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Making Meaning of Multimodalities In Teacher Professional Learning

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ABSTRACT

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The purpose of this study was to better understand multimodal usage in teacher professional learning. Thus, this qualitative phenomenology study was created and executed to better understand how leaders of teacher professional learning understand and implement modes in courses designed for teacher scholarship. Focusing on leader influences, curricular designs, learning ecologies, systemic functional linguistics, and teachers as students, modalities support learning by providing individuality through universal design. Thematic analysis illuminated four main themes and 10 subthemes were identified. The findings are of interest to a wide range of educators-teachers, professional learning leaders, principals, students, and policy makers. My paper discusses the findings as they relate to multimodalities, agency, and equity, while providing avenues for future research. Finally, multimodalities are forming new grammars that are open to many learners to understand, implement, and remix for themselves, society, and future educators and students.

Keywords: mode, multimodal, teacher professional learning, universal design for learning, systemic functional linguistics, technology, peer support, agency, teachers as students, MUDA (multimodal, universal, design, affordance framework)

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presented itself in the world in which we live and continuously builds upon itself to allow for knowledge to be attained.

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INTRODUCTION

Teachers enter their classrooms with a combination of professional skills and life experiences. As teachers practice the craft of teaching, they develop new skills and knowledge informed by their previous learning experiences (Cloonan, 2010). Like many professionals, teachers share these skills and knowledge with their fellow educators through informal conversations and structured professional development opportunities. Increasingly, teachers' new skills and knowledge involve using technology to support their pedagogy and as a method for sharing with colleagues.

According to *A Pedagogy of Multiliteracies* (Cope & Kalantzis, 2016), new knowledge and communications media have distinct characteristics that involve multimodalities. Examples of multimodalities include oral, visual, audio, gestural, tactile, and spatial patterns of meaning (Cope & Kalantzis, 2016). Therefore, educators and learners may use technology to go beyond the traditional range of literacy pedagogy (i.e., sage on the stage) and alphabetical representations (i.e., textbooks). While teachers have access to numerous technologies for teaching and learning, we know little about how they use or understand how new technologies may be best used in their classrooms. This rapid change is a significant problem for educational leaders and leaders of professional learning because it may mean they cannot effectively support teachers in their professional learning.

My study focused on a better understanding of the intersections of teaching, professional learning, and multimodal learning. Specifically, I was interested in how experienced teachers

involved in their professional learning make meaning of the multimodalities provided by classroom technologies. To explore this topic, I used the Learning by Design framework (Kalantzis & Cope, 2005) to understand the experiences of leaders of professional learning and teachers. Learning by Design is an analytical framework that identifies eight subgroups for understanding the learning processes of teachers (Kalantzis & Cope, 2005). It is a replicable construct to guide the emerging knowledge society towards a transformative curriculum.

Because my study explored how teachers use and make meaning of new classroom technologies, I used case study methodology which is ideal for interpreting a particular case, knowing what it is and what it does (Stake, 1995). I collected data from two online professional learning courses delivered by the iLearn Collaborative (iLC) Consulting and Professional Learning Services (2021) which provided supplemental learning for online and blended learning education for teacher professional development. These courses combined technology with instructional practices and student-centered learning.

I conducted data collection in Spring 2023. My data collection methods included: (a) conducting interviews with leaders of professional learning and teachers, (b) course design analysis, and (c) artifact analysis. These data collection methods were selected because they provided the researcher access, allowed for triangulation, and allowed for the robustness of interpretations (Stake, 1995) to provide insight into how people make meaning of learning. To analyze my data, I applied codes derived from Learning by Design (Kalantzis & Cope, 2005) to identify emerging themes.

Purpose of the Study and Research Questions

The purpose of this study was to better understand multimodal usage in teacher professional learning. The education system has evolved concerning the shift in technologies and

teaching, with examples such as smartphones, learning on demand, and internet access. My phenomenological study aids in understanding how educators take part in professional learning and apply that learning to their students. The study can support administrators and teachers in implementing multimodalities as technologies emerge. Exploring a community of practice aids teachers and educational leaders in becoming aware of critical teaching strategies. Exploring the phenomenon of professional learning of multimodalities for teachers to understand the shared lived meaning and experience was at the heart of my research. In doing so, a better understanding of this phenomenon may be achieved. In turn, implications have been identified for instructors of professional learning, teachers, and students.

Additionally, presenters of professional learning and organizational leaders who invest in professional learning for organizations (such as districts, colleges, and universities) can better understand teacher strategies to impact their practice and student learning. According to Cloonan (2010),

> Teachers must undertake more than digital makeover practices which raises the question of information theories, tools, and schemas. Literacy teachers trained in print-based typographical era pedagogies require tools to reframe teaching to account for changes in multimodal designs and social dynamics. (p. 17)

Teachers are consistently taking in knowledge as students and then disseminating knowledge as teachers. I hoped to fill the gap in the literature by understanding the professional learning phenomenon.

Exploring delivery methods and content may lead to a better understanding of how to implement professional learning of multimodalities. My study focused on multimodalities for teachers, instructional designers, and leaders of professional learning. Using case study

methodology for two professional learning courses, the researcher implemented: (a) interviews with presenters of professional learning and teachers, (b) course design analysis, and (c) artifact analysis. A research journal was also kept throughout the entirety of the study.

The study explored the convergence of teacher professional learning, technologies, and multimodalities. Two online professional learning courses were chosen based on content, methods, instructor experience, and delivery by working with iLearn Collaborative (iLC). In 2016, the Online Education and Blended Learning Resources Act was passed to provide supplemental learning for online and blended learning education for teacher professional development. Utilizing the Board of Cooperative Services and non-profit groups, the curriculum is delivered to teachers by education providers. The courses combined technology with instructional practices and student-centered learning.

To best understand making meaning of multimodal learning in teacher professional learning, I created the following research questions:

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

The purpose of Question 1 was to define the terminology of multimodalities; by answering Question 1, I laid a foundation of the definitions, discourse, and verbiage used by the participants of the study and provided insights on the way language was used by people in the field of education. The purpose of Question 2 was to explore influences for presenters of professional learning; by answering Question 2, I hoped to increase the understanding of how presenters were trained and perceived their careers. The purpose of Question 3 was to understand

how multimodalities are used; by answering Question 3, the understanding of the implementation of multimodalities in instruction and how multimodalities are applied in making meaning for all is increased.

Significance of the Study and Gap in the Literature

Many teachers define themselves as "life-long learners" (Hursen, 2014). During their lifetimes, teachers learn from the phenomena that they experience. "Good teaching demands that we progressively become better-educated people ourselves, as we grow in our understanding of the teaching fields, cultivate our abilities to communicate effectively, and enrich our understanding and effectiveness in guiding multiple social and intellectual interactions" (Simpson et al., 2004, p. vii.). Teachers share understandings with stakeholders such as colleagues, students, their communities (professional and personal), and the world through recursive feedback, synthesizing knowledge, and making meaning. Modalities are of import to this process as they often manifest through technologies to personalize learning.

My study explored the teacher education profession which undoubtedly relates to educational technology learning. Teacher education may be considered a "hidden profession" due to the lack of attention, formal designation, and the number of studies addressing this topic (Ping et al., 2018). During the formal and informal manifestation of learning, teacher educators are essential for preservice and in-service teachers, as is the content they instruct (Richter et al., 2021). Teacher educators play myriad roles in different settings as they support and guide teachers in obtaining knowledge regarding a diverse range of materials and delivery methods (Yuan & Yang, 2020). For this study, I defined teacher educators as people who are both teachers and researchers, a hybrid position that can be difficult to achieve.

Teaching depends on technology regarding the subject content area, assistive technologies, and delivery (Koehler & Mishra, 2009). Teachers must understand and integrate digital technologies into their course instruction and delivery, encompassing an ever-evolving comprehension of which technologies exist and their functions. According to DeCoito and Richardson, "Skilled teachers artfully incorporate technologies to incorporate technologies to enhance student learning by capitalizing on their capabilities to support and promote learning, while at the same time they are cognizant of the interdependence of technologies and content" (2018, p. 4). Additionally, universal design for learning (UDL) implementation includes accessible content for as many people as possible through course design. My study sought to understand the practices of skilled and artful teachers as they navigated learnings regarding multimodalities in differing settings with UDL tenets.

Integrating technology in education is a central tenet of teacher education. Educators must understand emerging technologies, technological tools, and methods of instruction. This understanding can lead to teachers being able to better support learning in schools. According to Prensky (2001),

> Today's students are no longer the people that our education system was designed to teach . . . a singularity has taken place-an event which changes things so fundamentally that there is absolutely no going back . . . the arrival and rapid dissemination of digital technology in the last decades of the 20th century. (p. I)

Digital technology has opened a floodgate of learning potential through multimodalities in education which have flourished over the last three decades, even as teachers prepare for expanding technological horizons of the future.

Since multimodalities, technology, and the education system are constantly evolving, educators find that their prior formal training may not be as applicable to successfully teaching a wide range of content. Some existing approaches to the curriculum for preservice student teachers and teachers often fail to acknowledge the affordances of the new technologies (Lankshear et al., 2000). Teachers may seek to enhance their skills by becoming students again and engaging in professional learning opportunities or be mandated to keep current.

The internet has provided a platform for teachers to work in personal and professional networks by collaboration in the form of shared documents, blogs, Twitter chats, affinity spaces, and more. Affinity spaces were established by Gee (2004) as:

> A place (physical, virtual, or a mixture of the two) wherein people interact with each other, often at a distance (that is, not necessarily face-to-face, though face-to-face interactions can also be involved), primarily through shared practices or a joint endeavor (which entails shared practices), and only secondarily through shared culture, gender, ethnicity, or face-to-face relationships. (p. 98)

These affinity spaces and groups have enabled learning through communities of practice.

Through these lived experiences, teachers have opportunities to continue their learning. Transformational professional learning shifts professionals' beliefs and behaviors and is tied to individual and professional identities (Netolicky, 2020). Teachers constantly make decisions about their pedagogy, content, cultural beliefs, and epistemologies (Forkosh-Baruch et al., 2021; Hurst & Brantlinger, 2022; National Research Council, 2000). The learning opportunities are built upon teachers' prior knowledge from their experiences and formal education. Understanding how teachers deliver, learn about, use, and make meaning of multimodalities via classroom technologies was at the heart of my study.

Given the considerations of teaching, technology, and emerging learning ecologies, teachers may not be able to keep up with the matter at hand which is understanding technologies for themselves and their students. This qualitative study is significant as I explored the phenomenon of professional learning concerning multimodalities and emerging technologies. We have some understanding of professional learning for teachers regarding multimodalities (Hechter & Vermette, 2014; Kyriakides et al., 2016; Uluyol & Sahin, 2016). However, little is understood about the experience of teachers and their learning of the usage of multimodalities through technology.

The gap in the literature is significant regarding the convergence of multimodalities, professional learning, and technology for teachers. DeCoito and Richardson (2018) found that professional learning initiatives must target teachers as recipients. Many other scholars have found that teachers must receive more ongoing professional learning in technological integration (Badia et al., 2013; Buckenmeyer, 2010; Özdemir, 2016; Ward & Parr, 2010; Zimlich, 2015). Additionally, further research is warranted in this area due to the rapid, continual growth of emerging technologies (Ward & Parr, 2010), implementing technologies into content (Voogt et al., 2013), intrinsic motivation and technology (Shroff & Vogel, 2009), and professional leadership in designing educational technology (Koehler & Mishra, 2005). Indeed, this research gap is considerable, and I hope this study benefits the canon of knowledge.

Definition of Terms

Specific terms pertain to the realm of professional learning for teachers regarding multimodalities. The terms multimodalities (multimodal learning), affordances of learning, learning by design, ways of knowing, professional learning, faculty learning, emergency remote teaching/training, andragogy, and lifelong learning are defined. "Effective pedagogy carefully

calibrates the distance between the learner's known lifeworld and the transformational possibilities of the to-be-known" (Cope & Kalantzis, 2016, p. 58). Educators understand the learner's status of knowing, defining what curriculum or lessons are the goals of the teaching and navigating the space of where the learner is to where the learner needs to go. I define each of the terms here so they will be understood as applied to my study.

Multimodalities

New information and communications media have distinct characteristics (Cope & Kalantzis, 2016). Cope and Kalantzis stated that "meaning is made in ways that are increasingly multiliterate--in which written-linguistic modes of meaning interface with oral, visual, audio, gestural, tactile, and spatial patterns of meaning" (2016, p. 3). These patterns of meaning "relate to 'multimodality' as the normal state of human communication" (Kress, 2010, p. 1). Multimodalities may allow learning to be more accessible, inclusive, individualized, diverse, relevant, and engaging while enabling the learner and teacher to make more meaningful connections. Cazden et al. (1996) observed:

> Increasingly important are modes of meaning other than Linguistic, including Visual Meanings (images, page layouts, screen formats); Audio Meanings (music, sound effects); Gestural Meanings (body language, sensuality); Spatial Meanings (the meanings of environmental spaces, architectural spaces); and Multimodal Meanings. The Multimodal mode is the most significant of the modes of meaning, as it relates to all the other modes in remarkably dynamic relationships. (p. 67)

Multimodal usage in media allows learners to produce their learning by acquiring and demonstrating new knowledge and skills. Synesthesia is "learning that emerges from mode switching, moving backward and forwards between representations in text, image, sound,

gesture, object, and space" (Cope & Kalantzis, 2016, p. 33). Modalities are leading to new methods of learning based on prior learning foundations. Multimodal learning is what is done when multimodalities are utilized in curriculum, pedagogy, and andragogy.

Professional Learning

Professional learning incorporates the use of technology by educators, among other things. Many technological tools have been developed, leading to additional ways of teaching, learning, and assessing learning (Holloway & Gouthro, 2020). Subsequently, studies have addressed the need for further professional learning for educators and technology resources (Bey, 2012). "Technology use" and "technology integration" are used interchangeably for three applications, "instructional preparation, for instructional delivery, and as a learning tool for students" (Inan & Lowther, 2010).

Professional learning resources "help teachers understand and apply appropriate pedagogical approaches for effective technology integration" (Amanatidis, 2015, p. 222). Multimodalities may aid in instructional methods if teachers can navigate the following barriers of technology integration: resources, knowledge and skills, institutional characteristics, attitudes and beliefs, assessment, and subject culture (Hew & Brush, 2007):

According to Winnen (2016), professional development and professional learning are often used reciprocally in career and personal growth areas in education. Development is a state of growth; learning is gaining knowledge by studying, being taught, or experiencing. Professional learning has replaced terms such as "professional development" or "staff development" to reflect the belief that teachers need to be learners and, therefore, must be life-long learners by constantly reflecting and improving their teaching (Lieberman & Miller, 2014,

p. 9). As educators learn more, they further contribute to the body of knowledge as both students and teachers.

Multimodal Learning

According to Cope and Kalantzis (2009), the modalities are

- Written language: writing (representing meaning to another) and reading (representing meaning to oneself)—handwriting, the printed page, the screen.
- Oral language: live or recorded speech (representing meaning to another); listening (representing meaning to oneself).
- Visual representation: still or moving image, sculpture, craft (representing meaning to another); view, vista, scene, perspective (representing meaning to oneself).
- Audio representation: music, ambient sounds, noises, alerts (representing meaning to another); hearing, listening (representing meaning to oneself).
- Tactile representation: touch, smell, and taste: the representation to oneself of bodily sensations and feelings or representations to others that "touch" one bodily. Forms of tactile representation include kinesthesia, physical contact, skin sensations (temperature, texture, pressure), grasp, manipulable objects, artifacts, cooking, and eating, aromas.
- Gestural representation: movements of the hands and arms, expressions of the face, eye movements and gaze, demeanors of the body, gait, clothing, fashion, hairstyle, dance, action sequences (Scollon, 2001), timing, frequency, ceremony, and ritual. Here gesture is understood broadly and metaphorically as a physical act of signing (as in "a gesture to . . .") rather than the narrower literal meaning of hand and arm movement.

- Representation of oneself may take the form of feelings and emotions or rehearsing action sequences in one's mind's eye.
- Spatial representation includes proximity, spacing, layout, interpersonal distance, territoriality, architecture/building, streetscape, cityscape, and landscape. (p. 362)

Definitions of modalities help identify the phenomenon of interest for my study.

Affordances of Learning

The affordances of learning are founded in emerging learning ecologies (whether an online class or face-to-face delivery. Kalantzis and Cope (2005, p. 28) defined affordances as new learning possibilities with technology, aiding in understanding lived experiences in objective reality (see Table 1).

Table 1

Affordances of Learning

Affordance	Definition	How it Looks
Ubiquitous learning	Learning anywhere, anytime	Technology access (often computers); create knowledge.
Active knowledge making	Produce knowledge beyond consuming knowledge	Educators construct meaning with stakeholders and synthesize learnings to make a part of the learning experience in creating knowledge.
Multimodal meaning	Learning is anchored in letters and sounds, sentences, and written language	Students show their multimodal knowledge representations via reports, research opportunities, and other presentations
Recursive feedback	Mediates human feedback to solicit and receive critiques to improve collaborative work	Students become assessors and teachers to design criteria, rubrics, and evaluations.
Collaborative intelligence	Learning beyond a singular learner infuses collaboration.	Create together
Metacognition	Builds on cognition to reflect and apply the ability to understand how a process has led to an outcome	Digital spaces allow learners to navigate different environments to access concepts and ideas necessary to their learning.
Differentiated learning	Diverse instruction, multi-grade level	New learning spaces allow teachers and learners to create learning experiences to address individual needs at their own pace.
Accessibility	Addresses constraints regarding inroads to the internet, computers, software, and technological skills to utilize tools, addressing the digital divide and digital inequality	Equitable and inclusive education for life-long learning skills.

Consuming, producing, and communicating knowledge results in humans creating meaning for themselves and others. Through this process, people create meaning by transforming the world and selves by making meaning in the world. "Meaning is the process of signifying, representing, or intending . . . or it may be a matter of purpose (meaning to . . .), action (meaning through . . .), or disposition (meaning by . . .)" (Cope & Kalantzis, 2016, p. 59). By creating meaning, stakeholders use purpose, action, and disposition to affect their world. By exploring the opportunities to learn (affordances of learning) through technology as instilled in the Learning by Design Framework, I hoped to understand the phenomenon.

Learning by Design Framework

Learning by Design is an approach to teacher professional learning constructed by Kalantzis and Cope in 2005. The Learning by Design Framework consists of four knowledge processes. Each process has two subprocesses; each represents different meaning-making opportunities for the learner and forms part of a complete pedagogy that may be utilized in any order (Rowland et al., 2014, p. 141). The processes help frame learning pedagogies as supported through multimodalities and making meaning.

The four fundamental ways of knowledge processes are dynamic. There is no necessity in order, nor is there a mandate that they happen in concert. Each of the four concepts has an internal dynamic and may relate differently to others. Kalantzis and Cope (2016, p. 71) based their Learning by Design model on foundational learning models such as Bloom's (1956) Taxonomy, Kolb's (1984) Model of Experiential Learning, Kalantzis and Cope’s (1997) Multiliteracies, and Scown's (2004) Evidenced-Critique-Impact Model. The four Learning by Design knowledge processes are experiencing, conceptualizing, analyzing, and applying which

correlate to the multimodalities of curriculum orientations as situated practice, overt instruction, critical framing, and transformed practice (see Table 2).

Table 2

Learning by Design Framework

Knowledge Processes	Curriculum Orientations
Experiencing	*Situated practice* Immersion in experience and the utilization of available discourses, including those from the students' varied lifeworlds (the Known and the New)
Conceptualizing	*Overt instruction* Systematic, analytic, and conscious understanding. The introduction of explicit language to describe the design of meaning (Naming and With Theory)
Analyzing	*Critical framing* Interpreting the social and cultural context of particular designs of meaning, standing back from definitions, and viewing them critically with their purposes and cultural context (Functionally and Critically)
Applying	*Transformed practice* Transfer in meaning making practice puts the transformed meaning to work in other cultural sites (Appropriately and Creatively)

As these processes apply to multimodal curriculum orientations, stakeholders make meaning through learning relationships (pedagogy and andragogy; Kalantzis & Cope, 2005). This framework is considered a schema in which any possible learning relationship may be applied and implemented. It tells the teacher what they are doing and which knowledge process a particular sequence of learning processes uses. The process gives the teacher a choice to further a learning process they are currently using, rethink a range of possible knowledge processes, and supplement their pedagogy from a broader range of possibilities. Therefore, this framework

creates an applicable basis for research, implementing findings, and directing future practice by aiding understanding in teacher professional learning.

Universal Design for Learning

Universal design for learning ensures that content is accessible to the largest audience by removing learning impediments (Center for Applied Special Technology [CAST], 2011a). Universal design refers to the concept of crafting physical spaces that allow for usability for as many people as possible. First implemented as an architectural concept in the 1980s, it was adapted by educators in the learning environment as UDL. Instructional designers, teachers, and curriculum design specialists (such as Anne Meyer, David H. Rose, and the Harvard Graduate School of Education, and CAST) to make all course aspects barrier free (Kennette & Wilson, 2019). By starting with course design rooted in UDL at the beginning of the course, instead of working backwards to later implement UDL concepts, barriers would be removed. If UDL tenants are applied to all components of learning, UDL would conceivably benefit all learners, not only those students with learning challenges or students with disabilities (CAST, 2011a; Courey et al., 2012; Meyer et al., 2014). Minimizing the barriers facing all students means that students and families no longer need to self-identify as needing accommodations (Kennette & Wilson, 2019). Instructors of professional learning for teachers, higher education faculty, K-12 educators, and other curricular experts should ensure that content is flexible and accessible to the greatest number of students without the students needing to disclose a disability.

