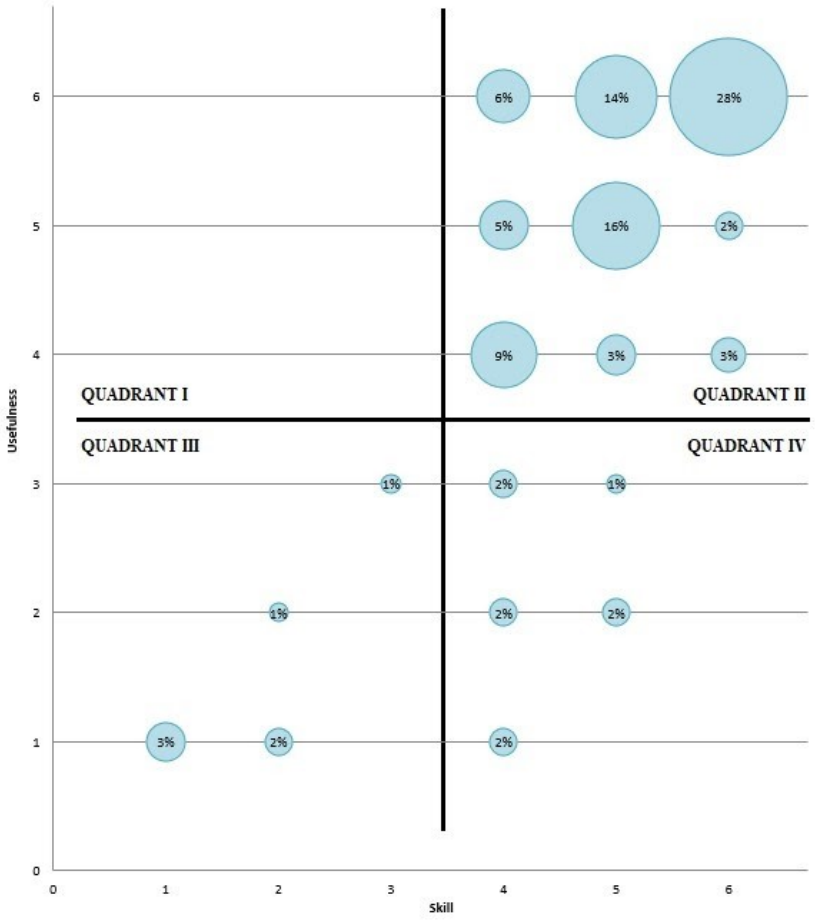


Figure 8. Learning Management System TUPS Quadrant Analysis

Another important question arose during data analysis when reporting regarding an LMS: Does 'Skill' relate to 'Usefulness'? To determine if a teacher's self-reported skill level depended on their self-reported use of technology in teaching, I performed a chi-square test of independence. The *p* value of the trial was 3.10E-11 indicating the variable related to skill and usage are related because when $p < 0.05$, one must reject the null and conclude the variables are not independent. This indicated that respondents who said they had a high degree of skill in using an LMS technology would also suggest that using an LMS is beneficial in their teaching role.

The four teachers interviewed all referred to synchronous coaching as a useful part of their success with using Canvas in their classroom. One participant commented, "[coaching] definitely increases the probability of trying new things because anytime I've had a problem or question, I'll usually email the coach first." In relation to learning new technology, a high school English teacher commented, "definitely your role in all of this as being a teacher and guide, and now the helper, you know just when we need [support]. It is invaluable. I think it's necessary. It's really important to have someone who can be our go-to when we're struggling with any new technology." When asked about the types of support they used, participants referred to utilizing a personal coach (i.e., synchronous support) and independent sources (i.e., asynchronous) for technology assistance in their teaching. Sixty-two percent of support-related interview comments referred to using a synchronous 1-1 coach, while 38% referred to using an independent asynchronous on-demand source such as the Google search engine, YouTube videos, or an online group such as Facebook.

In addition to establishing that coaching was useful, a thematic analysis of interview transcripts revealed links to both elements of active learning and Universal Design for Learning's pathways for supporting all learners. UDL learning design strategies were employed by teachers through their lesson design.

Each lesson was related to a level of active learning required on the part of the student. Further explanation of the use of Canvas within the context of the classroom and curriculum delivery highlighted the use of principles of UDL within activities to promote meaningful, challenging, and fair learning opportunities. Those UDL guidelines were used as the basis for thematic coding along with the level of integration (i.e., entry, adoption, adaptation, infusion, transformation) to determine if a teacher was designing an active learning environment shifting from teacher-centered to more student-centered with the use of a technology coaching intervention.

Coding the transcripts revealed teacher comments related to UDL occurred 45 times. Within the UDL theme, codes were further organized into one of three categories: engagement, representation, and action and expression. A breakdown of those codes are illustrated in Figure 10.

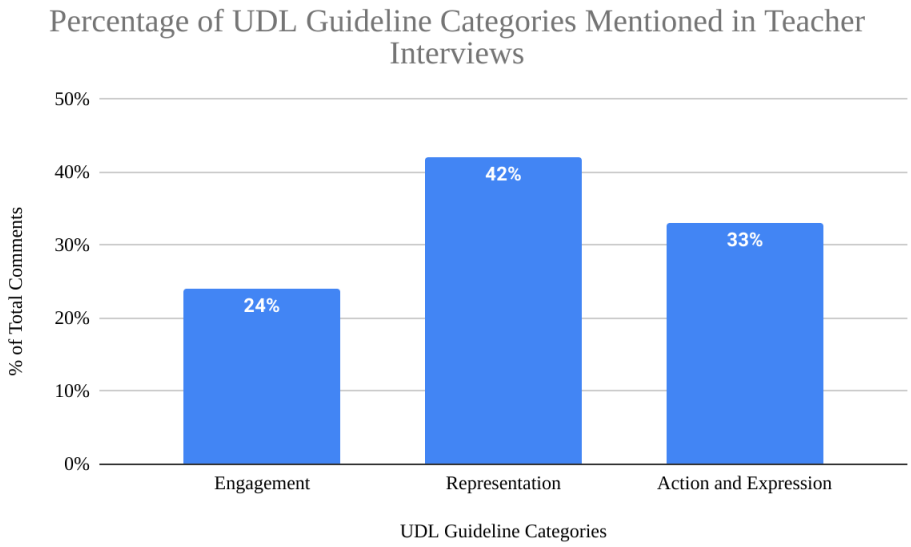


Figure 9. Percentage of UDL Guideline Categories Identified in Teacher Interviews