Universal Design for Learning Framework

Educators that have a diverse group of students and must meet curriculum goals may explore UDL. Because the way people learn is unique, curriculum must be designed from the start to meet diverse learning styles. Universal design for learning minimizes barriers and

maximizes learning for all students. Universal relates to curriculum that can be understood by everyone, drawing on backgrounds, strengths, needs, and interests (Edyburn, 2010). Curriculum should provide unique learning opportunities for each student. Regarding learning, there are three main categories of processing information: recognition (the "what" of learning), skills and strategies (the "how" of learning), and caring and prioritizing (the "why" of learning). Because every learner is unique and one size does not fit all, curriculum must be designed intentionally. Curriculum works better for everyone when it is full of flexibility and accommodating and is designed for people in the margins (not the average). Supporting and challenging learners is important and is implemented through learning goals, methods, materials, and assessments that work for all (CAST, 2011a). Exploring barriers that may interfere can lead to flexible paths that include representation, action and expression, and engagement. CAST designed the UDL framework with three principles which are divided into nine more specific guidelines (with further sub-divisions): multiple means of representation, multiple means of action and expression, and multiple means of engagement (CAST, 2011a).

First, presenting content and information in multiple ways of representation gives learners multiple ways to understand. For instance, activating background knowledge, highlighting critical features, using multiple media, and implementing graphics and animation with activating varied supports can lead to better comprehension. Second, learners understand by providing multiple means of action, using options of expressing what they know, implementing recursive feedback, and having support for differing levels of proficiency (CAST, 2011b). Third, engaging through multiple means leads to understanding that students have differing interests and certain things may engage one student but not another. Giving students choices can lead to inspiring them as well as autonomy in the learning process, supporting students through mistakes

and persisting may help them push through challenges. By constantly being mindful of the learning goal, removing barriers will keep the learning challenge in focus throughout the learning process. Finally, these three concepts may support intrinsic motivation, lead to strategies for improvement, and aid in relevant assessments for stakeholders.

Andragogy

Merriam et al. (2007) stated that there are differences in child and adult learning, and the best contribution to understanding adults as learners is andragogy. Knowles (2014) stated that a defined set of six foundational concepts of andragogy are (a) the learner's need to know, (b) the self-concept of the learner, (c) prior experience of the learner, (d) readiness to learn, (e) orientation to learning, and (f) motivation to learn. Application of andragogy to the individuality of learners in distinctive settings is viewed as a strength as the theory is put into practice; learning experiences are unique to the individual, and all students learn differently. When the core learning theory concepts of andragogy are implemented, individual learner differences lead to individual growth, subject matter differences lead to institutional growth, and situational differences lead to societal growth.

Adult learning teachers may collaborate with students to individualize the lessons to the learners' needs while determining appropriate learning strategies (Knowles et al., 2014). Students acquire knowledge by connecting to formerly known information which is essential for adult learners (Melrose et al., 2015). Andragogy leads to direct learning, collaboration, and contribution to the learning of others which was vital to this study. The experience assumption of andragogy concentrates on having previous experiences assimilated into learning experiences (Ferreira et al., 2018). Utilizing prior experiences to formulate current learning and future knowledge acquisition leads to lifelong learning.

Lifelong Learning

As education and technology evolve, so must the teacher. As concepts such as affinity spaces, Education 4.0, and virtual learning continue to manifest in learning, teachers must be able to integrate the new concepts into their learning ecology. Ramírez-Montoya et al. (2021) posited that teachers must master technology and integrate it into their classwork, employ active learning strategies, and know and implement educational innovations. Moreover, multimodal learning for teachers and by teachers allows teachers to update their educational models and better understand their pedagogical relationships. Lalor et al. (2015) stated that lifelong learning for teachers means that they are open to learning and know how to learn. Lifelong learning includes being open to continuous improvement and willingness to learn.

Pedagogical insights may flourish as new ideas are gained through lifelong learning. Additional factors such as instructor quality, drive, area of interest, and accessibility impact lifelong learning tendencies. Technological skills may significantly impact teacher learning and update one's teaching ability (Hahl & Mikulec, 2018). "Opportunities to create curiosity, motivation, perseverance, and learning regulation through feedback will support teachers in their lifelong learning abilities" (Matsumoto-Royo et al., 2021, p. 2). Incorporating andragogy, lifelong learning, leadership, and professional learning aids in understanding and making meaning of multimodalities in professional learning.

Researcher Perspective

I am fascinated by phenomena that I do not understand. While making meaning of phenomena, I know that interacting elements lead to emerging phenomena that help make conceptualizations and world views. Therefore, there is a critical nature to my role in life. Why

are things this way, and how could they be better (Crotty, 1998)? These questions guide me personally and professionally.

As an educator, student, and educational technologist in roles such as college administrator, adjunct faculty, elementary school teacher, and father, I believe learning can and should improve the world. I believe deeply and sincerely in access to learning, equity, social justice, and inclusion through accommodating learning to student needs. Identities are built in differing ways. I like that my identities evolve constantly.

An understanding of technology as a teacher and student has been omnipresent in my career for 30 years. I have been fascinated with the technologies that have supported a myriad of student inclusions in differing settings including multilanguage learners, students with special needs, and students with individualized learning plans. Many times, as I furthered my comprehension of a skill, a new concept emerged that I had not heard of before. This led to another opportunity to envision where the concept came from, why it manifested, and its implications. However, I needed to learn how to use it first. Through lectures, professional learning, affinity spaces, and collaboration, I channeled my intrinsic motivation to aid my grasp of the skill. Principals, advisors, teachers, students, and professors aided in my making meaning of professional learning as I taught and learned.

The New London Group (1996) provided an opportunity to research a contemporary, emerging theory and framework that addresses the current necessity for teachers, professional learning, students, and society (Cloonan, 2010). This work feels important to me; I believe in the components and think it may make a difference for those who want to learn about it and perhaps implement it. Given aspects of my life in education, I feel there is much more to learn, understand, and apply; therefore, I find a fit in constructivism. Piaget (1967) explored the

personal components of constructivism; Vygotsky (1978) explored societal components of constructivism, and as the personal and social components meld, meaning is made. Constructing meaning applies to how I make meaning of my world.

Conclusion

Teachers are required to stay current with technology to facilitate student growth. Multimodal learning embodies new educational learning methods and skills; however, teachers may not understand or implement multimodal learning in classroom settings. Teachers must learn and transmit instructional methods and educational content. Professional learning for teachers is one way to aid in understanding multimodalities delivery through technologies. My study provides an understanding of how and the means to successfully implement multimodalities through professional learning by addressing the gap in the literature. Utilizing the affordances of learning opportunities for growth as situated in the Learning by Design Framework, the data collected allows for greater understanding in multimodal learning. Subsequently, a qualitative phenomenological study on making meaning of professional learning for teachers can provide insight into the experience of professional learning providers, teachers, and students.

In Chapter II, through a literature review, I will discuss aspects of making meaning of multimodalities in teacher professional learning. The review will include technology, development of professional learning, implementations of multimodalities, the effectiveness of the implementation of multimodalities, and professional learning. In Chapter III, I will describe the methodology for this study regarding participants, types of methods I used, research procedures, and data analysis.

CHAPTER II

LITERATURE REVIEW

A literature review synthesizes previous scholarship and provides a need for a proposed study (Creswell, 2008). My literature review focused on four themes related to my study: multimodal learning (multimodalities), professional learning, technology access, and learning ecologies. Each theme has subthemes that are explored, leading to an established gap in the literature. There are many empirical studies of the themes. However, few studies have shown the intersection of the topics to address the research questions guiding this study which are as follows:

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

Framing the literature aided in bridging the historical aspect of learning with emerging trends in professional learning and multimodalities. Education and technology have been emboldened with developments as time has passed, and ideas have led to changes. If education may be considered a social structure that moves and shifts with tools, access, inclusion, and methods, stakeholders create and remix concepts that add to the body of knowledge.

Multimodal Learning

Using modes in teaching leads to a more coherent synthesis of remixing resources to construct a learning environment. Typically speaking, a mode is considered a unit of expression

and representation. According to Jewitt, a mode is the outcome of the cultural shaping of material (2009). Applying modes to differing contexts provides agency for choosing which modes to use and how to apply them individually or collectively. Multiple modes or modalities leads to the plural term "multimodalities" which manifests in multimodal learning.

Mode usage in learning was explored in a case study to explore the implementation of genre-based multimodal texts in multimodal teaching by Tandiana et al. (2020). Semiotic resources, collaboration, and remixing supported the instructors and the students (N = 23) in analyzing, modeling texts for others, and interpreting compositional meanings represented in a multimodal text. Students performed autonomous learning, such as multimodal text analysis, individually and in groups. The findings revealed the students' perception of knowledge building, multimodal teaching materials, and multimodal text analysis practices, leading to positive perceptions of multimodality teaching.

Modes aid thinking, theorizing, and writing about meaning, communication, and social matters. Kress (2010) explored the world of social semiotics, a theory that "deals with meaning in all its appearances, in all social occasions, and all cultural sites" (p. 2). Kress addressed questions such as "What identity do multimodalities take on? What are the differences in style utilization? What do differing modes mean individually and collectively?" Furthermore, Kress espoused that "the world of communication has changed and is changing still, and the reasons for that lie in a vast web of intertwined social, economic, cultural, and technological changes" (p. 5). Lastly, he suggested that the world is moving from the terminology of grammar to semiotic resources and "that representational and communicational practices are constantly altered, modified, as is all of culture, in line with and as an effect of social changes" (p. 7). As the world moves to semiotic resources, modes enable concrete learning to occur.

Järvelä et al. (2019) found that new technologies can provide rich data for investigating a range of cognitive and non-cognitive processes regarding self-regulated learning (SRL). The study's participants (N = 48 high school students) used cyclical processes such as planning, enacting strategies, reflecting, and adapting to complete collaborative multimodal learning tasks. Researchers digitized protocols with automated analysis to speed up feedback and data collection to better understand complex learning processes. These data focused on students' intentions to learn and students' beliefs about themselves as learners. Furthermore, the study elaborated on the type of instruction on students' exploratory behavior and arousal levels as tasks. One additional finding is that using more data channels, such as videos, could aid in contextualizing content and further interest. The study explained student interest in content by accessing that content with modes and individualized learning.

An empirical study in 2018 by Zapata and Ribota explored the instructional benefits of identity texts and learning by design for learner motivation in required second-language classes. Learning by Design allowed for an analysis of the learning relationships of teachers, students, and leaders of professional learning. In using multimodal identity texts, the study examined the learning process that allowed students to analyze, develop, and connect multimodal texts to their individual experiences (Zapata & Ribota, 2018). Examining informal and formal learning can be integrated through curricula that connect with who the learners are (lifeworld and community) but also reflect their diverse, multidimensional social and cultural backgrounds. Similarly to my study, Learning by Design provides an analytical framework to enter the data collected for concrete data analysis.

The process of learning is a significant component of Learning by Design. Zapata and Ribota (2018) utilized the knowledge processes of experiencing, conceptualizing, analyzing, and

applying the texts to develop a transformative curriculum. Written, oral, visual, audiovisual, and digital texts aid in researchers understanding how meaningful connections are made, taught, and understood. Like my study, multimodalities were explored concerning formal and informal learning. According to Zapata and Ribota (2018), students should be actively involved in their learning process through deep interactions with multimodalities. Understanding the Learning by Design framework allows me to establish the methods used in my study.

Enabling someone to discover or learn something for themselves, known as the heuristic process, is a long-established method of learning (Jewitt et al., 2016;). This discovery takes place by social actors utilizing modes in some fashion. Modes enable different resources to be utilized in a specific context. According to Norris (2004):

> A communicative mode is never a bounded or static unit but always a heuristic unit. The term "heuristic" highlights the explanatory function and accentuates the constant tension and contradiction between the representation system and the real-time interaction among social actors. . . . The individual in the interaction draws on systems of representation [modes] while simultaneously constructing, adapting, and changing those systems through their actions. In turn, all actions that individuals perform are mediated by the system of representation that is utilized. (p. 12)

Modes are part of the system of representation they comprise and, therefore, are essential components of the learning world. Modes and the teaching of modes may be a part of meaningful professional learning for teachers.

Yelland (2018) found, through a participant observation study, that multimodal experiences aid in children's literacy. Pedagogy and learning experiences were documented through narratives which showed that electronic tablet usage by teachers informed student

practice in their early years (four to eight years). The learning environment was deemed a new learning ecology (a hybrid of online and face-to-face) and documented that learning stories use multimodalities as a uniting element. Yelland stated that "multimodal learning ecologies can work to support emergent literacy which is viewed as a foundational skill needed by all children to thrive in their learning" (p. 5).

Rowsell and Walsh (2011) stated that modes stand alone and work differently through activities like sorting, choosing, assembling, distributing, and, finally, remixing. Blending transmodal (text elements that reach across modes), intermodal (containing links between modes that stand alone but cross-reference each other), and intramodal (combine to make meaning) account for the different ways of making meaning with modes. Modes allow for ways of expression by supporting individual preferences and approaches. As modes relate to semiosis as the process of signification in language and literature, they create new ways of knowing, learning, and expressing. The composition of multiple modes to transmit, produce, and reveal a new or reformed concept or product is known as remixing (Jewitt et al., 2016). This remixing embodies creation through solving problems.

Design is "one of the most important parts of multimodal expression because it encourages imagination, vision, and problem solving when learners become designers" (Albers & Harste, 2007, p. 13). Composing material allows for constructing a product through meaning-making activities and skills. Modes employ written, oral, visual, audio, gestural, spatial, and multimodal design areas to create a new product. Furthermore, language is limited, and meaning-making is enhanced by utilizing numerous modes. Additionally, technical skills are utilized to remix the final product at hand. Jewitt (2008) stated that additional components of multimodalities, including communicating texts across multiple technologies, media, and

audiences, are critical to the learning and sharing process. Utilizing these concepts in practice allows for implementing professional learning and multimodalities and will be explored through my study.

Kress (2010) elaborated on the "transductive moment" when a producer (in the study, a preschooler, but it could be anyone) channels the modes that feel right in working towards a purpose. Similarly, Rowsell and Walsh (2011) discovered six results from working with modes in learning environments in differing settings. First, interests are accommodated and explored; second, multimodalities are centered around storytelling that emerges from an idea; third, multimodalities are collaborative, based on participatory structures and communities of practice (Lave & Wenger, 1991); fourth, multimodalities build and remix on original materials and are not original themselves; fifth, modalities are used in everyday life; and sixth, multimodalities are based on human experiences and are a human venture. These outcomes state that using modes across learning environments is possible and generalizable. The next step will be a review of the literature on how multimodalities are taught to teachers and students.

Teaching Multimodalities

Literature regarding teaching multimodalities is spreading globally. For instance, Palsa and Ruokamo (2015) discussed the integration of multimodalities in Finland. Other examples of teaching multimodalities studies are: Holloway and Gouthro (2020) in Canada; Hong and Tan (2020) in Malaysia; Kalantzis and Cope (1997) negotiated Learning by Design and multimodalities throughout Australia and the United States; Kim et al. (2021) in Korea; and more. The broad scope of interest worldwide shows that the research supports educators in learning what multimodalities are and how to teach teachers to teach modalities. However, the literature states that professional learning support may be missing at local, national, and global

levels for teacher understanding and subsequent implementation in their district, school, and classroom. Understanding the "if" and "how" of multimodality teaching is critical. Some educators use multimodalities intentionally, knowingly, and productively in their teaching. However, some educators may use multimodalities but are unaware of specific educational outcomes (Cloonan, 2010). Subsequently, multimodal content and delivery methods in teacher professional learning are necessary and are at the heart of this research.

Kasch (2019) conducted research regarding teaching multimodalities relating to UDL. The qualitative study comprised 23 interviews in two language classrooms. Kasch (2019) studied recognition networks dealing with how to sense and assign meaning to patterns that are seen and understood in modalities. The students were asked to use digital modalities and describe their feelings about the functionalities. Students responded with experiences, comments, and viewpoints on how multimodality learning occurred. The researchers found that instructors competent in multimodal delivery (such as video, flipped learning, the internet as a resource, and audio sources) aided in scaffolds to function with projects and acquire higher levels of competence. Reading comprehension processes went beyond simply reading and incidental learning. The lessons were deemed scalable and supplemented for remedial functionalities in different settings with similar results. Learners' diverse interactions with functionalities led to self-efficacy and intrinsic motivation.

Nixon (2003) found a gap in the literature regarding implementing modalities into classroom practice for teachers and students: "There have been very few studies of critical and transformative new media literacy practices within school-based education" (p. 409). In 2005, Kist took this call to action. He produced *New Literacies in Action: Teaching and Learning in Multiple Media* which explored the tenets for implementing multimodalities in education and

teacher learning. Envisioning how multimodalities may manifest in the classroom, Kist (2005) posited a variety of components: interdisciplinary, inquiry-based, apprenticeship, modes, new media, games, anime, graphic novels, or pop culture to build in and out of school goals. Kist (2005) worked to identify characteristics of the classroom and included a compilation of characteristics such as:

- Classrooms feature daily work in multiple forms of representation.
- There are explicit discussions of the merits of using specific symbol systems in certain situations with many choices.
- There are metadialogues by the teacher who models working through problems using specific symbol systems.
- Students take part in a mix of individual and collaborative activities.
- Classrooms are places of student engagement in which students report achieving a "flow" state.

Kist (2005) espoused that the settings of the schools may be urban, rural, or college preparatory and spanned all grade levels. Each setting had a champion of multimodal efforts and combined multiple rationales and approaches built upon predecessors who began embracing modalities in the early 2000s. Kist (2005) inquired about the results of these projects based on technologies leading to making meaning for the students themselves or making meaning for the specific curricular standards at hand, so the students could eventually get jobs (p. 128). Preparation for the new technological economy through intrinsic motivation or learning objectives may be at the core of multimodalities (Kist, 2005). Literacies may be explored and learned by using multimodalities, as stated by Rowsell and Walsh (2011):

> As in comprehension and competence through a variety of modes such as image, sound, touch, multi-dimensions which is the principle upon which digital environments work . . . multimodality needs to be understood for educators to apply and assess new modes of learning as a part of everyday classroom practice. (p. 54)

Dressen-Hammouda and Wigham (2022) posited an empirical study based on instructional video tutorials which provide a window to understanding how multimodal literacy manifests through teaching. This study aimed to understand how English-language learners gain understanding within teaching environments. By examining modes and semiotic resources, they espoused that andragogy happens by supporting facilitation, ensuring ease of access, combining narration and animation, enabling the viewer to interact with the video, previewing tasks, and allowing viewers to practice and review content.

The case study (Dressen-Hammouda & Wigham, 2022) examined the effectiveness of student-produced videos through an evaluation survey and the 28 categories (see Table 3) with *N* = 10. The main goal of the videos was to teach through a format comprised of multimodal resources. Three specific modes were targeted, being the linguistic, temporal, and aural modes. The study did add "Time" to the New London Group's prior-established five schemas of modes, which the London Group incorporated through the spatial modality. The researchers found that literacy in modalities may be problematic in identifying appropriate titles, previewing the task, and task progression. The study concluded with a recommendation that future researchers study various "skills involved in successful multimodal design to make them more ‘teachable’ by articulating them with more explicit accounts, thus helping students build a clearer image of users and tasks" (Dressen-Hammouda & Wigham, 2022, p. 105).

Table 3

Modes and Resources for Designing Video Tutorials

Modes	Linguistic	Aural	Visual	Spatial	Temporal
Semiotic Resources	• Written/spoken words • Word choice • Grammar • Sentences • Paragraphs • Text	• Spoken words • Sound • Music • Volume • Rhythm • Delivery speed • Pitch • Tone • voice	• Images (still) • Images (moving) • Color • Layout • Design • Font • Size • Formatting • Symbols • Visual Data • Graphic animation	• Physical arrangement • Proximity • Spacing • Organization • Direction • Distance between elements	• Length • Speed • Tempo • Pacing • Pausing • Temporal cueing

The literature suggests that technology has impacted the role of the teacher and the format of the traditional classroom (i.e., sage on the stage). A transformation occurred from the model where teachers are the center of the classroom to one where learners become the centerpiece of teaching and learning processes (Partnership for 21st Century Learning, 2015). Learners have begun to utilize computers, social networking, audio, video, media, multimedia, and other technologies to better make meaning of their learning experience. Therefore, digital and multimodal practices are critical in presenting opportunities for teachers and learners in the 21st century classroom (Van Leeuwen, 2015). Opportunities abound for all stakeholders, yet the immense choice of these opportunities may be overwhelming. "Teachers should recognize the value of multimodality and be able to integrate multimodal practices for academic and social purposes in their classrooms" (Sakulprasertsri, 2020, p. 227).