Out of all the comments, teacher remarks highlighted opportunities for using technology as a tool to improve accessibility 42% of the time. A teacher commented, "Students always know what we are doing. Posting the daily or weekly agenda [in Canvas] offers students access to the resources we use in any unit at any point in time." This allowed teachers to illustrate content through multiple media and highlight the relationship between the content and the activity students are working to complete. The remaining areas of the UDL framework (i.e., engagement, action and expression, were identified in 24% and 33%, respectively, of the remaining comments linking UDL to teacher's design of learning activities using the LMS. Most teacher comments identified the use of the LMS to design lessons that are accessible to students in any capacity, whether they are learning in school or from any area other than the school campus. Although teachers mentioned

using multimedia for improving expression and communication of content, few teachers offered options for varying the physical action students could use to complete the task. Although there are steps toward integrating principles of UDL throughout the interview responses, most participants did not consider a broad integration of strategies for students to access, build, and internalize the learning content.

The Technology Integration Matrix highlighting Active Learning Teacher Descriptors highlights five levels of integration for lessons. Overall, the four teachers that interacted with the coach created and implemented lessons that fell within the adoption, adaptation, and infusion category descriptions. In a second grade reading unit learning about mythology, the teacher designed a wax museum project for students to emulate a hero, god, goddess, or monster from ancient Greek mythology. Students researched a variety of characters using video and text selections organized by the teacher in the LMS. The high-level text presented in the sources was above students' reading levels. Therefore, the teacher and coach worked collaboratively to teach students how to use screen-readers, turn on close-captioning, and make adjustments when certain technologies did not work as expected. Students worked at their own pace to examine many of the possible characters they could choose for their project's final presentation. Students filled in a paper outline for each character they learned about. The pre-labeled categories on the one-page outline included character name, nickname, relatives, mortal or immortal, and a space for special facts or story. Following the information gathering phase of the project, students self-selected one character from the group they researched. They created a short overview of their character and planned a presentation of the overview while dressed as their character. Students practiced their speeches and then presented them to the kindergarten classes in the school. The wax museum activity provided students with an opportunity to practice public speaking, exhibit creativity, and

build confidence through self-expression all while learning reading skills from a district-adopted curriculum.

When asked about student engagement and the type of learning occurring during the project, the teacher commented, “It more or less wasn't us teaching content. It was us teaching them how to use the resources [technology skills]. But once they figured out how to use resources, they were just absorbing all sorts of information.” Student use of technology was self-directed. The teacher acted as a project facilitator. The lesson design fell within an adaptation-infusion level of active learning. Additional lesson descriptions are provided in Table 8.

Table 8. Description of Units Designed through Coaching

Active learning descriptor	Lesson description	Grade level	Content area
Infusion	The teacher designed a unit where students self-selected a technology resource to learn about Greek gods, goddesses, monsters, and heroes. Students created a narrative from the knowledge they gained. They dressed as their character and performed a brief monologue of their character for an audience. All resources were available through a module in Canvas titled, 'Wax Museum.' Students had access to the resources and a Google site used to organize related videos for students.	2nd grade	English/ Language Arts
Adaptation	The unit focused on students self-selecting a hero to research using credible sources. Students were provided access to online community library databases, journals, and books. They worked at their own pace to generate slug lines and research notes in preparation for a research presentation in a format of the student's choosing. All unit resources were organized in a research module in Canvas followed by an assignment to submit the final product.	9th grade	English
Adaptation	The teacher designed a unit encouraging students to use artifacts from their career-based surveys in Naviance to connect with researching a career of interest. Project components included locating credible sources for career statistics, searching community databases in coordination with our community library, and presenting the advantages and disadvantages of the career as a requirement towards graduation from high school. The assignment was submitted in Canvas.	11th grade	English

Table 8 (continued)

Adoption	A unit investigating fresh water availability around the world included a portion where students used a variety of media sources to learn about the water crisis in Flint, Michigan. Students used access to audio and visual resources organized in the LMS to develop personal reflections explaining their views on public access to natural resources. Students shared their reflections via Canvas assignments.	9th grade	Environmental Science
Adoption	A kindergarten teacher created a link from her Canvas home page for a virtual learning center. Students learned to scan their QR code to log in to their Chromebook, click on the Canvas icon and access virtual centers from the teacher's homepage. The teacher changed the virtual center as students learned new letters of the alphabet. The virtual center consisted of a Google slide where students had to drag and drop letters onto a line to spell single-syllable words such as cat or hat that have a shared sound such as "-at."	Kindergarten	Varied

The use of Canvas as an organizer of information was widely noted as important in both the coaching sessions and during the semi-structured interviews. All interviewees mentioned the use of Canvas as a way to provide students with classroom materials and resources outside of the classroom. When designing units of instruction, the teachers considered the layout of the module to deliver content. Using questioning techniques during coaching sessions, I was able to direct teachers to consider how their design could meet student needs in the areas of engagement, representation, and expression. I noticed at the end of each unit that teachers spoke about their work in a positive light. Even though the lesson may have experienced changes along the way from what was initially planned, the teachers accepted the changes as part of the change process and reported positive outcomes for their students and their own use of technology when designing using an LMS.

5.0 Learning and Actions

5.1 Discussion

In the first part of this study, teachers completed the TUPS survey. In the TUPS section 'Teacher Uses of Technology,' teachers self-reported a high skill level in using an LMS and a high level of use regarding the LMS technology. This indicates that teachers felt an LMS was highly useful and were confident in their skill level when using an LMS. Survey results also indicated a difference between the frequency of teacher and student daily use of an LMS. Teachers self-reported that they used the LMS more frequently than they required of their students. This could indicate that teachers are not designing student-centered lessons requiring student use of the LMS. 'Using an LMS' is a broad statement from the TUPS survey that can be interpreted by respondents in different ways. This researcher assumes there is an element of both technical and adaptive skills needed to use an LMS as described in the literature review section describing iNACOL's Framework for Blended Teaching Competencies. Without further investigation though, it is difficult to assume how the statement was interpreted by survey respondents. Teachers in the HSD were required to put their daily lesson goals in the LMS, therefore they had to learn certain technical skills to complete the required daily job task. Prior to this research study, HSD teachers were not explicitly taught to develop blended teaching competencies related to adaptive skills that include reflection, continuous improvement and innovation, and communication. Findings from the TUPS survey prompted the researcher to consider using CAST's *Key Questions to Consider When Planning Lessons* to plan the approach to coaching sessions.

In the second part of this study, teachers were engaged in the TIM-C coaching cycle. There are two areas to consider when reviewing the results from this part of the PDSA cycle. First, I reviewed the findings from the coaching experience in regard to the Universal Design for Learning guidelines followed by a discussion of the levels of technology integration according to the Technology Integration Matrix. All participants stated that they used resources from both categories of coaching-support, synchronous and asynchronous. It is important to consider that both types of support offered professional development tailored to the teacher's request for technology skill, lesson topic, and/or developmentally appropriate design. Using either method of coaching provided a model that teachers could emulate in their own lesson design and growth related to self-efficacy of technological pedagogical knowledge (TPK). With a research study of this small scale, I unable to make a conclusion that one type of coaching was more effective or preferred than another. It is important to note that teachers did feel comfortable sharing that they do seek both synchronous and asynchronous help when planning for instruction. This acknowledgment could indicate teachers accepting that there is a new vision for teaching and learning and are working toward that change as noted in iNACOL's Framework for Blended Teaching Competencies.

When returning to consider Mishra and Koehler's (2006) TPACK (Technological, Pedagogical and Content Knowledge) framework, TPK is only one part of an integrated approach to effective teacher preparation. Consideration of pedagogical techniques that positively support learning styles or promote positive classroom management strategies are an important part of TPK. The relationship built between a coach and teacher through synchronous sessions lends itself as a stronger model to support the individualized approach to instruction than an asynchronous, on-

demand technology skill-related video or online tutorial. The educator benefits from the experience of the coach as a veteran teacher.

When personalized coaching sessions model inclusive strategies for teachers to personally improve their course and lesson design, coaches can build teacher confidence to do the same in their classroom for their students. Modeling for teachers led to gains in three areas related to the why, what, and how of learning for students. Their students develop as expert learners who develop self-assessment and reflective skills. They internalize knowledge through comprehensive activities such as transfer and generalization of concepts provided through accessible means. Finally, they become strategic thinkers able to manage their thinking and monitor their own progress toward learning goals. The why, what, and how of learning correlate with the three concentrations of the UDL framework: engagement, representation, and action and expression (CAST, 2018).

Thematic coding of teacher interviews revealed multiple references to designing instruction that required students to self-assess and reflect on their assignment. Design that includes self-assessment, reflection, and individual autonomy aligned with suggested forms of engagement as noted by UDL. Teachers highlighted the use of varying resources and allowed students individual choice and autonomy to select their pathway to completing assignments. Using the LMS to customize the display of information provided options for accessibility and comprehension. When interviewed, teachers noted the representation of information in multiple ways as a benefit of using the LMS to help them design effective instruction to reach all learners. Lastly, teachers identified strategies related to action and expression as promising strategies they employed with their students as part of this research. Teachers varied the methods for student response, used multiple media to convey concepts, and designed structured levels of support for encouraging student use of the LMS to complete assignments.

Using questioning techniques throughout coaching sessions enabled the coach to guide teachers along a path to self-discovery of their own teaching style in coordination with best practices for technology integration and universal design for learning. There wasn't a one-size-fits-all list of steps for coaching. My flexibility as the coach was an unexpected, important part of realizing success with the teachers I worked with in this study. It was important to keep building teacher confidence in them as the coaching experience progressed. The positive remarks made during teacher interviews support this observation.

Using the LMS technology to organize content to enhance accessibility for all was frequently mentioned as an employed strategy in the semi-structured interviews. Teachers noted the ability of students and parent observers to access a wide variety of teaching materials in multi-media format as a positive approach to instructional design using Canvas. The coaching model encouraged thoughtful content organization using the following questions for teachers: Does the information provide options for all learners to perceive what needs to be learned and help them regulate their own learning? Although the coaching model promotes options for all learners, it does not lend itself necessarily to creating a student-centered active learning environment as noted in the TUPS survey responses. If the teacher is the only one using the technology to deliver content and basic skills in which the learners are passively receiving it, then the classroom is not progressing toward a more active learning environment. In regard to the activities and units designed as part of the coaching sessions in this research, thorough content organization and presentation through the LMS did support the design of activities related to higher levels of active learning. The work to design instruction for an active learning environment is not work that can be completed all at once. The work is ongoing and can be identified through a gradual shift as shown by the teachers in this study. Teachers change positions. They change schools. The dynamic

nature of working in a school requires a coaching process that embraces change and offers support to teachers meeting them where they are at a certain point in time with regards to their skill level, mindset, and specialty content area.

The impact of this PDSA cycle on the problem of practice was positive. Teachers were actively supported in the classroom and designed more student-centered active learning units than they had in previous years according to discussions with the teachers. This affirms the leading outcome and driver measures that teachers would increase their offering of active learning lessons suggested prior to the PDSA cycle. I believe the real-time, one-on-one coaching sessions facilitated the success of the lessons. Process measures reviewed the effectiveness of the PD in addressing teachers' ability to design higher level active-learning units. The timing of this research, following a pandemic that required schools to teach in multiple hybrid formats, set the stage for teachers to reimagine how they designed their coursework. This may have influenced the willingness of teachers and students to actively participate. They were more willing to participate because they saw a direct personal benefit in learning how to design more effective courses using an LMS.

Looking at the interview responses, teachers continually commented about the use of Canvas as a way to organize and present information. Considering student-centered design was not mentioned as frequently as organization was during interviews, where do teachers' ideas of good online design lie? Are they only considering module design and content delivery in a way to replace lecture? A weakness in this overall process was the lack of highlighting the need for organization to complement active-learning design. Although teachers ranked the usefulness of an LMS as high and their skill level high, are they knowledgeable enough to make that judgement? How does one know what they do not know? Explicitly stating the role of organization as a component of active-learning design would create a clearer picture for educators to consider when

designing instruction. Another area of weakness in this PDSA cycle was the possibility that other factors could have affected the actual results of the coaching experience. Participating teachers and students could have been affected by the pre-existing relationship some of the students had with the coach. Previously, I had taught some of the students in seventh grade science and had established a respected relationship with students.

Each of the coaching projects was faced with challenges. Navigating technology not working as expected for the class or an individual student presented opportunities for the coach to intervene and model strategies that enabled the teacher to "stay the course" with the active learning lesson design. In his interview, the second grade teacher mentioned, "Naturally, technology doesn't always want to work. Being flexible was the biggest thing that [the coach] helped me with . . . it [the technology challenges] was just information overload." It was important to model appropriate strategies for seeking technology support. Students saw how the teacher and coach used different strategies to solve technology issues. Sometimes we were able to troubleshoot and fix the problem. Other times, we had to submit a ticket to a technology support desk and patiently wait for assistance. Given the class schedule, we had to modify lessons within the time period that we had the students because we did not have a solution to a video being blocked or another issue.