Sakulprasertsri (2020) conducted a mixed-method study to explore the modes of teaching and integration employed in 10 English classrooms in 2018 across Thailand. Utilizing a Likert Scale, questionnaires, and observation, he found that multiple modes of communication were

utilized by the teacher and the students. These modes included written and oral language, gestures, visuals, sounds, and movements in the classroom. Additionally, teachers often used Powerpoint slides with various animations and pictures. These assigned tasks required students to use multiple modes and designed many activities to involve students in the class. Students stated that teachers often used online tools such as Kahoot, Plickers, Quizlet, and Google applications. Finally, teachers implemented the chalkboard/whiteboard to write down important concepts and to access online functions to parlay learning concepts. Students, as well as teachers, must learn how to teach multimodalities and then do so regularly in a myriad of ways. Understanding how multimodalities are taught allows for exploring how multimodalities manifest as technology in education.

The Emergence of Multimodalities in Education

In Dewey's (1900) *The School in Society*, he wrote of the inventions that supported the rapidly growing fields of communications and manufacturing, a statement that could ring true for the profound changes in technological advances and global connectedness in modern times in rapidly growing fields such as technology.

> One can hardly believe there has been a revolution in all history so rapid, so extensive, and so complete. Through it, the face of the earth is making over, even as to its physical forms; political boundaries are wiped out and move about. . . . That this revolution should not affect education in some other than a formal and superficial fashion is inconceivable. (p. 7)

A similar shift has occurred in education--that of rapid growth and educators working to understand that growth. Implementing digital education practices from this study will support

professional learning for teachers (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020).

Dewey's expectation of how technology can shift what, how, and why content is learned is a precursor to the impact of technology on teaching and society. Furthermore, Dewey (1938) stated in *Experience and Education*, "there is a necessity of the introduction of a new order of conceptions leading to new modes of practice" and to "keep in mind the more fundamental ideas and practices of the past" (p. 242). Scaling Dewey's values into the modern world allows educators and researchers to identify change, build on proven methods of instruction, and flourish in "means of acquisition of the organized bodies of information and prepared forms of skill which comprehend the material of instruction . . . where change is the rule, not the exception" (p. 244). Multimodalities take Dewey's educational foundation and subsequent vision into the present by allowing students to create their active participation in the development of what students "do" and "learn" with emerging tools.

For example, the case study by Häggström et al. (2020) explored language development multimodally. Utilizing role play and student groups, students taught peers lessons on literacy by using eBooks (electronic books). One student stated, "When we had to plan and conduct the lessons, my role as a teacher became real, and I understood what it was about. It was both scary and fun." The study explored multimodal presentations by groups using any kind of multimodal expression they wished with a combination of sources and a remixed product. Häggström et al. stated:

> Knowing *about* multimodality then implies knowing what multimodality means and entails. Knowledge built on learning *with* multimodality is to understand what it may bring, how it can be used to scaffold language development, and how a teacher can utilize

> different modes when teaching. Multimodality is both used to support learning processes and a teaching approach; both students and teachers can express themselves in multimodal ways. (p. 134)

Technological advances coincide with learning as students need to master the new technology to be part of society, and the technologies provide new affordances of learning.

Since the inception of the New London Group in 1994, literature regarding multimodal learning has been emulated from the original participants (Cazden et al., 1996). This literature has spread across the world to educators who have found it helpful, and, in turn, many educators have added to the canon of work. Some teachers may not have had the support or motivation to learn, implement, and embrace technologies that they have not heard of or experienced.

This emergence of multimodalities in teaching was explored in 2021 by Tafazoli in a qualitative study ($N = 12$). In the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2009), teachers were interviewed regarding their current understanding of technologies and professional experiences. Findings included that teachers gained insufficient professional development on what and how to integrate technology into their teachings which supported the statement that "most teacher training courses do not include in-depth technology-enhanced learning development" (Lotherington et al., 2016, p. 44). Teachers took part in computer-assisted language learning (CALL) professional development (Son, 2018) and, in turn, taught what they learned to their students in traditional and online settings. One participant stated, "As a teacher, we know this course is essential for us to recognize how technology can be useful and ease the learning process for our students, so we ought to be familiar with and set it up in our lesson plan" (Lotherington et al., 2016, p. 44).

The teaching profession requires many lenses, duties, learnings, and roles which may be supported by the emergence of technologies in teaching. Significant roles include learning information as a student and sharing that information as an instructor with other students (professional colleagues, children in their learning environments, and other formal and informal settings such as policymakers, friends, and social circles). The intersection of the student role (learning) and the instructing role (disseminating) is where many teachers root themselves, pivoting constantly.

Universal Design for Learning

Universal design for learning strategies aim to minimize learning barriers for all students and remove the need for students with disabilities to advocate on their own behalf. Advancing inclusive learning structures in education by implementing UDL and moving away from a one-size-fits-all learning model addresses more accessible learning environments for increasingly diverse student populations (CAST, 2018). Presenters of professional learning for teachers and teachers may have barriers to adopting UDL practices. In a study by Hills et al. (2022), interviews were held with nine participants that stated barriers for UDL implementation included: (a) inconsistent understanding and implementation, (b) misconceptions, (c) time/workload constraints, (d) resource constraints, and (e) student discomfort. The researchers found two bridges for implementation: (a) growing awareness and willingness to adopt UDL principles, and (b) instructor and institutional champions committed to UDL pedagogy and practice.

In the study done by Kennette and Wilson (2019), students (17) and faculty (40) were surveyed twice throughout the fall 2017 semester at a college in Canada. Their findings included the following UDL usage in their classrooms:

- Representation
    - Present the same course content in multiple ways (graphics, video, text, graphic organizers/concept maps, etc.)
    - Offer an electronic version of the textbook
    - Post handouts on the virtual college connect system (or make them available digitally)
    - Include subtitles on videos (closed captioned)
    - Upload files that can be read using test-to-speech software
    - Provide clear guidelines for major assignments (e.g., example/sample assignment)
    - Include a field trip
    - Capture class lectures and made them available to stream after class (video or podcast)
    - Make a glossary of terms available (on the virtual college Learning Management System, in the textbook, or other)
    - Offer alternatives for auditory information (e.g., transcripts of videos) and visual information (e.g., description of images)
    - Highlight patterns and relationships in the course content
- Engagement
    - Offer interesting and relevant major assignments
    - Allow for some autonomy and/or control of student learning (e.g., options for assignments (topic or format); or choices on tests (choose one of two essay questions; or pick five of the following terms to define)

    - Let students decide which topics are covered in the course
    - Use hands-on activities in the class
    - Connect course content to real world experiences
    - Communicate with students (in class, outside of class, via message board, or email)
    - Provide clear and specific feedback on assignments
    - Offer a choice of how students receive feedback on assignments (e.g., verbal or written)
    - Allow students to resubmit assignments
    - Include peer evaluation as part of the coursework
    - Make PowerPoint slides available to students
    - Include group work and collaboration with other students (e.g., discussions)
    - Provide opportunities for self-assessment/self-evaluation and reflection
    - Answer questions about course content or assignments outside of class (e.g., discussion board, email)
    - Use gender-neutral language and inclusive examples (race/culture, etc.)
    - Minimize threats and distractions in the learning environment
    - Motivate students to do their best work
- Expression
    - Flexible due dates on major assignments (e.g., allowed to turn it in late)
    - Offer ungraded or optional assignments to practice course content
    - Provide sufficient (or unlimited) time for tests
    - Provide rubrics for major assignments

- Guide using increasing difficult activities or assignments
- Guide goal setting and the development of student learning strategies
- Provide opportunities for students to monitor progress (e.g., grades posted on college learning management system)

The researchers found that students who are exposed to many elements of UDL find most of the elements useful to their individual learning. Students perceive teacher communication as a key component in their success (feedback on assignments, communication outside of class, and responding to emails). Helpful learning elements (rubrics, communication, and sharing lecture slides) aided in access to learning. Student and teacher perceptions are equally valuable in perceived usefulness of UDL principles, though they include differing perspectives.

In exploring how technology can support learners in creative learning environments, flexibility can nurture the potential of every single individual (Rose, 2013). This support may include simple solutions such as language translation, support for reading and vocabulary, and pace of instruction. By restructuring learning to students by banning the average and designing to the edges, learning with technology may flourish. Students have differing skill sets in memory, language, knowledge, reading, vocabulary, curiosity, perception, cognition, and interest, and the learning environment should be usable by all people without need for adaptation (Rose, 2013). Implementation of UDL may have a profound impact on individuals by moving away from the "average" student to those that are "in the margins." Mole (2013) provided a model for inclusion of disabled students in higher education settings:

Table 4

Accommodation Versus Universal Design for Learning Approaches

Accommodation	Approach
Accommodation approach (based on medial model of disability)	UDL approach (based on social model of disability)
Accessibility is a problem for students with disabilities (SwD).	Accessibility is a problem of course design.
Accessibility is achieved through individual accommodations	Accessibility is achieved by implementing UDL principles in course design and delivery.
SwD have to seek out their own accommodations	Accessibility is built into instructional design and delivery.
Accessibility is retroactively fitted to the needs of SwD	Accessibility is proactively implemented for the benefit of all students.
Course content and assessments are exclusive (i.e., targeted to a narrow range of learners)	Course content and assessments are inclusive (i.e., targeted to a wide range of learners).
Accessibility is temporary and consumable (i.e., only applied for the duration of the course)	Accessibility is holistic and sustainable (i.e., doesn't need to be renewed)
Accessibility is superfluous to course design (i.e., only applied as an add-on)	Accessibility is built into course design

Furthermore, a study was conducted in 2017 by Cunningham et al. that explored the impact of professional development for eight teachers that addressed how to provide access for students with moderate disabilities. Trained UDL coaches provided cyclical, one-on-one instructional coaching consisting of lesson demonstrations and personalized feedback. Instructional practices and students' engagement in the classroom were explored. Through

embracing and preparing for diversity, the study found that teacher preparedness is linked to classroom achievement. Universal design for learning helps remove barriers from learning by utilizing three principals: (a) multiple means of representation of content; (b) multiple ways for students to represent their knowledge; and (c) multiple ways of engaging students (Cunningham et al., 2017). A needs-based assessment was implemented, followed by a town hall, and then the professional development program was implemented. Four UDL coaches used observations and checklists to aid in understanding the phenomena. Findings included benefits of debriefing sessions, discussing obstacles, and the valuation of coaches' lesson demonstrations. These findings led to classroom impact practices that helped student engagement, motivation, and focus.

Sociolinguistics

Language analysis may best be accomplished in context while focusing on values, society, and culture by moving past literacy and language. For instance, Gee and Gee (2007) stated that language in society is attached to social relations, politics, power, culture, experiences, values, attitudes, and things and places in the world. Specifically, Gee and Gee framed these cross-cultural concepts within communities and schools. Exploring the nature of language and communication and applying linguistics, Gee and Gee examined how literacy and privilege interact. Literacy is a "socially contested term" and may be situated in individuals or within society, affecting power.

Social identities and human relationships are included in the sociocultural nature of meaning and communication as they intertwine with human agency and responsibility. Making sense through discourse is what institutions (schools), and people (professional learning leaders and teachers), do. As individuals are socialized into a plethora of discourses, they form identities

within those discourses. Gee and Gee (2007) incorporated three grammar orientations related to text and talk, being "communicative traditions, ethnoracial traditions, and social class" (Collins, 2000, p. 70). Values, practices, modes of conduct, and communication are specific to groups and institutions. The individuals and discourses lead to performances situated in discourses. My study explored the discourse of effective educational leadership that facilitates teacher agency as a matter of culture, structure, and relationships operating as a dynamic, complex, and interrelated ecology (Duignan, 2012; Grootenboer, 2018).

Askurny and Pujiastuti, in 2019, aimed to research the different factors of linguistics and motivation. Through interviews and a Likert Scale questionnaire, they explored the communicative traditions, ethnoracial traditions, and social class of teachers, parents, and the environment of 203 students in Bintan Island, Indonesia. The results stated that the extrinsic and intrinsic factors supported a myriad of discourses that led to student learning. These discourses were modalities manifesting as grammar to specific groups. The interplay of extrinsic and intrinsic motivation is substantial, ongoing, and embodied through communication. Recommendations of the study included more access to learning methods, such as modalities, to aid in a more constructive learning environment. Lack of access was a common theme for instructional barriers and needed to be addressed.

Exploring the situated/sociocultural viewpoint looks at knowledge and learning opportunities regarding associations between an individual and an environment in which the individual thinks, feels, acts, and interacts. The individual and the environment have backgrounds with traditions, knowledge, and learning (Gee, 2018). Action opportunities, or affordances (Gibson, 1977), are perceived as achievable within the setting. The individual then must have the scope to transform the affordance into a usable action (Gee, 2018). This repertoire

of capacities for action is known as effectivities and was explored in the study as the usage of multimodalities. Using what is offered by the situation and put into action constructs a relationship between the actor and the setting. Additionally, other actors may be encompassed in a learner's environment and offer distinctive possibilities through shared action. These situated relationships are comprised of learning, individuals, and specific environments which include embodiment, distributed cognition, and social practices (Gee, 2018). The repertoire of capacities relates to how teachers utilize multimodalities and was examined throughout my study.

Combining different resources allows for three critical premises of multimodality; Jewitt et al. (2016) stated,

> First, meaning is made with different semiotic resources, each offering distinct possibilities and limitations; second, meaning making involves the production of multimodal wholes; third, if we want to study meaning, we need to attend to all semiotic resources being used to make a complete whole. (p. 3)

Linguistics, language, and literacy abound with differing theories and approaches. Halliday (2003) stated that a formal view of language rules is problematic for children. When they enter the school system, they find a myriad of rules and many restrictions on how to do (or not do) language. This learning leads students to see language not as a unique tool that can create a kaleidoscope of different meanings, but as a set of rules, exacerbating challenges between linguistic and social system processes. Multimodalities allow teachers and learners to break through prior constraints and individualize learning to themselves and their communicative traditions, ethnoracial traditions, and social class. Sociolinguistics frames multimodalities as a new grammar.

Multimodalities and Systemic Functional Linguistics

Based on social semiotics, or "meaning in all its appearances" (Kress, 2010, p. 2), the multimodal theory was posited by Jewitt and Kress in 2003 to engage language and additional grammar sources to create meaning. "The world of communication has changed and is changing still, and the reasons for that lie in a vast web of intertwined social, economic, cultural, and technological changes" (Kress, 2010, p. 5). A social semiotic theory of multimodality shifts from the usage of the term grammar to that of semiotic resources (Kress, 2010) and supports the usage of the terms grammar, design, and resource interchangeably. Keeping in mind the individual characteristics of cultures can lead to vast differences in these concepts and an opportunity to frame ideas multiculturally.

Pasaribu (2022) conducted a study of 20 college students in Indonesia, focusing on learning English through academic writing via a Zoom class during the Covid-19 pandemic. By collecting essays, the researcher analyzed content which included submissions with differing modalities. The modalities led to a grammar of understanding the presentation they created. Utilizing technology such as computers and cell phones, online lectures, and online group work, the students had the minimal motivation to study; however, they were motivated to learn English. Students took part in the emerging grammar of multimodal tools to access and implement English language learning and frame ideas multiculturally.

Halliday (1994) developed systemic functional linguistics (SFL) regarding language as a social semiotic system. Systemic functional linguistics has a goal of developing functional grammar. Engaging with multimodality is critical in recognizing the differences between semiotic resources and how they are combined in opportunities for meaning making. Jewitt et al. (2016) espoused that language is the most resourceful, meaningful, and widely used of all

modes; language can be studied in isolation; many linguistic principles are semiotic principles; each mode offers distinct possibilities and limitations; and modes are resources for making meaning. Halliday (1994) stated:

> Language has evolved to satisfy human needs, and the way it is organized is functional concerning those needs-it is not arbitrary. Functional grammar is essentially a “natural grammar” in the sense that it can be explained, ultimately, by reference to how language is used. (viii)

The SFL system addresses language, multimodalities, and technology as they interact with representational meaning.

Albers and Harste (2007) found that representational meaning may be defined in materiality, framing, design, and production, all being symbiotic to the others (Jewitt & Kress, 2003). Materiality refers to the materials utilized to represent meaning in a culture. For instance, websites, video games, animation, photos, videos, and text may be interactive and engaging. These characteristics of modes are defined as the material's affordances. Framing puts the elements utilized in context regarding how they relate and interplay. For instance, digital texts such as Google Slides, webpages, hyperlinks, audio, and video involve visual, musical, spatial movement, and other modes. Exploring the "modes as socially shaped and culturally given semiotic resources for making meaning” (Kress, 2010, p. 79) which is a central tenet of the research.

These design elements lead to a communicated message. Design details the usage of the resources available at that moment to create the representation and is the conceptual manifestation of expression (Kress & Van Leeuwen, 2001). Design processes may include imagination, vision, and problem-solving with learners as designers. "When students are both

designers as well as producers, strong principles of learning can emerge through design" (Albers & Harste, 2007, p. 13). Production is working with media to create, organize, and represent the product or text, technical skills, and remixing of resources. Understanding how modes manifest in SFL aids teachers and students in implementing individual and combined modes in a myriad of settings. Understanding how this grammar appears in technology, many have not been taught to preservice teachers which mandates additional learning.

Professional Learning

The mission of education is "to ensure that all students benefit from learning in ways that allow them to participate fully in public, community, and economic life" (Cazden et al., 1996, p. 60). Broadening the definition of the word "students" to include any learner in a professional learning setting encompasses principals, teachers, administrators, faculty, and facilitators to enhance their repertoire of instructional methods for their learners (pre-kindergarten through 12th-grade students, community college/college students, teachers, and other educational leaders such as principals and administrators) (Netolicky, 2020). Teachers specifically shift their lens between that of a student (learner) and a disseminator of knowledge (teacher). Implementing this construct in the study allowed for the broadening of the concept of professional learning (Netolicky, 2020) and the implementation of multimodalities.

Regarding incorporating teacher professional learning as it relates to constructionism, one prior study was conducted by Paudel in 2021. Paudel used constructionism to explore the phenomena of interest as teachers integrating classes of students identified with reading/writing difficulties. Professional learning for teachers supports participant perception as they explore their worlds. Exploring the participants' subjective experiences as a separate process from those experiences of the researcher is also a commonality. As Paudel explored phenomenology in the

constructionist realm, the meaning was made from participants' perspectives, best-practice examples, and the world of experiences. Incorporating the world of experience, construction, and interpretation led to understanding and attributing meaning (Paudel, 2021). Constructionism claims that humans construct meanings as they engage with the world they interpret (Crotty, 1998).

Kalantzis and Cope posited a study in 2016 that focused on collaborative learning and differentiated teacher practice in Greece through the Learning by Design framework. They stated that research over the last decades (Darling-Hammond, 1993; Fishman & McCarthy, 2000; Yoon et al., 2007) affirmed the traditional training model of teacher must evolve to the creation of interactive, collaborative, personalized, and reflective professional learning communities, where teachers consume and collectively produce knowledge, as collaborative professional learning. The study included 43 teachers that were designers and co-creators of learning environments. Knowledge processes such as sequencing, contributing to student learning, using technology, and enhancing existing approaches were explored in a pre- and post-survey. Results suggest professional learning practices to expand teaching repertoires, professional interaction, peer interactions, and social media activities in instructional design, addressing differentiating instruction, and scaffolding activities.

Inherent in professional learning is the concept of leadership. Northouse (2007) found leadership entails the components: (a) it is a process, (b) it involves influence, (c) it occurs within a group process, and (d) it involves goal attainment and is summarized as "a process whereby an individual influences a group of individuals to achieve a common goal" (p. 3). Most often, leadership in a school setting is centered around the school principal and other stakeholders and, according to Dinham (2007), includes: vision, expectations, and a culture of success; teacher

learning, responsibility, and trust; student support, everyday support, and collaboration; and focus on students, learning, and teaching.

Nikonorova (2022) implemented a study of 164 people regarding professional learning for teachers through an analysis of pre- and post-test data. Teachers took part in an electronic-designed professional learning course that taught online multimodal tools such as Padlet, Zoom, and Google Tools. Researchers explored developing transfer skills, creative thinking, and critical thinking. Teacher benefits were to (a) develop a holistic understanding and vision of the educational program; (b) expand cooperation; (c) allow integration of the content of different subjects; and (d) reflect and process content, methods, strategies, and technologies. Benefits for students and schools were also included. The professional e-courses included individual trajectories of work, practice-based, theory, hands-on activities, and feedback. Some identified problems were a lack of resources, language barriers, and lack of motivation. Some significant findings included professional learning regarding real-life issues, student involvement in the learning process, and the development of multimodalities.

Richardson (2003) espoused that much professional learning is short-sighted, focuses on transmission teaching models, and does not consider what teachers are already doing. She advocated for a shift in professional learning that is school-wide, is lengthy with follow-up support, considers participant beliefs and practices, gains buy-in, supports collegiality and agreement, has administrator's support, and does not overburden the teachers. This transformation shows how learning has translated SFL into pedagogical frameworks (Zhang, 2018) as applied to Lewin’s (1940) TLC.

However, gaining the knowledge and skills necessary to be effective instructional leaders is complex and includes varied definitions. The National Policy Board for Educational

Administrators (2015) created standards for the field in 2015 that apply to many leadership roles and "define the quality of work of persons who practice the profession, created by and for the profession to guide professional practice, and how practitioners are prepared, hired, developed, supervised, and evaluated" (p. 8). The standard relating to technology, Standard 4 Curriculum, Instruction, and Assessment, Point (e), Promote the effective use of technology in the service of teaching and learning (National Policy Board for Educational Administrators, 2015, p. 18), is specifically applicable to leadership and professional learning regarding technology use.

Vogel (2018) collected data on how principals define and prepare to be instructional leaders. In her study of 54 respondents, 35% of the principals stated that professional development was a theme for success in their buildings and is the responsibility of principals. These supports included professional learning community meetings, faculty meetings, and other professional learning to achieve student learning outcomes and identify student learning needs (p. 7). Additionally, one participant stated, "I believe a good instructional leader needs to be committed to staying up on the latest research and practices" (p. 6). Ironically, "student learning needs" and "staying up/current" may be considered technology usage. However, no participants in the study stated that technology use or implementation was part of their responsibility (p. 7). Vogel emphasized that nearly 50% of respondents had received little or no technological training or depended on staff and students to understand using technology (p. 12). Therefore, Vogel recommended:

> Principal preparation programs should include research on the effective use of technology to support student learning and model this technology usage within preparation programs. Technology usage best practices would address the lack of knowledge of using

> technology to promote student learning and inform the acquisition and implementation of technology within schools and districts as resources allow. (p. 13)

As they emerge, stakeholders can learn concepts and tools by establishing and prioritizing the need for a system-wide understanding of administrative and academic technologies.

The literature shows that educators are working towards emerging concepts at the confluence of leadership in professional learning, technology, and multimodalities. One such concept is online learning communities which were explored by Xu et al. (2021). The study included data on higher education teachers in China utilizing WeChat to build an online community of practice (OCoPs). The results stated that mutual engagement, joint enterprise, and shared repertoire manifest in multimodal learning. This knowledge-building community was built on online interaction comments, reflections, classroom observations, and interviews. This process led to the teachers having positive perceptions and a desire to nurture and maintain OCoPs. Teacher, instructional, and curriculum leadership include professional learning, technology, and multimodalities tenants. "We ask teachers to assume leadership roles without any preparation or coaching" (Katzenmeyer & Moller, 2001, p. 47). Many educators must continually learn to stay current on technology, literacy, and curriculum.

York-Barr and Duke (2004) summarized the findings of two decades (1980-2000) of teacher leadership research and created a teacher leadership framework. The tenants of teacher leadership include mentoring other teachers, leading workshops, engaging in peer coaching, modeling professional growth, and focusing on the benefits of employee participation, expertise about teaching and learning, acknowledgment, opportunities, rewards for accomplished teachers, and benefits to students. Applying this framework aids in understanding pedagogical capabilities for instructors of professional learning, teachers, and students, as explored in the study.

Best Practices in Teacher Professional Learning

The canon of literature on professional learning is vast and has a long history. Many studies have accrued information and theories throughout time. Some central tenants are that there are four main criteria for driving educator professional learning (Professional Development Council, 2019, p. 3): (a) What do students need to know and do? (b) What do teachers need to know and be able to do to help students achieve? (c) What are the most effective forms of professional development to help teachers help students? and (d) What difference did the professional development session make for students and their achievement? Many school districts have a professional development council comprised of teachers, administrators, and staff who meet throughout the year to keep current on trends, address issues, and plan. Integration of multimodality or a multimodal approach was also associated with 21st-century skills development, such as information and communication, thinking and problem-solving, and interpersonal and self-directional skills (Partnership for 21st Century Learning, 2015).

A study was conducted by Hite and Milbourne in 2022 that utilized phenomenology methodology to explore the professional learning experiences of K-12 STEM teacher leaders in the United States. The researchers worked to identify themes in understanding the experiences of the participants. The participants reflected upon generative experiences in their professional learning. In doing so, the analysis allowed for a deeper understanding of how personal and social contexts influenced professional pathways (Hite & Milbourne, 2022). Exploring teachers' lived experiences allowed for understanding the phenomena--in this case, professional learning of K-12 STEM master teacher leadership; regarding my study, the phenomena was making meaning of multimodalities in professional learning.

Brennan, in 2021, conducted a study that incorporated the case study approach. The study examined a self-directed, school-supported professional learning model at one high school. Bounded by time (one semester) and place (one school), the researcher examined learning goals and how they were pursued. This case study led to a deeper understanding of what supports are needed to implement similar supports in other schools. Similar to my study, the research was to recognize that different experiences within a case produce meaningful results. There are varied and multiple meanings that participants create within a specific research site (Creswell & Poth, 2018).

Faculty Training

Higher education faculty and instructors of professional learning training development regarding emerging technologies are critical for teaching and training students in skills that manifest as the foundation of their careers and throughout their careers. Students working towards their teacher licensure via college courses or practicing educators have a myriad of backgrounds regarding education (Netolicky, 2020). New technologies may intimidate instructors and students. Students may know more about technology than the instructor (Cargal, 2021). According to Apple Classrooms of the Future (1995), teacher training includes education that is:

> (a) situated in a constructivist learning environment with opportunities to explore, discover, and construct knowledge; (b) focused on classroom practice; (c) structured to provide time for reflection on learning and teaching; (d) designed to provide opportunities to plan projects for use in teacher-learners classrooms and schools. (p. 3)

Additional resources such as Apple Learning Interchange and Challenge Based Learning addressed access to the internet, mobile devices, and traditional schooling models. Faculty

learning communities (FLCs) provide members with information and support as they utilize digital technology tools.

Tuffnell (2021) implemented a case study to explore FLCs as they supported the development of online educators. He implemented the Community of Inquiry Framework (Garrison & Arbaugh, 2007) to emphasize the importance of faculty members developing online teaching practices that ensured engaging educational experiences. Cognitive presence (higher-order learning activities), teaching presence (manifested pedagogical relations), and social presence (integrating students into a broader network of learner-centered experiences) go through stages such as planning, action, and results for faculty to support faculty. The themes identified were learning design, learning and teaching approaches, and teaching tools/technology. While this study is related to online FLCs, results may be transferred to in-person or hybrid faculty supports in professional learning.

Whether for preservice teachers, practicing teachers, educators, or students, learning by doing is integral to understanding emerging technological tools, their possibilities, and their implementation. Studies abound regarding how to best train pre-service and in-service teachers, including content, methods, and delivery. Netolicky (2020) presented a field synthesis, including self-directed learning, attending courses, teacher quality, and accountability. In conjunction with Gee's (2018) affinity spaces, learning is situated by the learners and educators to provide uniqueness and customization. "Teaching and learning are not confined to one site or one kind of person; they are distributed across many locations, people, and practices" (Gee, 2018, p. 6).

To better understand the iLearn Collaborative course design, it was imperative to research the organization, state of Colorado bills, and mission of the organization. This process included an interview with Jill Pellegrini, iLearn Collaborative Director of Professional

Development. The interview aided in accessing and understanding the conceptualizations of the courses in the study, the organization's mission, and the challenges at hand. For instance, she stated (personal communication, date, 2022), "iLearn Collaborative developed an entire series of courses to support teachers who wanted to get into the space of personalized learning." The data provided gave a foundation of understanding about the course design, instructors, teachers as students, and information necessary to address the research questions.

Technological tools have often merged with education. According to Brown et al. (1989), "Tools are best learned in the context of their use . . . there should be no separation of learning from how it is learned and used" (p. 33). Norton and Hathaway (2008) continued, "Programs should be committed to the design of learning opportunities for in-service teachers that focus on mastery of tools (both conceptual and physical) through authentic activity, not isolated instruction on the mechanics or processes of the tool itself" (p. 15). Preservice teachers' curriculum is finite and will not cover future technological advances, emergencies, other specified curricula, content, or building expectations (Cloonan, 2010).

Emergency Remote Teaching

As technology became omnipresent in the early 2000s, it has led to digitally mediated communication, digital media, and gaming as the landscape of what we understand as learning environments has changed significantly. This change became exacerbated by the emergency remote teaching, training, and learning during the Covid-19 pandemic. There is a necessity for ongoing professional learning and support. After 2019, the Covid-19 pandemic began to take hold and affect education globally. According to Cargal (2021):

> Our world has changed drastically over the last year, and the education profession has adapted and overcome many challenges. Adapting to the ever-changing world of

> technology is something educators do daily. Many tried-and-true professional learning experiences have transformed into Zoom meetings, web conferences, and virtual workshops. (p. 18)

Education has changed drastically in a short time frame and has led to emergency remote teaching for those with access to computers and the internet or other distance-delivery resources; many educators have had to experience emergency remote training to accommodate this shift. "Teachers who had not taught online before were ill-prepared for this fast transition, and in too many instances, educational experiences were deficient for online learning. As a result, students will undoubtedly experience limited advancement in learning goals" (Hodges et al., 2020, p. 2). Pedagogical relationships between teacher educators and teachers are dynamic. Implementing multimodal methods will prepare stakeholders for the future of online, in-person, and hybrid learning.

Technology Access

The ability to understand, implement, and have access to technology varies throughout communities, countries, and the world. Teachers, districts, families, and societies all have differing access to technological tools. Known as the digital divide, access to technology may cause students and education in general to languish, whereas connections to technology may allow entities to flourish. Van Deursen and Van Dijk collaborated on a study in 2019 in the Netherlands regarding material access in resources and appropriation theory. The dataset was 1,600 people that use the internet. Based on the understanding that categorical inequities in society lead to an unequal distribution of resources which leads to unequal access to the internet, the inequalities produce different resources (economic, social, and cultural capital). Findings included the concern among policymakers that the digital divide problem is solved when a

country's internet connection rate reaches saturation which they found to be false. Additionally, material access (computers, phones, and the internet) can lead to inequalities in internet skills, uses, and outcomes.

Access was a central tenant to this study because there is a spectrum of resources, funding, and training available which was explored in the course's ecology and the participants' demographics. Underprivileged learner issues regarding access may include low socioeconomic status, linguistic isolation, single parents, no parents/support structures, unequal distance learning devices, poor internet access, weakly distributed/unorganized information via smartphones, lack of television channels broadcasting educational programs, and crowded households (Song et al., 2012). Technology may provide a mix of individualization and differentiation through personalized learning; however, if access is inconsistent or nonexistent, the learning process stalls. Additionally, some areas can provide free technological resources such as laptops, smartphones, tablets, and internet bandwidth. Access to in-school computer labs and equipment is also helpful for accessibility.

Assistive Technologies

Because not all students receive material in the same manner, accommodations are integral in learning environments and processes (Ko & Petty, 2022). Due to the breadth of multimodal learning opportunities, many educators may implement assistive technologies to support students with a myriad of needs, such as multilanguage learning, dyslexia, intellectual and developmental disabilities, mutism, autism spectrum disorder (ASD), attention-deficit hyperactivity disorder (ADHD), social skills, and hearing or visual impairment, to name a few. Some of the assistive technologies utilized are smartphones, tablets, hearing/seeing/speaking supports, graphic organizers, software, and cloud-based storage. If curriculum is designed with

accommodations, UDL, and multimodalities in mind, students may access curriculum ubiquitously with their devices which leads to less stigma around accommodations. For instance, Hedges et al. (2018) utilized a questionnaire with 456 students with ASD in California, Wisconsin, and North Carolina to examine how students use technology in supportive ways. Findings of this study included using technology in school and at home in a variety of supportive ways such as increasing independence, reducing anxiety, and increasing social opportunities. The participants stated that technology made learning easier (87%), fun (85%), and aided relaxation (84%). Content of the assignments include visual, auditory, and written modes which led to remixing and presenting of individual and collective work which aided students in learning and functioning independently.

Language acquisition is also supported by technologies. “The designing of digital tools in several languages, the supporting of media development, and the supporting of access to connectivity: all this needs to be done so people can discover different languages without giving up their respective mother tongues” (Azoulay, 2022, p. 1). Multimodalities may support language for native and non-native language speakers. For instance, MacDonald et al. (2020) studied design principles for engaging multilingual learners in three-dimensional science. The goal of the study was to better understand the learning disparity in multilingual learners’ opportunity gap in stem curriculum. They found eight principles that aided in learning for the participants, including: educators must leverage and sustain students’ cultural and linguistic assets, students learn through expanding science and language repertoires, and student contributions matter for sense-making--all which are supported by the development of new approaches and resources to overturn inequity in science education.

Online learning may occur with well-planned curriculum mapping for years, or as in the spring semester of 2020, in an emergency remote teaching situation. The global Covid-19 pandemic thrust the world and education into a predicament of social isolation, quarantine, and death. The timeliness of exploring multimodalities for teachers and students became more urgent and hurried. The effects on education globally will have ripple effects for years academically and monetarily and regarding social and emotional well-being (Cloonan, 2010). Multimodalities aid in navigating the current global, economic, political, and cultural transformations and challenge the status quo. My study was impacted by the experiences of Covid-19 because stakeholders knew the repercussions of being unprepared and have gone through the emergency remote teaching experience already.

Attending school may be a challenge for a myriad of reasons. The Organization for Economic Cooperation and Development (OECD) stated that more than 27% of adolescents evaluated from 72 countries felt dissatisfied with school (as cited in Opre et al., 2021). According to Avanesian et al. (2021), before the pandemic, 53% of all children in low- and middle-income countries suffered from learning poverty (unable to read by age 10). The pandemic has affected adaptability, social skills, learning abilities, affective problems, anxiety problems, and ADHD. Additionally, 90% of all students worldwide were affected by closures, accounting for 1.5 billion children and young people from pre-primary to tertiary education in almost 200 countries. This remote learning has continued for many learners (UNESCO, 2020). The pandemic has amplified inequalities in learning for children who lack access to information and communication technologies (ICTs) needed for learning at home and have had limited access to continuing their education (UNESCO, 2020). This lack of continuity has had severe implications for teachers and students.

Regarding education systems in America, troubling reports are being released regularly. The National Center for Education Statistics (Hussar et al., 2020) stated that there was a drop in kindergarten enrollment of 15% between the fall of 2019 and 2020 in some states and that people of color, low socioeconomic status, people with disabilities, and those not fluent in English were impacted most. The kindergarten attendance crisis has evolved into lower reading scores, which will continue to impact academic performance and success for this cohort of students. This cohort of students may never fully recover from the impact of the global pandemic, and the teachers have also had significant challenges. According to Netolicky (2016), considering identity, humanity, voice, and choice are essential factors of teacher professional learning which were explored in my study.

Studies relating to the effects on the worldwide education systems from Covid-19 are occurring in large numbers, many focusing on inequalities of the highly unequal digital world and teacher preparedness (UNESCO, 2020). Nearly half a billion students were unable to continue learning. Continued school closures may lead to continued learning through remote channels for the foreseeable future. "Blended learning approaches that combine in-person and remote instruction will be key to ensuring learning continuity and reaching the greatest number of children and could also play a role in reaching school-age children and youths who were out of school before the pandemic" (Avanesian et al., 2021, p. 7). Technological infrastructure must continue to expand to reach students who cannot access learning remotely. Finally, educational content must be tailored for remote delivery when in-person access is hindered, including teacher training.

The concept of social linguistics allows teachers and students to apply language learning to society and supports individual well-being. UNESCO (2020) found that teachers must rapidly

adapt to new and untested teaching methods to support students, parents, and adult caregivers to meet the challenges of homeschooling while addressing work obligations, community change, caring for family members, and addressing individual well-being. Furthermore,

> Social and emotional learning (SEL) skills are well established, evidence-based practices, that can be adapted to help equip children, young people, parents and teachers with the knowledge, skills, attitudes, and behaviors they need to stay healthy and positive, navigate emotions, practice mindful engagement, exhibit pro-social behavior and cope with daily challenges. (UNESCO, 2020, p. 2)

UNESCO recommends that SEL be part of caring and supporting teachers and should be part of teacher professional development on the use and development of distance learning modalities.

Potential Barriers

Potential barriers exist in teachers seeking professional learning in multimodal content and delivery methods. Due to the shift in the communications spectrum, including the transformation of knowledge, teachers must have agency in collaborative professional learning (Cloonan, 2010). These opportunities in professional learning must be prioritized, defined, and resources such as time, funding, and technologies must be allocated for support.

Chin et al. conducted a study in 2022 that explored barriers to professional learning for teachers in a mixed-methods approach. The study used voluntary response sampling, and teacher professional development (TPD) in Likert scale components were collected. The results stated potential barriers as (a) missing prerequisites, (b) cost, (c) lack of support from school administration, (d) scheduling conflicts with work, (e) lack of time due to family responsibilities, (f) no relevant professional development offered, and (g) there are no incentives for participating in professional development. Another finding was that some teachers were more interested in

continuing a professional development that they had already attended or were interested in pursuing. Autonomy in their TPDs was an additional motivator to participate, according to the study.

Educators must be intrinsically motivated to implement multimodalities throughout school systems, thus aiding teachers in feeling that the new learning is worthwhile. "The work itself is the primary motivator for student learning and improvement" (Elmore, 2004, p. 115). As meaning is made for teachers, individuals take those learnings into their role of teachers to instruct what they have learned.

Access to technologies includes funding, upkeep, amortization, and replacement when necessary. While spending may have increased, it may not be sufficient. A lack of knowledge may be omnipresent about implementing the technologies and latest trends, leaving students and teachers ill-prepared for their future. Technology integration and bandwidth in schools may be tertiary to building upkeep, teacher salaries, and infrastructure (Wages, 2021). Schools that are poorly funded, remotely located, overpopulated, or understaffed may exacerbate access issues. Teachers may not have sufficient skills to harness the digital technologies at hand and, therefore, unsuccessfully navigate digital landscapes to allow student participation in economic, social, and cultural life (Peña-López, 2015). Professional learning may undergird the opportunities to implement emerging technologies.

Finally, the melding of multimodalities as a new grammar replacing the traditional view of monolinguistic/monocultural literacy may be complex for teacher educators to understand and subsequently inform stakeholders of the importance and methods of instruction. "Writing now very often entails assembling a product that may contain written text as well as quite sophisticated layout, graphics, photographs, and images" (Rowsell & Walsh, 2011, p. 56). This

opportunity to learn trends that redefine the world of literacy and understand what it means to be literate may be intimidating, overwhelming, or thought unimportant (Gee, 2004). "In today's classrooms, educators must be prepared to work with how messages are sent, received, and interpreted, as well as how media and technology position us as viewers and users of multimedia texts in the world" (Albers & Harste, 2007, p. 6). Functional grammar entrenched in multimodalities may be replacing the past concept of language which may be challenging for teachers to learn and implement in their classrooms.

Learning Ecologies

Learning environments are presented with an extensive array of opportunities. These opportunities are known as ecologies and represent the many changes in the educational landscape. Like an ecosystem, a learning environment has a complex interaction of human, textual, discursive, and spatial dynamics (Cope & Kalantzis, 2017). As posited by González-Sanmamed et al. (2019),

> There are three critical perspectives as drivers of pedagogical reflection: lifelong and life-wide learning, the idea of learning as a social construct in which internal elementary and changing external factors converge, and the cognition of technology as a resource that can promote ubiquitous and expanded learning. (p. 1)

Learning opportunities are expanding, as are technologies and content delivery. This growth necessitates training for teachers to best understand and implement their teaching.

Stevenson et al. (2019) designed a case study with observations, questionnaires, and interviews of 17 participants to explore learning ecologies (maker space). The study examined physical materials and digital technologies for professional learning for teachers. The research found that hands-on and theoretical professional learning provided practical exposure, design

thinking methods, and design technologies. Exploring how professional ecologies can equip teachers with the knowledge, skill set, and dispositions necessary to implement 21st-century learning in their classrooms was at the heart of this study. Ultimately, teachers could feel more confident, enthusiastic, and capable through their classroom delivery of teaching in maker spaces.

A learning ecology is a platform in which learning occurs. Emergent learning flourishes in connectivism, communities of practice, and support. The past decade has witnessed an exponential increase in the usage and expansion of technologies for interaction and communication. Billions of emails, texts, Tweets, and blogs have manifested in just a few years. As information abounds, the ability to obtain material does as well. "The main challenge lies in the real transition to a less tutor-led approach to learning . . . content will not be delivered to learners but co-constructed with them" (De Freitas & Conole, 2010, p. 29). Therefore, it is essential to examine the delivery of content for professional learning and students to see how individuals share concepts, ideas, models, and learning from their own research and are assessed. Williams et al. (2009) stated that:

> An affordance is the product of interactions between a person and their environment, each of which potentially alters their knowledge, competencies, and identity, and potentially alters the (micro-) environment . . . [and] . . . Learning is the process of exploring, benchmarking, and mastering new affordances. (p. 20)

Further understanding of the learner, identity, delivery, and context is vital to making meaning of multimodal learning for teachers. Everything has changed, according to Cope and Kalantzis (2017), including configurations of space, learner-to-learner and learner-to-teacher relationships, textual forms of knowledge within which learners work, and the way learning outcomes are

assessed. Some components that are incorporated into online learning ecologies include (a) learning management systems; (b) e-textbooks; (c) flipped classrooms; (d) intelligent tutors, simulations, and games; (e) discussion boards; (f) web workspaces and e-portfolios; (g) adaptive, personalized, and differentiated instruction; and (h) machine assessments. Many of these constructs lead to reflexive pedagogy instead of didactic learning.