This research examined the effect of coaching on a small number of teachers in one suburban school district. It is difficult to extrapolate the findings and make generalizations about the effectiveness of coaching on active learning design in all classrooms. Given that statement, educators cannot wait for a cure-all to suggest the perfect recipe for success in the classroom. This work can be accomplished on a microlevel with individual teachers now while work is done to find a solution for effecting change on a macrolevel. This PDSA cycle affirms the importance of relationships and professional collaboration among educators to move our practice forward.

5.2 Next Steps and Implications

Throughout this PDSA cycle, the use of CAST's *Key Questions to Consider When Planning Lessons* with teachers to guide lesson planning during coaching sessions was implied without explicitly sharing the theoretical knowledge behind guiding questions. Teachers were unaware that the coaching was designed to follow the principles of Universal Design for Learning for fear that layering different professional development concepts would confuse teachers and make the buy-in harder to accept the new technology skills they were attempting to learn. In the future, I suggest teachers are briefly introduced to the research base that supports UDL with the understanding of the initiative and design guidelines that support it as it applies to each part of the coaching session(s) through an integrated approach.

Effective coaches should have experience as a classroom teacher and understand the inner workings of how an effective classroom operates. A coach should understand elements of classroom management, developmentally appropriate activities, and content knowledge. Without one or more of these skills, there is a risk of the coach not fulfilling the needs of the teacher they are assisting and fostering a negative attitude toward future coaching attempts to transform their teaching. If a coach is going to be present in the classroom, what does research suggest is important for co-teaching?

One area I did not consider was the teachers' desire to create lessons that students could complete online with little or no teacher interaction. The use of technology to automatically grade student submissions was a frequently asked question. It was clear teachers viewed technology and the use of an LMS as a way to teach differently. How teachers choose to engage students with the technology is clearly an area in need of future study. Several questions come to mind. Why are teachers wanting to design lessons that are automatically graded? Do teachers want to spend more

time designing lessons that are more transformative in nature (highest level of active learning), yet are required to assign frequent grades? Therefore, do teachers seek ways to formatively evaluate students more frequently when engaged in a longer, transformative, active learning unit?

Ultimately, the ability of educators to transform their role from purveyor of knowledge to guide or mentor will support the shift of their lesson design from an entry-level active learning lesson to one infused with student-centered choices. This shift will not occur all at once. Every time a teacher designs a lesson for a higher level of active learning, that teacher builds confidence to transform subsequent lessons. Teachers build confidence with each lesson that is transformed to a higher level of active learning. Planning for transformational active learning lessons will infiltrate teachers' pedagogical knowledge levels and subsequently improve their technological pedagogical knowledge.

6.0 Reflections

Engaging in scholarly practice and improvement science was a humbling experience. Relying on my personal experience in education to make decisions in the classroom is nothing new. However, using the literature base to design an intervention and the methodology to conduct the research in K-12 education was far different. With the huge shift to offering online access to content, the strengths of this research study included the knowledge that teachers desire to improve active learning designed lessons using an LMS. Although this research project was small in scope, it still made a positive difference. I learned that I enjoy reading scholarly literature but am drawn to the pieces that explain practical experiences that can be replicated in the classroom. This is a hallmark of improvement science in that I am taking a practical approach to integrating experiential knowledge and applying my own efforts to seek reform. I am not afraid of risk. Trying something new as part of improvement science offers no guarantees of success. I learned that no matter how much thought I put into the original design, there are parts I could have designed better (e.g., introducing the details of UDL). This was the first time I was responsible for designing an entire study. It was difficult to plan each stage of the process when I did not understand what the final journey would entail.

I learned that small tests of change in an education environment are more manageable. Larger tests of change are quicker to draw resistance and may be prevented from even beginning. Conducting research in an educational environment while concurrently working was difficult. Educators today do not have much unallocated time to plan and execute research if it does not align well with the courses they teach. I was fortunate to be in a position where I could adjust my schedule as needed to coach teachers in different buildings, grade levels, and subject areas.

Qualitatively analyzing data was a new approach I learned to generate evidence for a research study. As a trained biology teacher, I previously relied on quantitative data and statistical analysis using numbers when reading research reports. Generating themes and codes from interview experiences to conclude part of this qualitative research experience was truly eye-opening. I had been skeptical that qualitative data could produce results so aligned to the UDL and TIM frameworks. This experience has helped me see the value in qualitative research.

The research literature provides practitioners with a base to understand the many facets of professional practice, such as teaching, professional development for teachers, and blended learning. Understanding the body of literature that included the Universal Design for Learning framework, iNACOL framework for Blended Learning Competencies, and the TPACK framework helped shape my working theory of improvement. The literature review served as a piece to compare research findings from my PDSA cycle to contribute to a growing body of knowledge. The qualitative coding themes that arose during the semi-structured interviews were innately similar. After several passes through the transcripts, I realized there was an alignment with UDL and iNACOL principles. This alignment validated my research design as worthy of being compared to the standards outlined in these widely accepted frameworks. This alignment guided the construction of my discussion in this dissertation. As a scholarly practitioner, I have blended my professional knowledge with Improvement Science's PDSA cycle to address a research question that many in K-12 education are faced with.

As this PDSA cycle draws to a close, I am reminded of the improvement principles Bryk et al. propose in their book, *Learning to Improve: How America's Schools Can Get Better at Getting Better* (2017):

- Make the work problem-specific and user-centered.

- Focus on variation in performance.
- See the system that produces the current outcomes.
- We cannot improve at scale what we cannot measure.
- Use disciplined inquiry to drive improvement.
- Accelerate learning through networked communities.