Curriculum design may be understood not to describe the content, but to be a product of the interaction between people that are actively producing resources for themselves as well as future students. Students form the learning through their own creative engagement in their own remixing and representation (Downes, 2010). This means that no two syllabi or courses look identical, as content is remixed by participants, leading to a learning ecology in which agents and the system co-evolve. Additional components include collaborative assessment, peer feedback, and student contributions. Affinity spaces, blogs, classrooms, and MOOCs (massive open online courses) are examples of learning ecologies and lead to the emergent curriculum.

González-Sanmamed et al. conducted a study to explore the delivery of professional learning and personalized learning in 2019 with a descriptive methodology and survey. Criteria included resources for access, search, information management, resources to create and edit content, and resources for interaction and communication. Findings included that learning ecologies offer various tools used in teaching and professional learning. Some of those resources include email, office automation, mail managers, planner, virtual classroom, cloud storage, cloud editing, and video tutorials. However, some limitations exist, such as access, time, and motivation. Learning ecologies allow for new delivery methods as well as established ecologies from the past. There are ways and means to deliver curriculum and collaborate in work on a new scale which is also in need of teacher professional learning.

The Gap in the Literature

Having explored the four themes of multimodalities, professional learning, technology access, and learning ecologies, the literature review has shown that there are significant studies on each theme. However, there is a gap in the literature on melding each topic into professional learning for teachers regarding multimodalities. Technology, professional learning, and education have continued to evolve and interact consistently. What better arena to have this confluence manifest than the classroom? Much has been written about these topics individually but not collectively.

Additionally, each area is advancing so rapidly that empirical studies are current for a short period, build on the canon of knowledge, and are remixed into the epistemological realm. Specifically, making meaning of multimodalities in teacher professional learning has been rarely addressed with attention to multimodalities, access, affordances of learning, and learning by design. Finally, teachers attend professional learning opportunities; however, the topic may not include the subjects of multimodalities and learning about social functional linguistics which were addressed in my study.

Conclusion

There are many methods for teachers to convey content to their students as they solidify their repertoire of skills. Enhancing their pedagogical relationships as students (teachers) and disseminators of knowledge (teachers) allows them to make meaning in new, undiscovered, and under-utilized ways. The impacts of multimodalities for differing ecologies may be applied in many ways and are adaptable to many settings and teaching preferences. UNESCO (2020) recommended:

- Ensure availability of pre-and in-service teacher training concerning creation or modification of resources, mixing teacher training and creation of scenarios and co-design with teachers.
- Identify, trial, and improve scalable capacity-building measures for integrating subject-specific teacher resource development with the aspirations of sustainable development.
- Build teacher capacities to understand and address equity issues in learning with technology.
- Facilitate the formation of collective identity and responsibility of teachers through the empowered agency at the local, regional, and global levels.

Therefore, it is critical that meaning making regarding multimodalities in professional learning for teachers is explored in depth. Understanding professional learning opportunities for teachers in multimodalities to "create as well as consume professional knowledge through self-directed inquiry and research into their practice" (Grisham et al., 2000, p. 32) will aid in successfully understanding the characteristics of multimodal teaching. Enabling teachers to enact their roles as learners through professional learning will aid them in understanding emerging technologies. Multimodal tools such as the internet, sound, video, images, and electronic interactions allow teachers and learners to meet learning on their terms, apply their knowledge as they wish, and remix products to synthesize their functional, semiotic resource, grammar. Exploring how teachers learn and convey these methods to their learners is the crux of this research.

CHAPTER III

METHODOLOGY

The purpose of this study was to better understand multimodal usage in teacher professional learning. Chapter II reviewed the salient scholarships and themes related to making meaning of multimodalities in teacher professional learning. In Chapter III, I provide a detailed account of the steps I took in my study and the rationale for each decision I made as a researcher. The structure of this chapter consists of (a) research questions; (b) research process; (c) theoretical perspective; (d) methodology, data collection, and data analysis methods; (e) trustworthiness; and (f) researcher positionality. Framing learning by utilizing modes is part of meaning making (Jewitt & Kress, 2003). "Modes" refer to a semiotic resource grammar that educators can use to understand and create meaning recognized by society; modes rarely occur alone (Halliday, 1978; Hodge & Kress, 1988; Kress & Van Leeuwen, 2006). Multimodal use consists of technologies, grammar, and remixing. Albers and Harste (2007) stated that "a multimodal approach in teaching acknowledges that language is only partial and that many modes are involved in meaning making, even though one mode may be chosen to represent meaning (language, visual, spatial, digital, and so on)" (p. 7). For this study, I explored definitions, influences, and instruction to understand teacher implementation and understanding of multimodalities.

Research Questions

To better make sense of the meaning-making process of multimodalities in teacher professional learning, I constructed the following three research questions:

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

Research Process

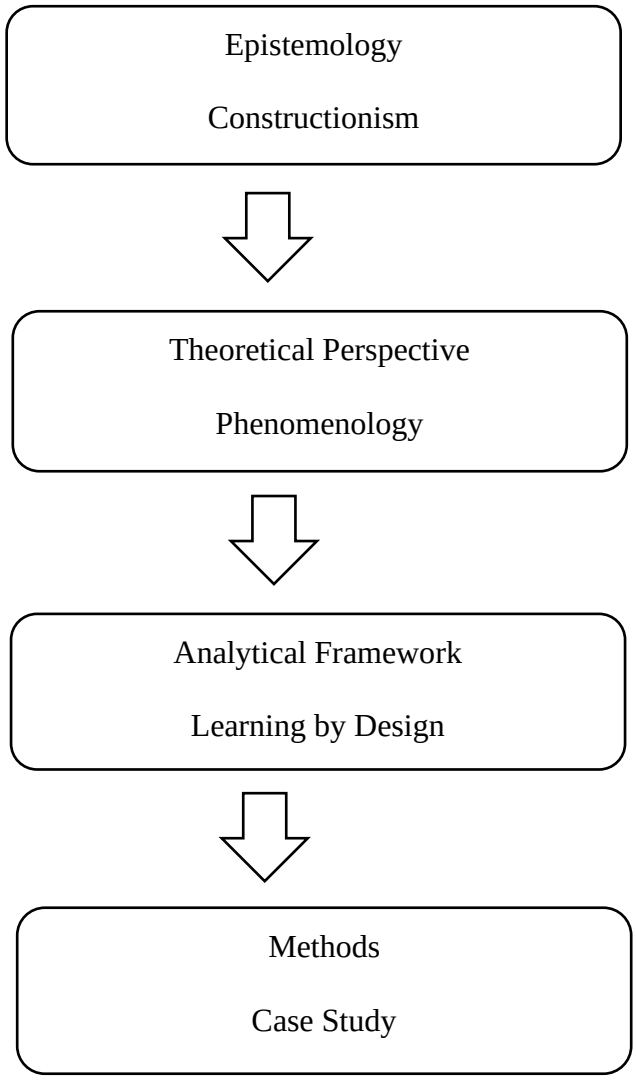
Establishing a research design applicable to a qualitative study includes six components (Creswell & Poth, 2018): (a) introduce the problem to address what readers need to understand the topic; (b) describe the procedures that guide the study, including philosophical assumptions, qualitative research approach used, role of the researcher, data collection procedures, data analysis procedures, strategies for validating findings, the proposed narrative structure of the study, and anticipated ethical issues; (c) report any prior study findings to undergird practicability and value of the study; (d) elaborate on the study implications and anticipated outcomes; (e) include references; and (f) include critical documents such as interview questions and data collection forms. Developing these six components helps to ensure that a qualitative study's research design is robust and its findings are trustworthy.

Qualitative research is often conducted because a researcher is interested in better understanding or exploring a socially constructed phenomenon, sometimes thought of as a problem or issue (Creswell & Poth, 2018). Researchers use qualitative designs when a desire to empower exists, an understanding of context persists, and the reporting style is appropriately literary and flexible. As applied to making meaning of multimodalities in teacher professional learning, embracing dynamic and emerging procedures through data collection and analysis helped understand "how people make sense of their world and the experiences they have in the world" (Merriam, 2009, p. 13).

According to Crotty (1998), there are four elements of research design: epistemology, theoretical perspective, analytical framework, and methods. Well-designed research requires each component of the design to be congruent with the others. Researchers are responsible for explaining each element of their research design and showing how the overall design is congruent and has an internal logic. I provide the following flowchart with each research design element and decisions I have made for this study.

Figure 1

Research Design Flowchart



Epistemology

Epistemology asks, “What is the nature of the relationship between the would-be knower and what can be known?” (Guba & Lincoln, 1994, p. 108). This concept was essential for my study regarding what knowledge is and how it is acquired. For example, andragogy is the process of adult professional learning which may be situated in the context of multimodal learning. Similarly, pedagogy allows the teacher to understand what their learners, students, can know and for the teacher to implement methods and content for that learning. Constructionism guides data collection through the theoretical perspective, phenomenology which is the theory that guides the study. Situating my research within a constructionist lens led to a deep understanding of making meaning of multimodalities.

Constructionism asserts that truth is not universal but is made through an active process (Schwandt et al., 2007). Social constructionism focuses on the social processes and interactions (Schwandt et al., 2007). Constructionism is founded on entering and grasping the frames of meaning involved in producing social life by lay actors and reconstructing these within the new frames of meaning involved in technical and conceptual schemes (Crotty, 1998). Creswell (2008) added that constructionism supports participant perception as they experience their worlds. These worlds comprise professional and personal settings which include careers, teaching environments, and professional learning opportunities. Constructionism was applicable to address my research questions because it supported learning regarding teacher experiences and interpreting them as phenomena. Therefore, constructionism was appropriate for answering the research questions at hand.

Constructionism allows for truth and meaning to emerge from the world in which we live. Truth comes from the experiences of putting "all understandings, scientific and non-

scientific alike, on the very same footing. They are all constructions" (Crotty, 1998, p. 17). In the context of my study, constructionism aided in understanding the knowledge, meaningful reality, and human practices involved in the research. The data collected were constructed in and out of interactions between human beings and their world as developed and transmitted within the social context (Crotty, 1998). The viewpoint was an intentional space between objective and subjective realms, aiding in understanding. Delving into the lived experience and understanding the life world (Van Manen, 1997) allowed the research to be situated on how meaning is made. Additionally, utilizing constructionism, I was able to report on the unique individual experiences of research participants. Having established the constructionism epistemology, I will discuss the theoretical perspective of phenomenology.

Theoretical Perspective

My study's theoretical perspective was phenomenology which looks at specific phenomena (Jones et al., 2014). A theoretical perspective is based on a set of assumptions about reality that inform questions, lead to answers, and is a lens that drives research (Creswell & Poth, 2018). Using phenomenology in this study, I found the common meaning of participants' lived experiences as a phenomenon was experienced. Reducing individual experiences within a phenomenon to a description of the universal essence and grasping the “very nature of a thing” (Van Manen, 1990, p. 177), with the intent to understand the intentionality of consciousness, was at the crux of my study. The “thing” to be better understood was the way educators use and make meaning of multimodalities.

Phenomenology permits researchers to gain a deep understanding of our everyday meaning. This understanding includes cultural practices and how they operate in a larger context (Fiske, 1991). This inquiry leads to a representation of authentic lived experiences. We

understand that "everyday conversations reflect microcosms of the larger societal and political relationships of a specific place in history" (Houston et al., 1997, p. 189) and are intertwined in phenomenology. Phenomenology is interested in the study of “persons” instead of “individuals” (Van Manen, 1990). Auden (1967) emphasized that the term “person” focuses on the uniqueness of each human being. Therefore, participants' understandings can be viewed as multi-dimensional and from the mosaic of particular social, cultural, and life circumstances (Van Manen, 1990). These considerations are critical when considering the experiences of persons from traditionally marginalized groups. Researchers give voice to participants without manipulating, altering, or reshaping life experiences (Opre et al., 2021).

Seven defining features of a phenomenological study constitute a dynamic interplay (Creswell & Poth, 2018). Therefore, the seven defining features of phenomenology (Creswell & Poth, 2018) were implemented as follows. First, there was an emphasis on the phenomena which is making meaning of multimodalities. Second, a heterogeneous group of individuals (two instructors of professional learning courses and six students who are teachers) that experienced the phenomena were explored. Third, conducting a phenomenological study incorporates the lived experiences of individuals and how they have subjective experiences of the phenomenon and objective experiences of something in common with others. This shared experience was their participation in the professional learning course. Fourth, the researcher bracketed personal experiences as phenomenological reflection, attended to in the researcher positionality section. Fifth, data collection procedures often include interviewing individuals that have experienced the phenomenon which took place in the study. As well as interviews, additional data collection was explored in the data collection section that follows. The sixth step is analyzing data to follow systematic procedures to move from narrow units of analysis to broader units with detailed

descriptions of what the individuals have experienced and how they have experienced it. This data analysis is addressed in the appropriate section later in this chapter. Lastly, data analysis involves communicating the findings and utilizing the "what" and "how" in the experience.

Analytical Framework

An analytical framework is designed to structure a researcher's thinking systematically as a model to facilitate understanding and making sense of a topic. The analytical framework used for this study was Learning by Design (Cope & Kalantzis, 2016) and is comprised of four processes. Each process has two subprocesses; each represents different meaning-making opportunities for the learner and forms part of a complete pedagogy that may be utilized in any order (Rowland et al., 2014, p. 141). This framework guided the data analysis procedures.

Learning by Design is an analytical framework that identifies eight subgroups for understanding the learning processes of teachers (Kalantzis & Cope, 2005). It is a replicable construct to guide the emerging knowledge of society towards a transformative curriculum. The four Learning by Design knowledge processes are: experiencing, conceptualizing, analyzing, and applying—all of which lead to multimodalities curriculum orientations such as situated practice, overt instruction, critical framing, and transformed practice. The four fundamental ways of knowing are dynamic (see Table 5). There is no necessity in order nor is there a mandate that they happen in concert. Each of the four concepts may relate to the others in differing ways. This conceptual schema, or way of knowing (epistemology), may lead to broadening and transforming curriculum. “The schema is a way of identifying the epistemological underpinning of a piece of learning (modality), and embodied as a template for designing, documenting, and publishing learning content that suits a culture, group of learners, or a pedagogical orientation” (Kalantzis & Cope, 2005, p. 67).

Table 5

Mapping Pedagogy Against the Knowledge Process

Learning by Design	Multimodalities Pedagogy/Andragogy Curriculum Orientations
Experiencing the known the new	*Situated practice* Immersion in experience and utilizing available discourses, including those from the students' varied lifeworlds.
Conceptualizing naming with theory	*Overt instruction* Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.
Analyzing functionally critically	*Critical framing* Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.
Applying Appropriately Creatively	*Transformed practice* Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.

These processes are applied to the multimodalities curriculum orientations; meaning is made for stakeholders through learning relationships (Cope & Kalantzis, 2016). The framework allows for a process to better understand learning content. The framework was utilized in the study by coding the findings and applying them into the Learning by Design processes and curriculum orientations. The process led to emerging themes. For example, a mode (such as an audio clip in a lesson) may be communicated by experiencing the known or the new, conceptualizing by naming or with theory, analyzing functionally or critically, or applying appropriately or creatively. Specific modes may include privilege and contain differing amounts of privilege among educators. More specifically, the content of the courses was analyzed by using the Learning by Design components placed within the framework, and results were matriculated in commonalities and differences. This understanding leads to the "how" and

"what" of the phenomena. The analysis included understanding and categorizing what the teachers and students were doing and which knowledge processes were used. The analysis aided in using possible knowledge processes and understanding learning relationships from a broader range of possibilities. Adult learning embraces andragogy. Therefore, this framework created an applicable basis for research.

Methodology, Data Collection, and Data Analysis

This section provides the methodological research approach and details about the setting of the study, participants and sampling procedures, data collection, data analysis, trustworthiness, and researcher positionality.

Case Study

The methodological research approach for this study was a case study. A case study is bound in time and place (Creswell, 2008). Regarding my study, the time was the spring semester of 2023. The place was two iLearn Collaborative professional learning courses. I conducted an instrumental case study which served as a model for similar cases. Instrumental case studies differ from intrinsic case studies and are used when research is conducted for its inherent value (Stake, 1995). In my study, the experiences of the course instructors and the students were explored through the positionality of an observer.

According to Stake (1995), a case study refers to an integrated system, bounded in time. Compiling data will allow the researcher to make meaning of the phenomenon observed (Creswell, 2008). This study was constructed to aid the researcher in comprehending how multimodalities are defined, implemented, and understood by two instructors and six students who are teachers. Understanding the case study contributes to the knowledge of the phenomenon

as it relates to the participants (Yin, 2003). Exploring characteristics of the two iLearn Collaborative courses over the spring semester of 2023 aided in understanding how instructors and students who are teachers in this study navigated and utilized multimodalities in professional learning courses. Interpreting the case study to understand how teachers and students constructed meaning of the phenomenon of professional learning experiences has led to understanding making meaning of multimodalities in teacher professional learning.

Setting

The setting of the study was two online, asynchronous courses taught in Spring, 2023. The courses and content were different, with differing titles and curriculum which have not been compared. The courses took place over a one-semester (4-month) period. The iLearn Collaborative gatekeeper, Dr. Judy Perez, chose both courses for the study based on which courses were offered due to course registrations. Dr. Perez is the CEO and Founder of iLearn Collaborative. Courses that could have been selected for my data collection included Online Instruction, Social Emotional Learning, Blended Instruction, Culturally Relevant Educator, Personalized Learning, Leadership for District Online Implementation, Introduction to Data Analysis, Classroom Management, and English Language Learning; the courses that were selected were Culturally Responsive Educator and Introduction to Data Analysis. The courses were selected because they were the only ones offered by iLC during spring 2023. Exploring definitions of multimodalities, influences of using multimodalities, and the use of multimodalities in instruction were explored in both parallel courses. The study provided the opportunity to see how the concepts manifested in the two different courses; therefore, it did not matter which of the two courses the students were enrolled in. The course settings, or "Canvas shells," will be described in the data collection and data analysis sections of this chapter.

Focusing attention on the spaces and learning ecologies aid in comprehending the way curriculum is transmitted. A criterion for course application in my study was that courses must have been offered during the timeframe of my research.

The courses took place in the Canvas learning management system (LMS). Instructors designed and entered the curriculum into Canvas. Online course shells aid access, delivery, and communication techniques and are a window into instructional design (Przybylski, 2020). The curriculum was addressed by the students within the LMS as they utilized the syllabus, read, watched, and listened to course materials (such as course texts, videos by leaders in the field, and podcasts by educators), and implemented multimodalities by remixing assignments to submit and present. The composition of multiple modes to transmit, produce, and reveal a new or reformed concept or product is known as remixing (Jewitt et al., 2016).

Sampling Procedures and Participants

The students of these courses were teachers enrolled in the iLearn Collaborate courses. While they were K-12 licensed teachers in their professional work, I will refer to them as students to avoid confusion. I collaborated with iLearn Collaborative to access course content, course instructors, and the students in the courses to solicit participation.

Sampling Procedures

I used purposive sampling for my study. Purposeful sampling focuses on the average setting or individual who may experience the phenomena to be explored (Merriam & Tisdell, 2016). Sampling seeks a specific strategy, whom to recruit for participation, and the sample size. I worked with the iLearn Collaborative Chief Executive Officer who identified two course instructors willing to participate in the study, who identified the two specific courses for the study. Next, I obtained course enrollment lists for the instructors' courses and contacted potential

participants regarding interest in my research. Two instructors and six students in the respective courses (a total of eight participants) participated in the study. No modifications were part of the participants' experiences in the courses.

Participants

This study included eight participants. Two were presenters of professional learning for teachers, and six were teachers as students in the iLearn courses. The voluntary demographic questionnaire asked them to choose a pseudonym, age, ethnicity, education level, occupation, years teaching/grade level, and any other information they felt important to share. All participated in a 1-hour interview, checked transcripts, and were available for clarifying questions. One participant was currently not teaching as she was renewing her license. All participants were White females. The participants' education level varied as four participants had earned their Bachelor's degree, three participants had earned their Master's degree in education, and one had earned their Ph. D. The range of participants' ages was from 29-66 years. Experience in education varied from 3-48 years. Educational experiences included early childhood curriculum coach and parent supervisor, elementary teacher, middle school teacher, high school teacher (content areas of Social Studies, History, Biology, and Math), and adult educator.

The participants were situated in two different but similar courses. Respectively, Mountain Goat instructed The Culturally Responsive Educator and Personalized Learning Innovations course with the participants Belinda, Jordan, and Kate. The Introduction to Data Analysis for Tiered Students course was taught by Theresa and attended by the participants Kristen, Janet, and Rowan. The courses were part of the iLearn Collaborative 55-course portfolio and were accessible to the researcher due to their timing and enrollment for the spring 2023

semester. The first course listed above was for individuals working to meet the requirements of Colorado House Bill 14-1298 which is the English Language Proficiency Act (2018). The bill addressed evidence-based English language proficiency for English language learners while achieving and maintaining grade-level performance in academic content areas. Individuals signed up for this course as a means of meeting the licensure requirement. The latter course was part of an online school professional renewal curriculum requested by the participants' school and subsequently designed and provided by iLearn Collaborative to address that school's needs. The course was mandatory for all educators in the school.

The courses were quite different, and their diversity aided in answering the research questions. Modes and multimodal usage were abundant in the instructional design of each course. If other courses had been part of the study, multimodal usage and grammar may have appeared in different ways. The courses that were part of my study provided a window into how multimodalities were defined and presented as well as the influences that encouraged teacher leaders to use multimodalities. The variability of the courses, multiple means of delivering content, and course innovations were a window into what modes may enhance curriculum and promote student participation.

Theresa. Theresa self-identified as a 36-year-old White female, holding a Ph.D. in education. Theresa reported being in education as an instructor for 14 years. Her experiences have included working in adult education for 8 years, and she has worked extensively with pre-K-10th grade coaching for instructors. She instructed a course in the study. Her insights included navigating emerging technologies as a student, teacher, and coach and in her personal life. Theresa felt that education is socially constructed and is created by the society in which we live. Theresa worked diligently to comprehend the "how" and the "why" of the learning goals,

collaboration, and project-based learning that she and her students defined, worked towards, and achieved.

Mountain Goat. Mountain Goat self-identified as a 45-year-old White female, holding a Master's degree in education. Her work has spanned a career of 23 years. Mountain Goat has worked extensively in middle and high school teaching and with adult learners. She instructed a course in the study. Through her experience as a leader of professional learning, she focused her curriculum on choice, agency, connection to the real world, and learning/presenting in multiple ways. She nurtured unique gifts that students may bring to the world beyond educational settings while addressing standards and competency-based learning. She preferred movement and tactile learning. Mountain Goat incorporated a lot of different things in her assessments and teaching because she has realized that one size does not fit all. Applying what is learned for her and her students was an important part of her work in education.

Belinda. Belinda self-identified as a 40-year-old White female. She had achieved a Bachelor's degree with some graduate-level coursework. Her teaching experience included 10 years teaching middle school social studies and three years substitute teaching at various grade levels. Belinda was enrolled in the Culturally Responsive Educator and Personalized Learning Innovations course to renew her Colorado teaching licensure and to meet the culturally and linguistically diverse education requirement. She appreciated being part of learning communities, professional learning opportunities, and looked forward to being able to implement her learnings from professional learning in her work environs. Belinda spoke about her preferences for learning material that was relevant, on her terms, and accessible when she needed it.

Jordan. Jordan self-identified as a 42-year-old White female. She holds a Master's degree in education. Her teaching experience included 11 years in a 9-12 grade setting; 1 year in a 5-8 grade setting, and had substitute taught for 2 years in a 5-8 grade setting. She was a farmer during the study and was working on renewing her teaching license and was enrolled in the Culturally Responsive Educator and Personalized Learning Innovations course. She was navigating career options and looking to reenter the teaching field. She needed to complete the culturally and linguistically diverse education requirement for licensure renewal in the state of Colorado. Her professional learning expectations included choice, agency, peer feedback, and applicability.

Kate. Kate self-identified as a 66-year-old White female. She holds a Bachelor of Science degree and had taken some graduate-level courses. She was an early childhood education curriculum coach and parent supervisor and was enrolled in the Culturally Responsive Educator and Personalized Learning Innovations course. She had worked in education for 40 years with infants, elementary students, and high school students. Kate disclosed that for the last eight years she has worked at a charter school focusing on pregnant and parenting teens and their children. The school also has non-parenting students in high school and non-high school families that have children in the childcare program. Kate was working on the culturally linguistically diverse education requirement for licensure renewal in the state of Colorado regarding her elementary teaching license and director of a large center certification.

Kristen. Kristen self-identified as a 52-year-old White female. She holds a Bachelor of Arts degree in history. She had been in education as a teacher for 25 years. Four years had been spent as an elementary teacher and 21 years as a junior and high school teacher. She was enrolled in the Introduction to Data Analysis for Tiered course. Her passion for life-long learning

included professional learning communities, self-efficacy, and exploring technology. Being able to focus on objectives for herself and her learners was imperative in her teaching style. She made it a priority to find time to immerse herself in professional learning,

Janet. Janet self-identified as a 29-year-old White female. She held a Master's Degree in secondary education and a Bachelor of Science Degree in biology. She had been teaching for three years in middle and high schools. She went to an online college. Her college and professional opportunities have included distance-learning science labs supported by online modules. She was enrolled in the Introduction to Data Analysis for Tiered course. She appreciated professional learning opportunities to refresh and be aware of the changes in technology that are always coming. She liked being on the cutting edge of technology and felt a need to keep up with technology so she could incorporate her learnings with her educationally diverse population of students.

Rowen Kiernan. Rowan Kiernan (RK) self-identified as a 58-year-old White female. She had completed a Master's Degree in education (mathematics emphasis) and an undergraduate degree in computer science. She had taught for 10 years as a 9th and 10th grade instructor. She was enrolled in the Introduction to Data Analysis for Tiered course. Teaching was her second career, and she became an educator because she was passionate about teaching. She would have appreciated more technology training in her teacher licensure program and takes advantage of any professional learning that she has an opportunity to attend. Her views on technology included allowing students to have access via their phones and to meet students where they are to support how they learn.

The three research questions led to the four data collection process. A sample size of eight was utilized in the Zhao (2021) study in which faculty perceptions of online teaching and

learning in communities of practice were explored. That study led to a thick, rich description of the phenomena and reached data saturation while addressing the research questions. Because this was a case study, four to five participants led to saturation, thick description, and trustworthiness (Creswell & Poth, 2018; Yin, 2018).

The instructors were vetted and hired by iLearn Collaborative as leaders in the professional learning field; the students were licensed K-12 teachers enrolled in professional learning iLearn Collaborative courses. Institutional Review Board Approval for the study was submitted and subsequently approved (see Appendix A). Next, an Announcement for Participation in the Study (see Appendix B) was sent to potential participants identified by the iLC stakeholders. When potential participants contacted me stating that they would like to participate, I sent the potential participants the Participant Volunteer form (see Appendix C) and Informed Consent to Participate in Research (see Appendix D). Next, the Participant Demographic Questionnaire (see Appendix E) was sent to participants and returned to me. If more than three students in each course would have liked to participate, I would have used random sampling to finalize the six participants. Saturation is the "point at which gathering more data about a theoretical construct reveals no new properties" (Bryant & Charmaz, 2007, p. 611). The sample was adequate for the phenomena studied and captured the diversity, depth, and nuances studied, thereby providing rigor (Francis et al., 2010). Having obtained a participant data set of eight participants, which is sufficient to achieve trustworthiness, I will now elaborate on data collection.

Data Collection

According to Creswell and Poth (2018), using a wide variety of sources of data like "words" and "images" makes up the backbone of qualitative data collection. Working towards a thick, rich description of unique individual and group experiences (Crotty, 1998) was the goal of the data collection process. To achieve this, I used four types of data collection. Data collection included semi-structured interviews with instructors and students, course design observation, course artifacts, and a research journal. Establishing protocols before data collection helped ensure the process follows tenets of qualitative research and IRB standards.

Interviews

Interviewing is the most common data collection method in qualitative research and tends to be more open-ended and less structured (Merriam & Tisdell, 2016). Well-designed interview questions allow the researcher to collect data directly from participants who have experience with a specific phenomenon, making it possible to answer the objectives of the research (Gill et al., 2008). Semi-structured interviews are comprised of open-ended questions and allow for flexibility in the flow of questioning and are, therefore, an excellent fit for this study (Fox, 2009). The interview questions for my study (see Appendix F) were designed to address Research Questions 1 and 2. A goal of the interviews was to obtain a vibrant and vivid description of the phenomena at hand (Rubin & Rubin, 2012). Semi-structured interviews as a data collection method allowed me to ask follow-up questions from the participants when necessary.

The semi-structured interviews were conducted virtually on Zoom, audio-recorded, stored on my password-protected laptop, and backed up using password-protected cloud storage. Interviews were scheduled with the participants by me emailing them a Zoom meeting link when they agreed to participate in the study. I provided a

range of possible interview times for each participant that worked regarding our schedules.

There were three main components of collecting the data regarding the interviews. Interviews were recorded, transcribed, and member checked. Transcribing and member checking will be discussed in the upcoming data analysis section. The interviews were conducted as soon as possible after the courses started. Holding the interviews as soon as possible allowed insights into the phenomenon and allowed me to begin the transcription and coding process which will be explained in the data analysis section.

Course Design

My second type of data collection was to make observations on each significant element of the course design comprised of (a) delivery tools, (b) access/assistive technology tools, and (c) participation tools. These data were collected by observation, screenshots, and note-taking. Delivery tools (syllabi, course content, and modules) provided a window into how multimodalities were communicated and understood. Access to the assistive technology tools (conversations, multimodalities in instruction, and technology usage) showed the interaction between the instructor and students as well as the students' interactions among each other. Participation tools (researching, assignment participation/submission/presentation, and learning interactions) were essential to better understand course interaction, content interaction, external resource tools, and participant feedback tools. Observing course components such as assignments, assistive technologies, modules, posts, submissions, methods of communication, audio, visual, and written communications, and modalities of instruction led to a clear description of the phenomena.

Understanding how presenters of professional learning for teachers use multimodalities in their instruction was understood through this collection method. Observing included reviewing each module, discussion, and assignment and taking notes on the interactions throughout the course. Screenshots captured the visual images in use. The observations explored how multimodalities were used, discussed, defined, and learned. These observations were recorded in the research journal throughout the courses and included course content, course delivery, multimodal usage, and discussions.

Additionally, multimodal definitions and influences were components of the course design, answering the research questions. The data collection process captured the interplay between theory, method, fieldwork, performance, critical practice, and social justice. This process led to understanding making meaning of multimodalities in teacher professional learning.

Artifacts

Artifacts are objects that are a form of evidence that educators and learners can use to tell the story of their learning. Artifacts are significant evidence that teachers and students use to show effectiveness and assess and identify examples of the impact on learning. Specifically, I used screenshots, note-taking, and observation to collect course syllabi, assignments, discussion posts/boards, texts, photographs, audio recordings, and presentations (Kist, 2005) to provide a complete picture of multimodal usage. These data were collected throughout the course, from beginning to end.

Multimodal learning and meaning making were imbedded in the content and setting of the course. The course ecologies (settings) included multimodal learning opportunities, such as material and content communications, and I collected those through the methods that were

appropriate, such as screenshots, observation, and note taking. Examples of settings that support artifacts include active participation, affinity spaces, group work, and collaboration (Przybylski, 2020). The settings were embedded with artifacts and assisted in addressing the research questions at hand by showing how multimodalities are defined, utilized, and understood by the participants.

In a study by Whitney (2016), artifacts such as identity maps, photos, blogs, and word walls allowed for a deeper understanding of how multimodalities addressed the research questions of their study. Whitney collected the data with visual methods, such as screenshots, and wrote thick descriptions through notetaking. These examples of artifacts are not just "things;" they are "reflections of the wider lives of communities and individuals . . . suggesting interrelation between physical objects and human behavior" (Emmison et al., 2012, p. 109). Screenshots, note-taking, and observation of artifacts allowed for a better understanding of how meaning was made in multimodal learning.

Additionally, I observed course submissions from the students to better understand their remixing of modalities. The submissions were collected by observation, screenshots, and note-taking. The descriptive opportunity embodies "picturing through concrete sensory details the basic scenes, settings, objects, people, and actions to be observed" (Emerson, 1995, p. 58). Artifact collection was important to my study because the research questions at hand, specifically how multimodalities are implemented, were addressed.

Research Journal

A research journal is a written record of the researcher's activities, thoughts, and feelings documented throughout the research process. I began my research journal once my doctoral proposal was accepted by my committee. My research journal provided a myriad of data

collection opportunities, including recording data, organizing the study, and allowing me to synthesize my thought process regarding the data collected. The research journal was chronologically linear and became more robust throughout the study. The data collection branched off and discussed different facets of research as I navigated the entire research process. I wrote about the course interactions, recording multimodality usage, noting ideas and events, record keeping regarding processes and decisions, and reflecting on the phenomena. I recorded details of instructor communications, student work, components of the setting, how artifacts came to life, and implementing multimodalities. By utilizing a research journal throughout the study, I was able to reflect and gather data by utilizing descriptive writing regarding a version of the world. Exploring and recording brief interactions (instructor and student dialogues), complex scenes (course settings and assignments in context), and sequencing interactions (how learning is conveyed and assignments remixed) aided in the understanding of the data collected.

The research journal provided ideas and themes that were noted through memoing and coding and subsequently addressed the research questions pertaining to multimodal definitions, influences, and usage. Charmaz (2015) stated keeping a research journal includes tracking codes and categories, links between codes and categories, gaps, the usefulness of categories, and practical implications. Many ideas were collected and generated, and the research journal aided in the organization, prioritizing, and at times, disregarding of ideas. A research journal is an integral part of establishing an audit trail (Merriam & Tisdell, 2016). Research journals aid in providing trustworthiness (Creswell & Poth, 2018). Consideration was given to recurrent and underlying themes and insights, leading to identifying what was essential which was critical in addressing the phenomena of my study.

Collecting my data was a rigorous process with four collection methods. Using semi-structured interviews, course design observation, artifacts, and a research journal supported data collection from a wide variety of sources and gathered thick, rich data for analysis. Having described the four data collection methods, I will explain data analysis.

Data Analysis

Through analyzing the data I collected for my study, I hoped to develop a complex, complete description of the phenomena including working patterns and an understanding of participant views. This description helped me to create a new, novel understanding of the group (Creswell & Poth, 2018). In qualitative research, data analysis involves the researcher identifying patterns and looking for correspondences between data. According to Creswell and Poth (2018), data analysis leads to naturalistic generalizations that people can learn from the case for themselves, apply learnings to a population of cases, or transfer them to another similar context. My overview of data analysis of the collected data in my study served as a road map to provide clarity for how the data were applied to the analytic process of coding, categorizing, and leading to emerging themes in which data are fractured, conceptualized, and integrated.

Thematic analysis was used to identify patterns of meaning with multiple participants (Auerbach & Silverstein, 2003). Entering the transcriptions of the interviews, the course design observations, artifact analysis, and the research journal data into the Learning by Design Analytical framework led to a better understanding of the phenomenon at hand and addressed the research questions. The data collected were analyzed inductively with experiencing, conceptualizing, applying, and analyzing and led to an understanding of how meaning is made regarding multimodalities in professional learning. Analyzing the collected data occurred as

follows: (a) transcribing interviews, (b) coding, (c) categorizing, (d) thematic analysis, and (e) noting the emergence of themes.

Coding

Coding is a process of assigning general concepts (codes) to incidences in the data. Codes are considered data comprised of language and reflect the phenomenon of the study as understood from the lens of the researcher through the analytical process (Saldana, 2016). Reviewing codes leads to their synthesis as they combine to build categories. Similar codes have similar meanings which evolve into categories.

After having collected some of the data, the process of coding began. Open, axial, and selective coding were used. Open coding allowed me to "notice and identify descriptive, common, or unusual ideas, phrases, or words, and then attach those to a broader meaning of the phenomenon" and "breaking up data into usable pieces to explore the ideas contained within the in-depth aspects of the data" (Jones et al., 2014, p. 164). Axial coding allows the researcher to draw connections between the codes developed in open coding and for data to collapse into themes (Charmaz, 2006). The selective coding process is analyzing the axial coding and selecting those themes that relate specifically to the research questions. Vollstedt and Rezat (2019) aided in the understanding of open, axial, and selective coding by explaining,

> Coding procedures are not to be misunderstood as being precise procedures that are easily distinguishable. On the contrary, the procedures are neither clear-cut nor do they easily define phases that chronologically come one after the other. They embody somewhat different ways of working with the data that can be combined and can move back and forth if needed. (p. 86)

Using coding in the study provided a foundation to categorize the data.

Categorizing

Categorizing occurs after coding and is the process of grouping patterns observed in the data into meaningful units. Categorization must be rooted in the data from which they arise. Moving units back and forth between categories provides progressive movement of category outcomes (Bengtsson, 2016). Regarding my study, I utilized the codes that emerged and placed the data into multiple categories, such as experiencing, conceptualizing, analyzing, and applying. Categorization is complete when a reasonable explanation of the process and data are divided into domains. So et al. (2021) designed a study that explained how categorizing aided the data analysis in their study. The study related to teachers' professional development with peer coaching to support students with intellectual disabilities in STEM. The researchers were able to address the research questions at hand through the categorizing process, as the data matriculated from coding, to categorizing, to themes. So et al. (2021) collected and then analyzed the data by extrapolating the data into open, axial, and selective coding which led to categorizing and thematic analysis. Categorizing leads to the next step in this process, thematic analysis.

Thematic Analysis

Thematic analysis occurs after the data have been transcribed, coded, and categorized and is comprised of searching for coherent, meaningful patterns in the data relevant to the research questions. The process of searching is active and includes categorizing all the data relevant to each theme (Clarke & Braun, 2013). Themes were reviewed to make certain they worked in relation to the codes and data set. Themes were named and defined through a detailed analysis of each theme. Themes fit into the overall story of the data (Clarke & Braun, 2013). The interview transcripts, course design observation details, and artifact information were entered into NVIVO software through a subscription, wherein themes were established. NVIVO aided me in

establishing codes, organizing the data, finding insights, and analyzing the data. The iterative process of coding continued throughout the data analysis, wherein the researcher revisited open, axial, and selective coding. Themes that were specific to the research questions were specifically chosen through selective coding as areas of focus. In contrast, other themes were discarded as not relevant to my study.

This study was phenomenological, so data files were created, the text was examined with notes, the essence of the phenomena was described, significant statements were developed and grouped into meaning units, a textural description took place, such as "what happened," a structural description such as "how the phenomena was experienced" took place, and an "essence" using a composite description was developed (Creswell & Poth, 2018). Thoughtful data analysis was undergirded by trustworthiness.

Trustworthiness

In qualitative research, it is crucial to establish trustworthiness to ensure the quality of the research. Trustworthiness is the process of addressing the transferability, confirmability, credibility, and dependability of the study (Morrow, 2005). I attempted to maintain credibility using triangulation, thick, detailed descriptions, member checking, and an audit trail. Concepts and themes emerged directly from the data.

Transferability

Transferability is the proof that sufficient information is provided by the researcher so the reader may decide if the findings are applicable to differing contexts. Although case studies are not generalizable, they can be transferable to similar situations (Creswell & Poth, 2018). The sample size of eight allowed for in-depth data analysis. Purposive sampling ensures that the data collected are rich with information, while detailed descriptions of these data allow comparisons

with similar situations (Creswell & Poth, 2018). While the goal of the researcher in the study was not to make these comparisons, the researcher intended to make certain that the quality of the data presented allows for transferability. My study employed thick description, triangulation, and an audit trail to support transferability.

Thick Description

Constructing a detailed description of the culture-sharing group is critical to understanding the overall system of how a phenomenon takes place. The function of thick description is "sharing the participant's understanding of the situation with the reader. Thick description is a written record of cultural interpretation" (Fetterman, 2010, p. 125). A thick description was utilized in my study through interviews, course design observation, and artifact analysis to support transferability. This analysis addressed all three research questions and aided in the detailed account of the data. Next is the concept of triangulation for consideration.

Triangulation

Corroborating evidence through multiple data sources is triangulation (Creswell & Poth, 2018). Triangulation, using a minimum of three data sources, ensures that the research study uses multiple sources of data collection; this study had four data sources (interviewing, course design observation, artifact analysis, and research journal) and supported transferability. Triangulation leads to trustworthy findings (Yin, 2018), so the reader may decide if the study results may apply to other contexts. “The use of multiple methods of collecting data (methods triangulation) is a strategy for obtaining consistent and dependable data” (Merriam & Tisdell, 2018, p. 252) and supports transferability.

Audit Trail

Audit trails are in-depth and illustrate findings based on the researcher's collection and analysis of data in a transparent method. Audit trails demonstrate that the results are transparent regarding the participants' interviews, artifacts, and comments about the data (Crotty, 1998). The audit trail included all collected data: recordings, transcripts, artifacts, communications, correspondence, research journal, and member-checking feedback. The audit trail in the study accounted for how data were collected, how categories emerged, and how decisions were made and allow the reader to understand how the researcher arrived at the results, supporting transferability. In addition to the transferability of research, my study included confirmability.

Confirmability

Confirmability is the level of confidence that the findings are based on the findings of the research and not the researcher’s biases. Regarding confirmability, the researcher documented the decision-making process, chronological events, ideas, and reasoning for decisions made throughout the study. According to Creswell and Poth (2018), utilization of these methods establishes any biases that may exist by the researcher so that they may be considered along with the analysis of the data. Furthermore, the detailed descriptions in the research journal allowed for the research methods to be scrutinized, as well as easily repeated. The research journal helps to explicate the steps and document the decisions throughout the study leading to ensuring that the concepts and themes emerged directly from the data.

Throughout the data collection process, ethics were constantly considered regarding confirmability relating to participants, sites, stakeholders, and publishers of the research. The study sites were respected, distractions were minimized, no pressure was placed on participants, no deception was intended nor occurred for participants, potential power imbalances were

understood, participants were appreciated, and data and materials were secured. These steps aided in confirmability by including reflexivity, thick description, and triangulation.