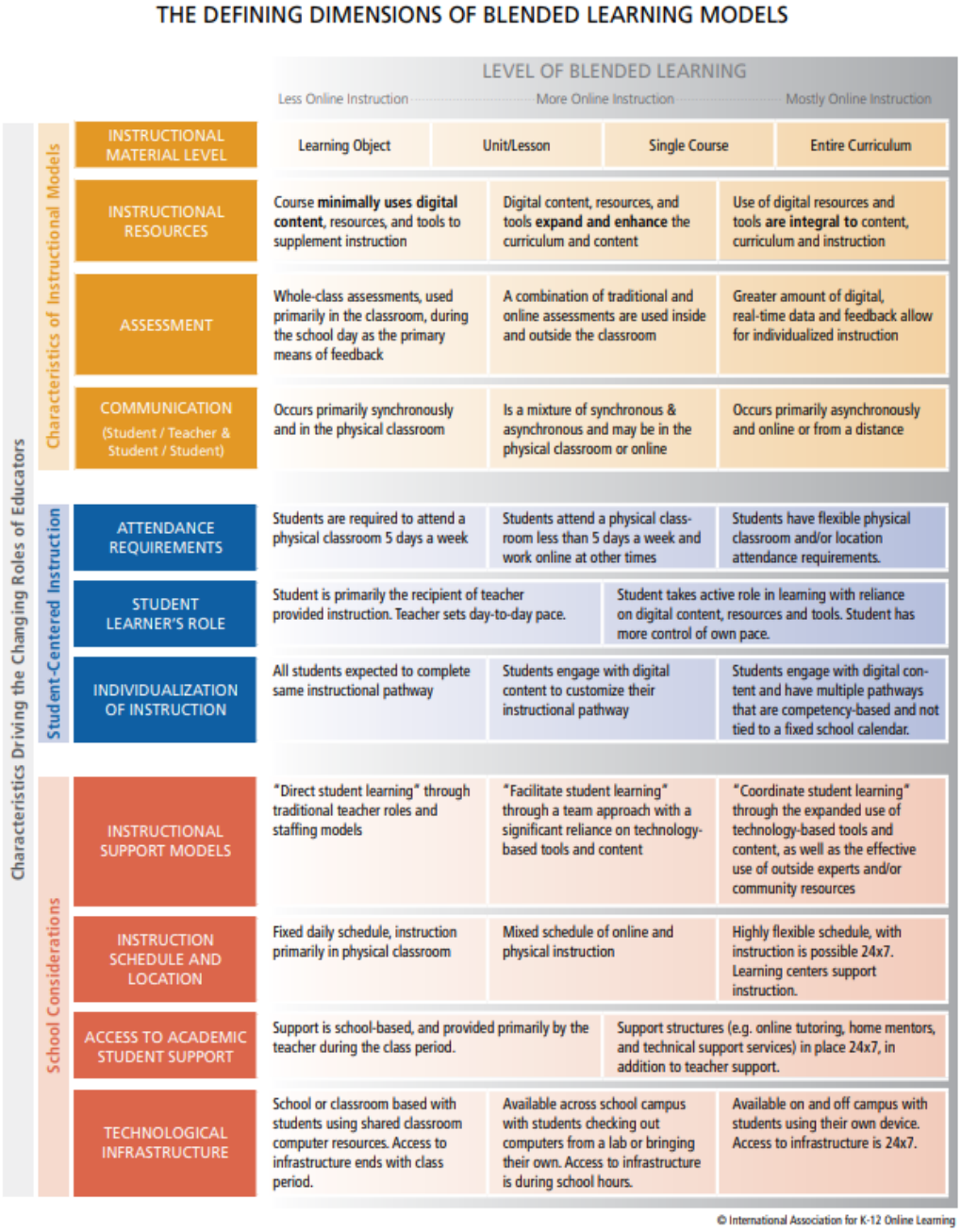
Although it is easier for me as a teacher to focus on problems affecting me in my classroom, it is more difficult to share those findings with a networked community for fear of inadequacy or disinterest. Public education's complex structure and nature require us to conduct an adequate needs and stakeholder analysis before conducting a cycle of improvement science. Without understanding the system, it is challenging to design and then analyze the effectiveness of small tests of change. The challenge of improving K-12 education is an important one. There are many areas of struggle. We cannot let that overwhelming feeling prevent us from trying to do better each small 'PDSA cycle' step at a time.

Finally, it would be remiss of me not to acknowledge my efforts to design an improvement strategy that addresses inequities in our educational system. I teach in a suburban area that serves a predominantly white population. I must understand the complexities of my educational entity and the complexity of the students' lives that I teach now and will teach in the future. I cannot stress enough the importance of a thorough literature review that includes current authors explaining practical applications and examples of research that address the topics of diversity, equity, and inclusion within education. Designing equitable small tests of change is critical to contributing positively to the larger body of educational research. Improvement is continuous. It requires a sustained effort to think and act in a way that moves education forward even when we

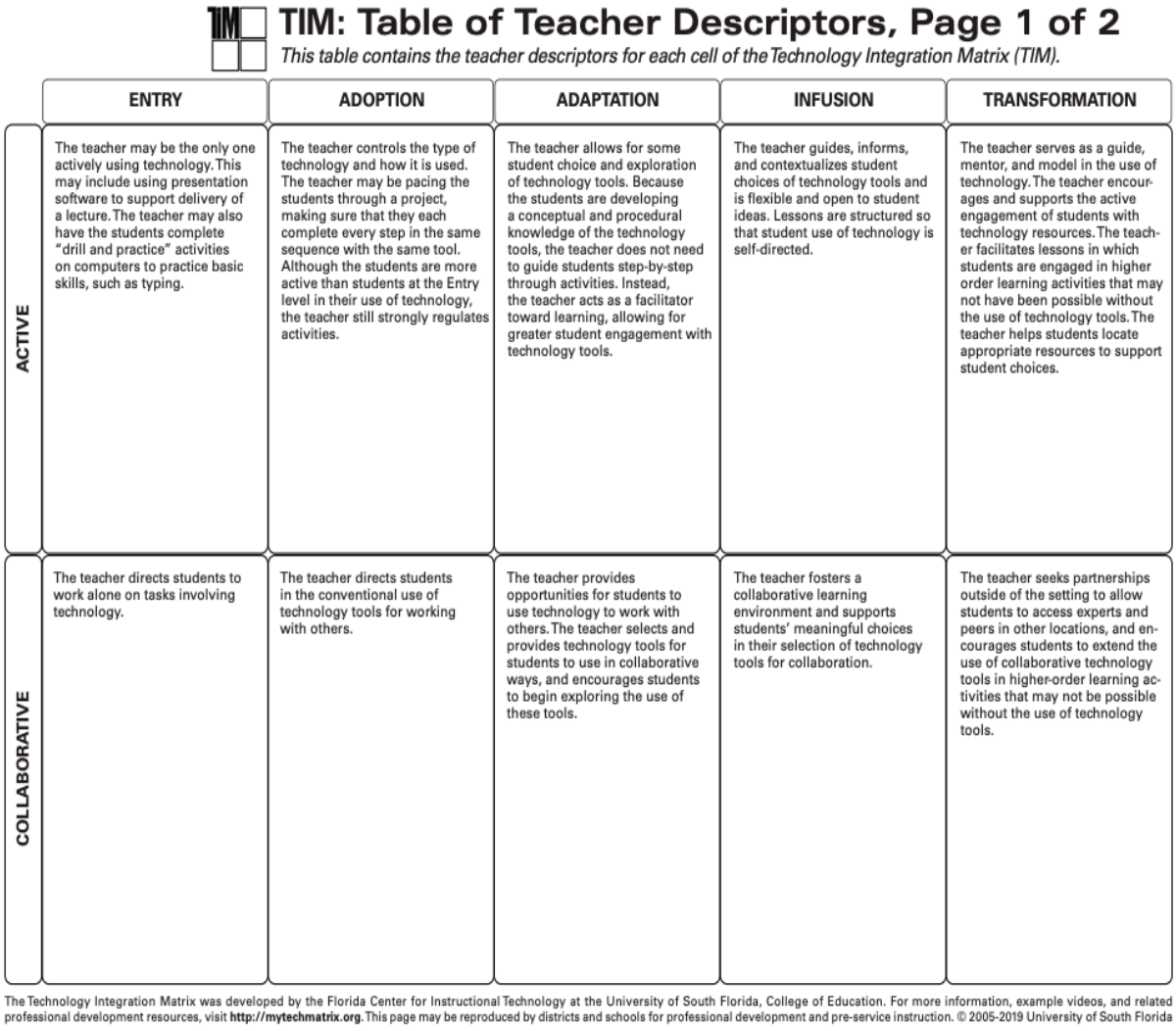
tire. Therefore, the improvement of science in education must be a community effort that collectively works together to dismantle current ineffective strategies.