Reflexivity

Monitoring the research process is critical in relation to the connection between researcher biases and researcher assumptions (Schwandt et al., 2007). Integrity in the research process is paramount, and the power dynamics of the researcher and participants must be mentioned. There may be power relations in the study (Koro-Ljungberg, 2012) as well as the researcher's positionality-race, gender, social class, and sexual orientation--which must be understood. "Reflexivity is generally understood as an awareness of the influence the researcher has on what is being studied, and simultaneously of how the research process affects the researcher. It is both a state of mind and a set of actions" (Probst & Berenson, 2014, p. 815). Therefore, a research journal was kept and included the reflection of the research process with transparency. Conscious reflection is an essential aspect of development, and reflection acts as a mediator in constructing knowledge by "interrupting" thought processes and encouraging critical thinking (Vygotsky, 1986). Reflection aided in undergirding confirmability by scrutinizing any influences on self-interests in the research.

Thick Description

A thick description is applicable to the confirmability aspect of my study through the emphasis on disclosing intentions throughout the research process. The findings of the study were rooted in the data collected and analyzed in the study, not from the researcher's positionality or biases. By aiding in the proof of neutrality of the study, questions are thoughtfully planned out and lead to a robust interview. Actions are replicated with each participant, ensuring confirmability. "All research must have 'truth value,' 'applicability,'

'consistency,' and 'neutrality' to be considered worthwhile" (Guba & Lincoln, 1981, p. 9). The coding schema of the data collection was documented and incorporated into the study for transparency. According to Jones et al. (2014), confirmability mandates that the researcher tie findings to data and analysis. Therefore, there was rigor in the process and, subsequently, the findings by making thick description imperative.

Triangulation

Triangulation refers to using multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Patton, 1999) which leads to confirmability. Applying triangulation to confirmability in my study included determining triangulation methods, documenting triangulation within the journal, deciding if further triangulation was necessary, and writing up the triangulation results (Amankwaa, 2016). Using multiple data sources with differing participants aided in substantiating the study's findings by showing the findings emulate the data, not from the researcher's beliefs.

Credibility

Credibility is based on the description of the phenomenon of interest and the generation of believable research claims and is transparent by using a systematic process throughout all stages of research (Kvale, 1994). Credibility is data represented by the researcher's understanding of the perspectives of the participants themselves. Using member checking, thick description, reflexivity, and triangulation led to data being presented from the findings, not the researcher's stance. The five significant creditability attributes (Yarbrough et al., 2010) are: utility, feasibility, propriety, accuracy, and accountability, and were upheld in my study through the means below.

Member Checking

Member checking is a systematic procedure to share the data with participants and obtain participant feedback, according to Creswell and Poth (2018). Feedback from participants was solicited and integrated to enhance results for clarity, thus making them credible. Richards (2003) stated that member checking is to "seek views of members on the accuracy of data gathered" (p. 287). This process aids in the credibility and trustworthiness of the research. Member checking is

> The single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective they have on what is going on, as well as being an important way of identifying your own biases and misunderstanding of what you observed. (Maxwell, 2005, p. 111)

Participants were emailed the transcriptions of their interviews two weeks after the interview and asked to complete the member-checking process within two weeks. There were no revisions or additions from any of the participant interviews. After members approved the transcriptions of their interviews, the interview analyzing process began.

Thick Description

Describing the data collected with meanings, intentions, and purpose aid in the credibility of the study. Guba and Lincoln (1994) stated thick description is a way of achieving external validity. By describing a phenomenon in sufficient detail, one may evaluate the extent to which the conclusions are drawn and transferable to other times, settings, and people. My study included the criteria of thick description, thus improving data analysis credibility.

Reflexivity

Reflexivity is "an attitude of attending systematically to the context of knowledge construction, especially to the effect of the researcher at every step of the research process" (Guba & Lincoln, 1981, p. 32). Reflexivity adds to the credibility of qualitative research by clarifying values, purposes, and beliefs. Keeping a research journal upheld the data analysis to credible reflexivity standards throughout the study.

Triangulation

Triangulation is a qualitative research strategy to test validity through the convergence of information from different sources about the same phenomenon (Polit & Beck, 2012). This means of collecting multiple data sources leads to enhanced dependability. Readers are able to understand the decision-making process of the researcher which leads to credibility. My study utilized triangulation by implementing four means of data collection (interviews, course design observation, artifact analysis, and a research journal) to aid in credibility. The next component of trustworthiness to be implemented is dependability.

Dependability

Dependability is achieved by ensuring the research process is logical, traceable, and documented (Tobin & Begley, 2004). Dependability was achieved in my study by the research journal, audit trail, and member checking. Readers of the study can examine the research process and, thus, are better able to judge the dependability of the research (Guba & Lincoln, 1994). Implementing coding methods, triangulation, reflexivity, and thick description methods added to the dependability of the study.

Coding

Coding the data to lead to themes will present opportunities for dependable data analysis. Open coding will allow the researcher to "notice and identify descriptive, common, or unusual ideas, phrases, or words, and then attach those to a broader meaning of the phenomenon" (Jones et al., 2014, p. 164). Coding decisions and emerging themes were tracked through the study in the research journal and audit trail leading to dependability.

Triangulation

Dependability was addressed through triangulation of the data (interviews, course design observation, and artifact analysis). Interviews included member checking for clear meaning, course design observation included constructive communication of the courses, and artifact analysis included a review of the submission of work in the study. These components led to a clear understanding of the data and ensure dependability.

Reflexivity

Reflexivity is a central tenant of dependability. The continual process of reflection by the researcher on their values, preconceptions, and behavior regarding data collection and participants were transparent and thorough. Dependability refers to the consistency and reliability of the research findings and the degree to which research procedures are documented, allowing someone outside the research to follow, audit, and critique the research study (Polit & Beck, 2012; Sandelowski, 1986). In my study, I implemented reflexivity by keeping a research journal and audit trail to make decisions transparent and not affect the findings.

Thick Description

Denzin (1989) highlighted the features of “thick description” as follows: (1) it gives the context of an act; (2) it states the intentions and meanings that organize the actions; (3) it traces

the evolution and development of the act; and (4) it presents the action as a text that can be interpreted (p. 33). Utilizing the data collection methods of interviews, course design observation, artifact analysis, and research journal led to a thick description of my study and led to dependability. The four collection methods provided a strong foundation to describe and understand the phenomena in context.

Summary

This chapter has involved the foundational theories that ground the research and guide the research, specifically constructionism. I gave a synopsis of the methodology of the study, phenomenology, including the philosophical foundations of how this specific methodology fits the plan of the study. The chapter then covered the Learning by Design analytical framework, setting of the study, participants and sampling procedures, data collection, data analysis, and trustworthiness with rigor. I included details of the data collection methods of interviews, course design observation, artifact analysis, and research journal. The data analysis component discussed trustworthiness by addressing the transferability, confirmability, credibility, and dependability of the study.

Researcher Positionality

Using a phenomenological perspective, I sought to examine making meaning of multimodalities in teacher professional learning in a unique light by bracketing any preconceived notions I may have as a researcher. Bracketing is a concept that allows a researcher to direct energy into the phenomenon presenting itself, according to Dahlberg et al. (2001). As a researcher, I put aside the status quo meanings assigned to course involvement and listened to participants' voices as they described their experiences richly. This was accomplished by understanding course components, roles, and work and distancing myself and research by

positioning myself as a researcher. By bracketing preconceptions, I was able to report the participants' unique experiences more accurately.

The role of the researcher is critical to the congruence and consistency of the research design. The role of the researcher is that of a professional as they interact with the participants in the setting. Additionally, the study and relationships may evolve over the course of the study. Specific biases I may hold are those of a 50-year-old White male immersed in public education. I have experience teaching technology in education and learning about technology in education. My position allows me to understand some perspectives of teachers and students as learners of technology and education.

Conclusion

This case study was built upon phenomenology and constructionism. By focusing on making meaning of multimodalities in teacher professional learning, the study used constructionism to understand the experiences and definitions of the participants. By understanding our world, we take part by remixing what we know with what we learn.

> Learning is comprised of the shift from the book and the page to the screen; at the level of semiotic production in the shift from older technologies of print to digital, electronic means; and in representation, in the shift of the dominant mode of writing to the mode of image, as well as others. (Kress, 2010, p. 10)

Collecting the data was an extensive process and drew upon multiple sources. Themes emerged from the data. The research questions allowed for the exploration of the experience and the subsequent data analysis. Analyzing the data was a direct interpretation of the findings upheld by reliability and trustworthiness.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to better understand multimodal usage in teacher professional learning. Multimodalities abound in educational settings and are consistently being utilized and remixed by and for the learner. Presenters of professional learning have established the necessity to instruct and implement multimodal content and delivery for their students, who subsequently deliver multimodal content to their learners. The opportunities to grow with and convey meaning from multimodalities allow for participants to share their understanding of multimodalities, how multimodalities are defined, what influences occur for multimodal usage, and how multimodalities are used in instruction. Experiences with multimodalities in professional learning increase implementation, understanding, and opportunities for usage. By including presenters of professional learning as well as teacher leaders in this study, a clear understanding of multimodal learning became evident.

To accomplish an understanding of modes, their usage, and how they are taught and understood, the following research questions were developed:

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

The findings of my study are presented in this chapter. Semi-structured interviews took place to capture data from two presenters of professional learning six teacher leaders. Courses were analyzed. Course artifacts were analyzed. These data were collected and analyzed to understand how meaning is made regarding multimodalities in teacher professional learning. I organized this chapter with ten emergent themes to answer the three research questions.

Summary of Data Collected

Participants included eight educators; Table 6 includes demographic information with pseudonym usage to preserve anonymity.

Table 6

Participant Self-Identified Demographics with Pseudonym

Pseudonym	Age	Ethnicity	Education Level	Occupation	Years Teaching/ Grade Level
Theresa	36	Caucasian	Ph. D.	Adult educator	8/Adult learners
Mountain Goat	45	Caucasian	M. Ed	Adult educator	23/Adult learners
Belinda	40	Caucasian	Bachelor	Social studies teacher	13/6-8 grades
Jordan	42	Caucasian	Bachelor	Farmer	14/5-12 grades
Kate	66	Caucasian	Bachelor	Early childhood curriculum coach and parent supervisor	B/ECE-12th grades
Kristen	52	Caucasian	Bachelor	History teacher	25/K-12
Janet	29	Caucasian	M. Ed	Biology teacher	3/9-10
Rowen	58	Caucasian	M. Ed	Math teacher	10/9-10
Jill*	45	Caucasian	M. Ed	Director of Professional Development	Adult Learners

Note. N = 8. Age range is 36-66; 8 participants self-identified as Caucasian female. *Jill was not a participant in the study; however, was interviewed for understanding of iLC courses because she was the iLC Director of Professional Development.

Key Findings

This study explored how presenters of professional learning define multimodalities and use multimodalities in their instruction. Additionally, this study explored how teacher leaders, who were students in the iLC courses were influenced to use multimodalities. The participants relayed their knowledge, understanding, and usage of multimodalities as they took part in individual, semi-structured interviews. By implementing course design analysis, instructional methods and delivery became clear. Access to course artifacts such as assignments, discussion boards, and resources aided my analysis to holistically understand how meaning is made through multimodal usage in a professional learning setting. My study's theoretical framework provided the foundation to collect and analyze the data which led to emergent themes.

Participants shared their academic journey into and throughout the field of teaching, including their experiences with teacher licensure, career evolution, modalities, professional learning, and technology. While varied, commonalities such as wanting to learn, needing to have a diverse and strong skill set, personalization of learning, and impacting others were aspects of their experiences. Subsequently, their roles as educators expanded through being life-long learners, wanting to stay current, and to share their knowledge with peers and students. Their definitions of multimodalities were unique, yet common in that multimodalities supported personalized learning in myriad ways. Multimodal learning is often embraced and manifests in differing ways, such as structured professional learning courses, Peer Learning Networks (PLNs), Professional Learning Communities (PLCs), and feedback from students. These data reflected the literature regarding educators needing and wanting to learn and implement new ideas for themselves and their students (Kalantzis & Cope, 2005; Netolicky, 2016). By applying the lenses of Affordances of Learning content, Learning by Design Framework, and Universal

Design for Learning, I was able to understand how the interview responses, course analysis, and artifact analysis embodied multimodal meaning making.

To aid in organizing the multimodal usage in the courses, I designed an observation instrument (see Appendix G) which tracked multimodal usage as in relation to Universal Design for Learning, Affordances of Learning, and Learning by Design. The instrument was applied to each assignment in each course. Appendix H was created for the Culturally Responsive Educator class and Appendix I was created for the Introduction to Data Analysis class.

All eight participants in the study used multimodalities in their roles as educators (disseminators of knowledge) and as students (consumers of knowledge). By asking participants how they define multimodalities through the interview questions, I allowed them to voice their interpretations of multimodalities directly. By analyzing how courses are designed to include multimodalities as content and as delivery methods, I understood how multimodalities are defined, used, and influenced these educators. Finally, through artifact analysis, it became evident how participants used multimodalities in instruction as well as assignment submission. As themes emerged, it became clear that educators relied on modes as and for instructional grammar (Gee, 2018; Kalantzis & Cope, 2016; Kress, 2010; Kist, 2005). Educators also relied on peer support regarding career growth by using multimodalities. Mountain Goat stated, “my training was very minimal, and I think it is sometimes like this today, where it is like, ‘Here is a gadget, figure it out.’”

As concepts began to appear in the data analysis, themes emerged. Teachers relied on each other, themselves, students, and leaders of professional learning to provide the skills that they needed to be relevant and successful (Kim et al., 2021). Relevant skills manifested through the modalities of written language, oral language, visual representation, audio representation,

gestural representation, and spatial representation (Cope & Kalantzis, 2009) and were delivered through technological and personal means. The data produced 10 themes that addressed the three research questions (see Table 7).

Table 7

Research Questions and Themes

Research Question	Theme
How are presenters of professional learning for teachers defining multimodalities?	Personalization Transferability Engagement
What influences have shaped teacher leaders to use multimodalities?	Meeting Student Learning Needs Instructional Models Peers Students
How are presenters of professional learning for teachers using multimodalities in their instruction?	Providing Flexible Access Modeling Personalization Requiring Application

Note. Themes that emerged from interviews, course analysis, and artifact analysis to answer the research questions.

Theme One: Personalization

Both iLC courses included in the study were designed to aid teacher leaders in career advancement; one was based on Culturally and Linguistically Diverse Education; the other was based on Data Analysis for Tiered Students. Each course had different content; however, the instructional design was similar. The participant goals for taking the courses were diverse, and the personalization of the course components allowed individual learning to occur. Interview questions were constructed to learn how participants made meaning of their iLC course in

relation to their own goals and individual careers. Responses related to interests, motivators, and applicability to their own teaching.

Presenters of professional learning and teacher leaders were aware of the seismic shift that has taken place regarding their learning ecosystems since the Covid 19 experience of emergency remote teaching. This shift in learning ecosystems resonated today, even as the Covid 19 experience has waned. Skills acquired during that time remained with educators as they created their learning ecosystems and took the best of each aspect of either online learning or in-person learning when applicable. Mountain Goat stated:

> Your first year of online teaching, you take what you have done in the brick-and-mortar setting. You bring it online, and then get feedback from your students and coworkers. You start to recognize all the technology and all the things that need to be different. So being flexible in learning timing and options with modes works really well.

Participants used phrases relating to personalization such as “show the big picture of options,” “provide different modal choices and content,” and “give them choice so they can find resources that are most beneficial to them.” These comments described how personalization manifested in professional learning. Each of the eight participants relished the ability to make their professional learning experience applicable to their goals.

Presenters of professional learning constructed their assignments to be varied, versatile, and specifically applicable to all their students. This Universal Design for Learning concept was evident in answers from Theresa and Mountain Goat, the presenters of professional learning. Multimodalities provided options for educators to have agency in their roles in school and in life. Mountain Goat iterated:

> You're really providing agency and ownership for every learner that you work with. That's the goal. You want all of us in education to be life-long learners because our field is continuing to grow and evolve. Educators should be learning the new tools and topics and research that are out there. Life-long learning is important for all of us.

Meaning was made through the choice of applying what was of interest to the teacher and the student and how to best convey that professional learning concept. Theresa stated:

> The best thing I have seen is when people are in their departments, when they have these big in-service days, and they have a list of 12 different things for teachers to choose from. This allows teachers to assess what they already know, need to know, and learn what is important to them and their students, with guidance from their instructor. You know the "why", but you want your team to discover it. Because if they don't see it, then what's the point?

The presenters of professional learning provided content for their courses which students could adjust to their goals and interests. The students added to the dialogue regarding personalization as they submitted their assignments which were applicable to their careers—and their own classroom students' work. Teacher leaders used phrases such as "building relationships aids in students participating in their own learning," "I must incorporate coursework into the real world," and "It's super important to be flexible and allow students freedom to show what they have learned." Teachers want to learn more about the content they teach and how to teach it. Creating ownership and agency led to the ability to flourish in a setting which is supported through multimodal usage. Jill added to the conversation:

> Personalized learning innovation is critical. Teachers are learning how to customize and really tailor instruction to the individual needs of all their students, regardless of what

that population looks like. The feedback that we (iLC) have received from teachers has been extremely applicable and useful for them, and we (iLC) provide that element of customization.

Personalization became evident through the course design analysis, interviews, and artifact analysis. Ideas shared from presenters and teachers included modality usage through choice boards, game-based learning, maker spaces, flipped learning, and shared drives, all which addressed personalized learning for presenters, teachers, and students. Grant and Basye (2014) stated that personalized learning focuses on using differing concepts and approaches to support individual, self-directed learning goals. That statement rings true with the findings of my study and answers research question 1, "How are presenters of professional learning defining multimodalities?"

Theme Two: Transferability

Transferability, or conveying a concept from one person or setting to another, supports personalization for students and teachers. Regarding transferability, professional learning teacher leaders utilized multimodalities in their instruction to students, and the concepts were replicated in student (as teacher) classrooms. As teacher leaders in the courses participated in meaningful learning, they were able to directly transfer those learnings to their classrooms.

For instance, teacher leaders commented, "There were tons of multimodalities being used, and lots of them were new to myself and my students," "I discussed things that we have done (in the iLC course) with my students and put them into practice," and "I showed my students the big picture of options and let them narrow down the focus on what they think is best." Students took what had been learned in iLC courses and transferred it to their own courses.

Multimodal usage was indeed a collage of meaning. Because professional learning implies multiple settings, transferability of content and delivery was important for stakeholders. The foundational ecosystem (the iLC course) began with the learning material at hand. That material was then transferred to teacher leaders' (the students of the iLC courses) classrooms. This transfer of knowledge consisted of goals, ideas, and delivery methods. In turn, the additional stakeholders, the students in the K-12 classroom, were taught by presenters of professional learning. The students consumed and transferred the lessons themselves. Jordan explained the transferability in the iLC lesson on choice boards:

> This choice board gives lots of options: writing, artistic representation, use of technology, and so on. A student who struggles with reading or language acquisition might choose to watch the videos or complete the geography activity. Students surf around on the Canadian History Museum's website and go from there. The variety of topics will give students the opportunity to choose at least one thing that interests them.

Choice boards were taught as content and delivery within the iLC course. This exemplifies that participants personalized what they were learning and transferred it to their teaching which cycled through to their students and continued to other learnings for adults.

Theme Three: Engagement

Participating in professional learning aided presenters of professional learning and teacher leaders to be vested in the learning at hand. Office hours, discussion participation, and assignment feedback manifested throughout the entire course, and students depended on engagement to succeed. Mountain Goat explained:

> It comes back to what are you trying to get across? And what do your students need—and how do you engage them to learn? A special English language learner student might need

> something different than a gifted student. You must have multiple strategies for multiple learners throughout the classroom and the school.

Through engagement opportunities, teacher leaders learned, grew, and adapted to the challenges at hand. Mountain Goat's comment allowed for the understanding of how presenters of professional learning questioned their purpose in lessons, identified objectives, and engaged with learners using multiple strategies for personalized learning. Many teachers as students felt a struggle regarding professional learning as repetitive, redundant, and unnecessary which could lead to a lack of participation. Theresa explained:

> When you've been a math teacher for 10 years, do you really need to go into a math training? New people need to do some new things that more experienced teachers just don't need anymore. Multiple modes work nicely for that diverse instruction. You are providing the opportunity to get more people involved than there would be by choosing only one modality.

Theresa's observation echoed the seminal text Learning by Design (Kalantzis & Cope, 2005) which stated that teacher engagement increased opportunities for students to express themselves in different modes, leading to student success and feelings of belonging (p. 148).

Participants in the study were engaged in the iLC course and most were engaged in teaching at the time of the iLC course. Due to this immediacy, engagement flourished for them as students and as teachers. This juxtaposition made their iLC course more impactful. Jordan stated, "I am most motivated by peer feedback in the course." Kate stated, "The rubrics are clear, and I know what needs to be done and when it needs to be completed." Belinda added, "Even five years ago is old school now. Teachers are really good at engaging with new technology, so

they can run a workshop to support a learning community." These examples of engagement aided in understanding how teachers define multimodalities.