Appendix A Hudson School District Core Values

Appendix B Powel and Kennedy's iNACOL's Defining Dimensions of Blended Learning Models (2019)



Appendix C TIM: Table of Complete Descriptors



TIM: Table of Teacher Descriptors, Page 1 of 2

This table contains the teacher descriptors for each cell of the Technology Integration Matrix (TIM).

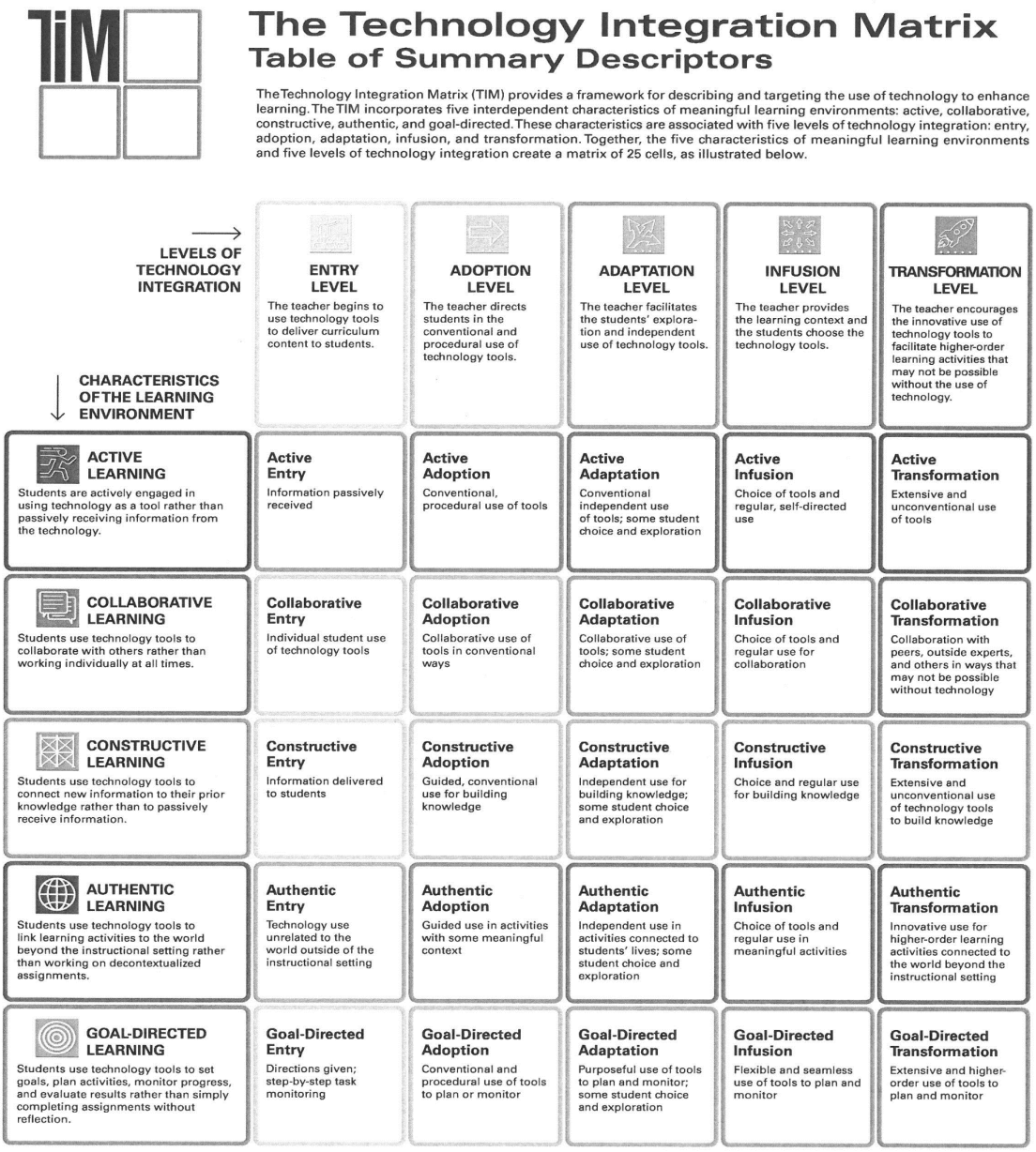
	ENTRY	ADOPTION	ADAPTATION	INFUSION	TRANSFORMATION
ACTIVE	The teacher may be the only one actively using technology. This may include using presentation software to support delivery of a lecture. The teacher may also have the students complete "drill and practice" activities on computers to practice basic skills, such as typing.	The teacher controls the type of technology and how it is used. The teacher may be pacing the students through a project, making sure that they each complete every step in the same sequence with the same tool. Although the students are more active than students at the Entry level in their use of technology, the teacher still strongly regulates activities.	The teacher allows for some student choice and exploration of technology tools. Because the students are developing a conceptual and procedural knowledge of the technology tools, the teacher does not need to guide students step-by-step through activities. Instead, the teacher acts as a facilitator toward learning, allowing for greater student engagement with technology tools.	The teacher guides, informs, and contextualizes student choices of technology tools and is flexible and open to student ideas. Lessons are structured so that student use of technology is self-directed.	The teacher serves as a guide, mentor, and model in the use of technology. The teacher encourages and supports the active engagement of students with technology resources. The teacher facilitates lessons in which students are engaged in higher order learning activities that may not have been possible without the use of technology tools. The teacher helps students locate appropriate resources to support student choices.
COLLABORATIVE	The teacher directs students to work alone on tasks involving technology.	The teacher directs students in the conventional use of technology tools for working with others.	The teacher provides opportunities for students to use technology to work with others. The teacher selects and provides technology tools for students to use in collaborative ways, and encourages students to begin exploring the use of these tools.	The teacher fosters a collaborative learning environment and supports students' meaningful choices in their selection of technology tools for collaboration.	The teacher seeks partnerships outside of the setting to allow students to access experts and peers in other locations, and encourages students to extend the use of collaborative technology tools in higher-order learning activities that may not be possible without the use of technology tools.

TIM: Table of Teacher Descriptors, Page 2 of 2

This table contains the teacher descriptors for each cell of the Technology Integration Matrix (TIM).

	ENTRY	ADOPTION	ADAPTATION	INFUSION	TRANSFORMATION
CONSTRUCTIVE	The teacher uses technology to deliver information to students.	The teacher provides some opportunities for students to use technology in conventional ways to build knowledge and experience. The students construct meaning about the relationships between prior knowledge and new learning, but the teacher makes the choices regarding technology use.	The teacher creates instruction in which students' use of technology tools is integral to building an understanding of a concept. The teacher gives the students access to technology tools and guides them in exploring and choosing appropriate resources.	The teacher consistently allows students to select technology tools to use in building an understanding of a concept. The teacher provides a context in which technology tools are seamlessly integrated into a lesson, and is supportive of student autonomy in choosing the tools and when they can best be used to accomplish the desired outcomes.	The teacher facilitates higher-order learning opportunities in which students regularly engage in activities that may be impossible to achieve without the use of technology tools. The teacher encourages students to explore the use of technology in unconventional ways and to use the full capacity of multiple tools in order to build knowledge.
AUTHENTIC	The teacher assigns work based on a predetermined curriculum unrelated to the students or issues beyond the instructional setting.	The teacher directs students in the conventional use of technology tools for learning activities that are sometimes related to the students or issues beyond the instructional setting.	The teacher creates instruction that purposefully integrates technology tools and provides access to information on community and world issues. The teacher directs the choice of technology tools but students use the tools on their own, and may begin to explore other capabilities of the tools.	The teacher encourages students to use technology tools to make connections to the world outside of the instructional setting, and to their lives and interests. The teacher provides a learning context in which students regularly use technology tools and have the freedom to choose the tools that, for each student, best match the task.	The teacher encourages innovative use of technology tools in higher-order learning activities that support connections to the lives of the students and the world beyond the instructional setting
GOAL-DIRECTED	The teacher gives students directions and monitors step-by-step completion of tasks. The teacher sets goals for students and monitors their progress.	The teacher directs students step by step in the conventional use of technology tools to set goals, plan, monitor, evaluate an activity, or reflect upon learning activities.	The teacher selects the technology tools and clearly integrates them into the lesson. The teacher facilitates students' independent use of the technology tools to set goals, plan, monitor progress, evaluate outcomes, and reflect upon learning activities. The teacher may provide guidance in breaking down tasks.	The teacher creates a learning context in which students regularly use technology tools to set goals, plan, monitor, evaluate outcomes, and reflect upon learning activities. The teacher facilitates students' choice and independent use of technology tools to accomplish these tasks.	The teacher creates a rich learning environment in which students regularly engage in higher-order planning, monitoring, evaluative, and reflective activities that may be impossible to achieve without technology. The teacher sets a context in which students are encouraged to use technology tools in innovative ways to direct and reflect on their own learning.

Appendix D TIM: Technology Integration Matrix



The Technology Integration Matrix
Table of Summary Descriptors

The Technology Integration Matrix (TIM) provides a framework for describing and targeting the use of technology to enhance learning. The TIM incorporates five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed. These characteristics are associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. Together, the five characteristics of meaningful learning environments and five levels of technology integration create a matrix of 25 cells, as illustrated below.

CHARACTERISTICS OF THE LEARNING ENVIRONMENT ↓ / LEVELS OF TECHNOLOGY INTEGRATION →	ENTRY LEVEL The teacher begins to use technology tools to deliver curriculum content to students.	ADOPTION LEVEL The teacher directs students in the conventional and procedural use of technology tools.	ADAPTATION LEVEL The teacher facilitates the students' exploration and independent use of technology tools.	INFUSION LEVEL The teacher provides the learning context and the students choose the technology tools.	TRANSFORMATION LEVEL The teacher encourages the innovative use of technology tools to facilitate higher-order learning activities that may not be possible without the use of technology.
ACTIVE LEARNING Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.	**Active Entry** Information passively received	**Active Adoption** Conventional, procedural use of tools	**Active Adaptation** Conventional independent use of tools; some student choice and exploration	**Active Infusion** Choice of tools and regular, self-directed use	**Active Transformation** Extensive and unconventional use of tools
COLLABORATIVE LEARNING Students use technology tools to collaborate with others rather than working individually at all times.	**Collaborative Entry** Individual student use of technology tools	**Collaborative Adoption** Collaborative use of tools in conventional ways	**Collaborative Adaptation** Collaborative use of tools; some student choice and exploration	**Collaborative Infusion** Choice of tools and regular use for collaboration	**Collaborative Transformation** Collaboration with peers, outside experts, and others in ways that may not be possible without technology
CONSTRUCTIVE LEARNING Students use technology tools to connect new information to their prior knowledge rather than to passively receive information.	**Constructive Entry** Information delivered to students	**Constructive Adoption** Guided, conventional use for building knowledge	**Constructive Adaptation** Independent use for building knowledge; some student choice and exploration	**Constructive Infusion** Choice and regular use for building knowledge	**Constructive Transformation** Extensive and unconventional use of technology tools to build knowledge
AUTHENTIC LEARNING Students use technology tools to link learning activities to the world beyond the instructional setting rather than working on decontextualized assignments.	**Authentic Entry** Technology use unrelated to the world outside of the instructional setting	**Authentic Adoption** Guided use in activities with some meaningful context	**Authentic Adaptation** Independent use in activities connected to students' lives; some student choice and exploration	**Authentic Infusion** Choice of tools and regular use in meaningful activities	**Authentic Transformation** Innovative use for higher-order learning activities connected to the world beyond the instructional setting
GOAL-DIRECTED LEARNING Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.	**Goal-Directed Entry** Directions given; step-by-step task monitoring	**Goal-Directed Adoption** Conventional and procedural use of tools to plan or monitor	**Goal-Directed Adaptation** Purposeful use of tools to plan and monitor; some student choice and exploration	**Goal-Directed Infusion** Flexible and seamless use of tools to plan and monitor	**Goal-Directed Transformation** Extensive and higher-order use of tools to plan and monitor

Bibliography

Archambault, L., DeBruler, K., & Freidhoff, J. (2014). K-12 online and blended teacher licensure: Striking a balance between policy and preparedness. *Journal of Technology and Teacher Education, 22*(1), 83–106.

Barbour, M. K., & Harrison, K. U. (2016). Teachers' perceptions of K-12 online. *Journal of Educational Technology Systems, 45*(1), 74–92. https://doi.org/10.1177/0047239516637072

Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom.* ASHE-ERIC Higher Education Reports. The George Washington University. https://eric.ed.gov/?id=ED336049

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2017). *Learning to improve: How America's schools can get better at getting better*. Harvard Education Press.

Bryson, J. M., Patton, M. Q., & Bowman, R. A. (2011). Working with evaluation stakeholders: A rationale, step-wise approach and toolkit. *Evaluation and Program Planning, 34*(1), 1–12. http://doi.org/10.1016/j.evalprogplan.2010.07.001

CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. http://udlguidelines.cast.org

CAST. (2020). *Key questions to consider when planning lessons*. http://www.cast.org/products-services/resources/2020/udl-guidelines-key-questions-planning-lessons

Costanza-Chock, S. (2020). *Design justice: Community-led practices to build the worlds we need*. MIT Press.

Darling-Hammond, Linda. (1999). *Teacher quality and student achievement: A review of state policy evidence*. Center for the Study of Teaching and Policy. https://www.education.uw.edu/ctp/sites/default/files/ctpmail/PDFs/LDH_1999.pdf

Davis, N., Roblyer, M. P., Charania, A., Ferdig, R., Harms, C., Compton, L. K. L., & Cho, M. O. (2007). Illustrating the "virtual" in virtual schooling: Challenges and strategies for creating real tools to prepare virtual teachers. *The Internet and Higher Education, 10*(1), 27–39.

Dewey, J. (1938). *Experience and education*. Macmillan Company.

Eden, C., & Ackermann, F. (1998). *Making strategy*. Sage.

Florida Center for Instructional Technology (FCIT). (2019). *The Technology Integration Matrix.* https://fcit.usf.edu/matrix/matrix/

Galanek, J.D., Gierdowski, D.C., and Brooks, D.C. (2018) ECAR Study of Undergraduate Students and Information Technology Research report. *EDUCAUSE Center for Analysis and Research (ECAR).* https://www.educause.edu/ecar/research-publications/ecar-study-of-undergraduate-students-and-information-technology/2018/introduction-and-key-findings

Graham, B. (2019). K-12 blended teaching readiness: Model and instrument development. *Journal of Research on Technology in Education, 51*(3), 239–258. https://doi.org/10.1080/15391523.2019.1586601

Hinnant-Crawford, B. (2020). *Improvement science in education*. Myers Education Press.

Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in "Educational" apps: Lessons from the science of learning. *Psychological Science in the Public Interest, 16*(1), 3–34. http://doi.org/10.1177/1529100615569721

Horn, M. B., Staker, H., & Christensen, C. M. (2017). *They are blended: Using disruptive innovation to improve schools*. Jossey-Bass.

iNACOL. (2014). *iNACOL blended learning teacher competency framework.* International Association for K-12 Online Learning. https://files.eric.ed.gov/fulltext/ED561318.pdf

International Society for Technology in Education (ISTE). (n.d.). *Be bold with us.* https://www.iste.org/about/about-iste

Koh, J. H. L. (2019). TPACK design scaffolds for supporting teacher pedagogical change. *Educational Technology Research and Development, 67*(3), 577–595. http://doi.org/10.1007/s11423-018-9627-5

Langley, G. J. (2014). *The improvement guide: A practical approach to enhancing organizational performance*. Jossey-Bass.

Maina, M., Craft, B., & Mor, Y. (2015). *The art & science of learning design*. Brill Sense.

Marzano, R. J. (2007). *The art and science of teaching: A comprehensive framework for effective instruction.* Association for Supervision and Curriculum Development.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record, 108*(6), 1017.

Perry, J. A., Zambo, D., & Crow, R. (2020). *The improvement science dissertation in practice: A guide for faculty, committee members, and students*. Myers Education Press.

Pulham, E., & Graham, C. R. (2018). Comparing K-12 online and blended teaching competencies: A literature review. *Distance Education, 39*(3), 411–432. http://doi.org/10.1080/01587919.2018.1476840

Reed, P. A. (2018). Technology education standards in the United States: History and rationale. In M. deVries (Ed.), *Handbook of technology education* (pp. 235–250). Springer International Publishing. https://doi.org/10.1007/978-3-319-44687-5_9

Rice, K., & Dawley, L. (2009). The status of professional development for K-12 online teachers: Insights and implications. *Journal of Technology and Teacher Education, 17*(4), 523–545.

Ritzhaupt, Huggins-Manley, A. C., Dawson, K., Ağaçlı-Doğan, N., & Doğan, S. (2017). Validity and appropriate uses of the revised technology uses and perceptions survey (TUPS). *Journal of Research on Technology in Education, 49*(1-2), 73–87. https://doi.org/10.1080/15391523.2017.1289132

Saldaña, J. (2021). *The Coding Manual for Qualitative Researchers* (4th ed.). SAGE Publications.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14. https://doi.org/10.2307/1175860

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22. https://doi.org/10.17763/haer.57.1.j463w79r56455411

U.S. Department of Education. (2017). *Reimagining the role of technology in education: 2017 national education technology plan update*.