In the themes Personalization, Transferability, and Engagement; the research aligned directly with participant interview answers, course analysis, and artifact analysis to answer the first research question of "How are presenters of professional learning for teachers defining multimodalities?" By specifically allowing individualization of content created through a Universal Design for Learning lens, presenters of professional learning were using multimodalities to aid learners to use visual, auditory, written, oral, gestural, and spatial modes in their own ways to reach individual and course goals. Transferability supported this venture by replicating what has been learned, and then the learning was remixed to additional settings which included iLC courses and teacher leaders' own classrooms. Engagement flourished through professional learning opportunities by incorporating varied learning means, interesting projects, and applicability. The next themes will address the second research question.

The second research question was, "What influences have shaped teacher leaders to use multimodalities?" The answer to this question was presented through the emergence of four themes which were Meeting Student Learning Needs, Instructional Models, Peers, and Students. Through this analysis, multiple stakeholders and concepts emerged to influence the usage of multimodalities.

Theme Four: Meeting Student Learning Needs

Student learning needs were met through the usage of multimodal content and delivery methods. Teacher as student learning included standardized testing, individual achievement, and professional growth; student needs equated to understanding new skills, presenting what they have learned, and applying knowledge to their lifeworld. Professional learning addressed student

needs by being designed around research-based practices and principles. Participants' responses agreed with this statement as they answered questions relating to meeting student learning needs, accommodations, and personalization of learning.

Presenters of professional learning were challenged with providing content that met student needs. This andragogical process was complex because students had a varied understanding of the concepts at hand. Some were well-versed in the content and multimodal usage, while some did not have much experience or understanding of multimodalities. Similarly, teacher leaders faced the same challenges as their classroom students. This challenge may be exacerbated by school funding and resources. Jordan received some data in a lesson that made her think more about access and how student needs are impacted. She stated the following in a discussion:

> I was dismayed at how BIG the gap has become between low-income students and higher-income students. We can't ignore how schools are funded. I noticed a stark difference between when I worked at a lower-funded school and now a higher-funded school. The resources available to the students are VASTLY different--in terms of technology, support staff, class sizes, and even having functioning heating and a/c in the building. Not only that, kids coming to school with empty tummies will struggle, no question. One of my goals is to learn about the resources available to support low-income students in my area and become a trusted resource to families.

Teachers had a better understanding of their students' learning needs and how to address those needs through their own professional learning courses. Educators understand that learning can be challenging. Belinda stated the following in the discussion board:

> I found that in my 5-8th grade English Language Level 1 class, all Spanish-speaking newcomers to the country, it was important for me to ask them to tell their stories through modalities. It was also important to validate and incorporate their first language. There is a cultural component to this education style that can't be overlooked when considering newcomer English Language Learner populations. This group responded much more enthusiastically to a rigid level of structure and opportunities to learn technological skills.

Student needs varied and included academic, social, linguistic, and special needs. Kate added, "In a six-mile radius of our school, there are over 100 languages spoken." Educator professional learning with modalities may include academic specialization. Participants were able to personalize what they learned in the courses and apply new skills into their areas of specialization. Similarly, students in specialized categories listed above can access their learning through multimodalities, on their own terms.

Addressing challenges in language acquisition and disabilities was enabled by supportive technologies and was presented to specialists and general classroom educators throughout their careers, and this was evident in participant discussions, interviews, and artifacts. Audio and linguistic supports such as text-to-speech capability have significant impacts on education and society. Kristen shared her tips on accessing feedback in a discussion board post:

> Google surveys are a great way to ask for feedback when it comes to looking at data and analysis. Students and parents can look at assessments, questions, school practices and provide feedback about what is working for them and areas that I, as a teacher, might not have thought of or looked at.

Social emotional learning also has avenues of experiences through multimodalities that appear in learning environments, construct learning means, and show there is more to learning than just academics. According to Kristen:

> I often get feedback from students when I send out SEL activities. I think it's important to understand that our students have struggles and are dealing with stuff at home. By sending out the activities with a personalized message, it helps students to see that the teachers here care about more than just academics. The SEL data is so important in reaching our students where they are at. Sometimes they have had a loss in the family or will engage in the SEL activities, but not in class. So, we can use the data to better understand our students and families.

Participants elaborated on their experiences which included a wide range of student learning needs and how multimodalities address them. Teachers understood that professional learning is associated with meeting student learning needs through multimodal usage.

To conclude this theme, a presenter of professional learning, Mountain Goat, asked her teacher leaders the following question, "What is it that you are trying to get your students to demonstrate or learn?" and followed with:

> There's more than one way to get there. I think choice boards, which we do a lot in our professional development classes, have probably been one of the best solutions for that. You can do a podcast, or a Prezi presentation, or perhaps play a game. You can have varying levels of the simpler stuff to meet student needs. . . there's options. There are projects for more advanced work. I would say, "Think about your 'why.'"

Teacher leaders are vested in their students, and their main role was to meet student learning needs. Through multimodal usage, they addressed the spectrum of student needs, collectively

and individually, in their classrooms. Using multiple modes allowed for more holistic communication addressing differing tasks, functions, and choices.

Theme Five: Instructional Models

In previous themes, I have posited concepts that show how teacher leaders defined multimodalities as well as how teacher leaders use multimodalities. The fifth theme embodies the way multimodalities were incorporated in instruction to meet the needs of learners as well as aid in the definition of multimodalities. Participants shared examples of how multimodalities flourish from the first day of their iLC course to their final submissions. The syllabi fused with course content by providing visual, audio, written, oral, gestural, and spatial components built on Universal Design for Learning components. Similarly, the Learning by Design Framework was implemented to lead to transformative curriculum. Lastly, the Affordance of Learning content aided in multimodal usage for the course. Multimodalities used in course syllabi are presented in Table 8.

The instructional modeling allowed for multimodalities to be conveyed, learned, remixed, and implemented in the iLC courses and the teachers' classrooms. By understanding and implementing emerging technologies and building on peer support, the learning ecosystems evolved, and the students began using and remixing modalities in their learning within the course and their own learning ecosystems in which they were teachers.

Table 8

Multimodalities Used in iLearn Collaborative Course Syllabi

Concept	Multimodality Used for Course
Affordance of Learning	Ubiquitous learning (anytime/where). Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language). Metacognition (cognition to reflect and apply processes and outcomes). Experiencing the new (situated practice). Immersion in experience and utilizing discourses, including those from the students' varied lifeworlds.
Learning by Design Framework	Conceptualizing by naming (overt instruction). Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning). Analyzing functionally and critically (critical framing interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.). Applying appropriately and creatively (transformed practice). transfer in meaning making practice which puts the transformed meaning to work in other contexts of cultural sites.
Universal Design for Learning	I Provide multiple means of representation (leads to resourceful, knowledgeable learners). 3.2 highlight patterns, critical features, big ideas, and relationships. II Provide multiple means of action and expression (leads to strategic, goal-directed learners). 6.1 Guide appropriate goal setting. 6.2 Support planning and strategy development. 6.3 Facilitate managing information and resources. 6.4 Enhance capacity for monitoring progress. III Provide multiple means of engagement (leads to purposeful, motivated learners). 8.9 Heighten salience of goals and objectives. 9.1 Promote expectations and beliefs that optimize motivation.

Belinda tied her professional learning course back to the component of discussion boards and group work as instructional models which is reflected in the literature of Poortman and Brown (2023).

> One of my favorite parts of professional development is just talking to other teachers, seeing what other teachers are doing, and seeing different lesson plans come through. If I

> see an awesome anchor chart in a classroom, I'll take a picture of it and snag that idea. So that's one of my favorite things about this class. You post what you've created, and classmates give you feedback on that, and that's been tremendously helpful, just having other teachers' perspectives. I can look at their stuff and swap ideas.

Additionally, Belinda shared her remixing of an assignment as she modeled the instruction from her iLC course, For the assignment Strategies for Teaching English Language Learners, Belinda shared a Scholastic.com webpage. The webpage not only focused on the learning at hand but provided additional resources for students and peers, such as additional webpage links, images, and audio resources. Additionally, there were many teacher resources, such as classroom printouts, lesson plans, and slide decks; on the webpage for teachers to utilize.

Jordan based her Student Agency assignment on an online article. This modality included photos, webpage links, and additional resources to construct meaning of student agency. The presenter of professional learning gave students choices of resources that supported the learning goals at hand, and students picked what they wanted to learn from and about. Jordan surmised in her assignment submission: “This article shows a diversified, personalized, student-centered classroom. For CLD students, this means becoming familiar with students’ backgrounds, languages, struggles, and strengths and sharing information within support structures.” Her modeling of instruction showed that she understood the professional learning content and implemented the content and delivery in an additional setting, her classroom.

Theme Six: Peers

Presenters of professional learning stated they worked consistently in peer relationships. Peer collaboration has been consistent throughout their careers. The participants spoke of their relationships with course designers and their role in the course curriculum. As presenters of professional learning made progress through designing and teaching their iLC courses many collaborated with peer colleagues. This openness aided in their understanding and remixing of multimodal content and delivery methods. Peer learning settings were formal Professional Learning Committees (PLCs) or informal Personal Learning Networks (PLNs), there were a wide range of manifestations that influenced teacher leaders to use multimodalities. Participant interview responses and course design supported Netolicky's (2020) professional standards including high expectations, promoting progress, demonstrating knowledge, teaching well-structured lessons, adapting, assessing, and fulfilling wider professional responsibilities.

Peer teaching and learning addressed Affordance of Learning content, Learning by Design Framework, and UDL. Mountain Goat explained,

> Some peer feedback makes me think that I must have not explained this well or maybe I need to structure it differently. It makes sense to them (students), and occasionally we do have to think way outside the box, because we will get an administrator or an instructional coach or someone who's in a different role at the school where the way that we have the course structured is not going to work for them. We must be kind of creative, and usually I'll ask for a partnership.

As instructors received peer feedback, they continually understood and implemented emerging technologies for themselves, their peers, and their students which are key components in professional learning.

The presenters of professional learning used a role combination of learner, teacher, and professional leader through modalities and emerging technologies in the courses. Theresa's peer to peer experiences allowed her to personalize her teaching in ways that reflected modeling personalization, transferability, and engagement. The presenters of professional implemented peer understandings by allowing their students to have flexible access and apply their learnings by remixing resources and new technologies, allowing modes to advance their understanding and implementation of technologies in a fun and rewarding way.

Peer learning for teacher leaders influences teacher leaders to use multimodalities. These learning relationships support creating meaning and influence teacher leaders to use multimodalities, as seen by participant interviews, course analysis, and object analysis. In turn, there are opportunities to provide recursive feedback to iLC peers and enhance the iLC courses.

Theme Seven: Students

As stated previously, the term "students" is a manifestation of consuming knowledge, and there are multiple student roles in this study. First and foremost are the teachers who have stepped out of their teacher role, temporarily, to consume knowledge as students. Additionally, there are students in the K-12 or college environs whose main role is to consume knowledge. However, they also switch roles at times to be conveyors of knowledge. This theme concentrates on how students impacted their teachers and subsequently influenced teacher leaders to use multimodalities.

Belinda spoke of her experience implementing iPads in the 2000s, which provided a window on emerging technology regarding student teaching, learning, and usage. Similarly, many new technologies provided opportunities to teach and learn (Nikonorova, 2022). Belinda

had been implementing emerging technologies and learning to understand them with her peers and her students since her school piloted the use of iPads in the classroom and explained:

> I had the opportunity to test a lot of things out in a small class group and watched growth from 6th to 8th grade which really helped me become a good teacher. Our district approached us to pilot a one-to-one iPad model early on, and the students taught me how to use them. Eventually, I would train other teachers once they rolled it (iPads) out to the entire district.

Belinda felt that she had become a better educator by opening herself up to learn from her students to collaborate and learn technologies together. Of note was that she not only learned for herself and students but additionally created a professional learning community to provide peer support for her school and district. Her roles as a student, teacher, and subsequently an impromptu presenter of professional learning was evident in this technological and modal experience.

As teacher and student comfortability with the iPads grew, so did her informal peer support for other teachers.

> My students began to implement additional applications for the iPad, like using Garage Band and iMovie and the Apple textbooks that had the iBooks that were interactive. Kids would read text, and then they could click in the textbook--a video or view photographs, or it would jump them over to the national archives. They could interact with it, one on one. It was right there, and they could kind of navigate that on their own. They got really good at finding what they were looking for. The teachers loved it!

Students also become teachers in the world of education and multimodal usage. Many students love to teach their instructors concepts that are nestled in multimodalities. Kristen stated:

> My students are usually learning modes through technology in their real-world experiences and bring them to class. They are interested and ideas open up. They teach each other, and they often teach me. That is fun, and it gives them agency. We construct from there.

The iLC course classmates had an opportunity to share what they have learned from their students as well. Belinda mentioned in a discussion board:

> I love having a variety of end-of-unit projects--it makes learning so much more interesting, and lets kids play to their strengths. They teach me volumes. It does take forethought and planning, but I love the idea of providing rubrics ahead of time so kids can be responsible for completing the benchmarks and share technologies they have learned.

Because most school districts are composed of students and families with many different linguistic backgrounds, communication and learning is challenging (Tandiana et al., 2020;). Schools, administrators, teachers, peers, and students are part of the phenomena of their educational setting and need to understand the tools to teach all students. Embracing cultural and linguistic differences is paramount to success for all and often manifests in student influences.

As students shared learnings with their classes, teachers listened and incorporated those lessons. Teachers adjusted their lessons appropriately according to the participants of this study. Participants aided in the understanding of how teachers create content and deliver content multimodally. Belinda continued:

> Am I doing this in a way that I can reach second language learners? What about the kids that are only pushed into the classroom for a short amount of time during the day? Or have just joined us at the school in the middle of the semester? What I'm looking for is,

> am I reaching a wide array of abilities in my classroom with the way I'm designing these lessons? That's when I look at differentiation with and through modes. I seek out student feedback and see what is working.

By analyzing the data from interviews, course analysis, and artifact analysis; the second research question has been addressed. The second research question was, "What influences have shaped teacher leaders to use multimodalities?" Modeling instruction shows that students have become teachers by understanding content and delivery methods and remixing information to make it their own. Peers in a variety of settings can model and share resources and platforms for varied multimodalities to enhance learning for themselves and others. Lastly, students are conducive to influencing teacher leaders to use multimodalities because they provide feedback, innovate learning, and embrace opportunities for multimodal content and delivery which influences teacher leaders to use multimodalities.

The third and final research question was, "How are presenters of professional learning for teachers using multimodalities in their instruction?" Due to the wide-ranging nature of visual, auditory, written, oral, spatial, and gestural modalities, the participants shared a treasure trove of data. The themes that emerged were: Providing Flexible Access, Modeling Personalization, and Requiring Application. Incorporating multimodalities, or synesthesia, was common and aided in content and delivery of the iLC courses. Presenters of professional learning worked to address learners in the themes identified above in ways that provided flexible access, modeled personalization, and required application.

Theme Eight: Providing Flexible Access

Professional learning for teachers supplements current careers and skill sets with additional knowledge. Participants shared that time was a precious commodity at work and in

life, and it was challenging to find time for professional learning. The iLC courses were self-paced, asynchronous, online learning ecosystems. The flexibility built into the courses allowed teacher leaders to access them on their own time, to submit assignments on a personalized time frame, were paid for by their school or with government funding and were situated within their professional career timeline.

This flexibility allowed participants to prioritize other professional and personal components as they saw fit for the tasks presented in the courses. Kate stated, "I started late. . . . I didn't sign up for this class until two weeks ago (five weeks into the semester). I like that I can go at my own speed, and I tend to work hard and get things done quickly." Jordan added, "Regarding online platforms, I like the amount of choice embedded, and I like that people can work at their own pace, and oftentimes, on their own time. That's a huge asset for both teacher learning and student learning." Participants were able to find time to address the course requirements and do additional learning beyond the required curriculum in some cases. Belinda spoke of the integration of modes in her course:

> You have a section that you read, and then jump to a podcast or Youtube video, or whatever, and it's totally embedded in the Canvas shell. I like that the course is self-paced because it gives you time to pause the video and explore unfamiliar terms. "Let me Google it and figure out what they're talking about here," and then you can jump back in with better understanding and make more meaning out of it.

Emerging technology was consistent in the careers of instructors of professional learning and teacher leaders in this study and having materials on demand was important. Even if the technology had emerged in the past, a teacher may not have known about it or had the time to learn about or master it, they could access the central repository of course resources to learn.

Varied technological skills may affect student progress; however, participants found time to learn the skills that were required to be successful. Even though timing posed a few challenges to the asynchronous courses, many participants preferred the flexibility of blending their professional and personal time management to incorporate professional learning when it worked for them. Belinda reflected on how her iLC course implemented multimodalities:

> There are interactive modules that are kind of self-paced videos. They are interactive, where there is a test, where you go in and do the test when you are ready, prepared, and have made time for it. And it's all hands on. Just do it yourself. Jump right in.

Kate added, “It’s nice to be able to work at your own speed.”

Theresa affirmed flexible access is important:

> Starting the year off right by providing PLC opportunities would be the best time to get started with the goal-setting process. The facilitator of either the department meeting or the PLC, they already have ideas. Departments need to have time to get together once the school year has started. What are the team goals? How do we access the team goals? Do we need interactive? Do we need adaptive practice? Do we need to find some kind of in-real-time interactive notebook situation? Because without the “why,” then, who cares?

While the courses were compartmentalized by academic semester, they were comprised of self-directed learning. Adult learners addressed content online through personalized time frames. Jill explained:

> We have our on-demand population which means that all the iLC courses are offered year-round, during your typical university terms. We have our fall term, our spring term, our summer term, and anybody can enroll in our courses during those terms, and they can jump into the course anytime because we don't have hard deadlines. But honestly, the

> summer is when we get better enrollment. But then the hands-on piece is more of a hypothetical piece than it is hands on. Courses during the school year are probably when it is the most useful because they have a class of students that they can learn something, try it the next day, and truly reflect. We allow our teachers the flexibility of learning asynchronously while still engaging with their peers in the classroom. Flexibility is key for our teacher population.

In addition to the course content, there were discussion forums. The discussion forums were a robust forum for dialogue about course content, reflection, and student-to-student and student-to teacher interaction. According to Jill:

> So, we have our discussion forums. They have that time with their instructor. If they want one-on-one coaching from the instructor, they could set that up. They get feedback from the instructor, so they have all the benefits of active facilitation. That is a bonus of "I can work on the content whenever it works for me with my schedule."

Once the professional learning course was planned, designed, and implemented, there were flexible access supports in place for the teacher as student. There is continuous support throughout the course, and resources may be used after the course (Cloonan, 2010). Students could access information throughout the course in an asynchronous delivery that was individualized through course design. Flexible Access leads to the next theme which is Modeling Personalization.

Theme Nine: Modeling Personalization

Presenters of professional learning were tasked with modeling personalization. Personalization was consistent in preceding themes (Personalization and Meeting Student Learning Needs). Modeling how making meaning is personalized through lessons with

multimodalities was a component of how presenters of professional learning used multimodalities in their instruction. Courses were designed to convey information through visual, auditory, linguistic, spatial, and gestural modalities which resulted in the personalization of content and delivery and the modelling of those concepts for others.

My study has included three frameworks for analysis--Universal Design for Learning, Affordances of Learning, and Learning by Design. Fundamentally, they aid in transformative curriculum for all learners. Rowen gleaned:

> Because people are different, because students are different, because everyone is different, the best practice is to use as many modes as you can to be able to diversify yourself, to make it so that the students can pick what they need out of it and get what they need out of it. I do a lot of talking. I do a lot of writing. I do some videos. They all support learning.

Regarding learning, there were three main categories of processing information which were: recognition (the "what" of learning); skills and strategies (the "how" of learning); and caring and prioritizing (the "why of learning"). These concepts interplayed with each other, similarly to synesthesia in multimodal learning, from presenters of professional learning, teachers as students, and students, leading to the creation of learning. Modeling personalization required the teacher to gauge learning styles individually (learners) and collectively (classrooms).

Additionally, it was important to communicate the "why" of learning to the teachers as students or students of a classroom, as Mountain Goat stated:

> Students ask, "Why am I learning this?" And you don't want to just be "because the standards say I have to teach you." So whenever possible, try to connect it to something

> in the real world or in their life, and if you truly know your students, have a broad idea of maybe what kind of field they want to go into. Tying it [the lesson] to the real world and trying to help them see the bigger picture, there is a purpose to help you in your future.

Janet shared:

> You're going to have some that learn best from one way and some that learn best from another way. You're going to have those kids who are audio learners. You're going to have those kids who are visual learners. It's not that they can't learn something from other methods, but they just learn best, from either visual or audio, or whatever it is. Having those multiple ways where you're teaching that, it's really going to hit home. They're going to have that information presented multiple ways.

As evident from prior themes, personalization is an important benefit of multimodal use, and thus it is important that presenters of professional learning model personalization. Once personalization was modeled, knowledge was applied.

Theme Ten: Requiring Application

Presenters of professional learning for teachers used multimodalities in their instruction by requiring their students to apply the concepts themselves. This application manifested in course artifacts such as discussion boards and assignment submissions. Students experienced, conceptualized, analyzed, and applied their learnings in a variety of ways. These Learning by Design Framework components aided in participant understanding of how to implement what they had learned in the course—within the course and their own learning ecosystem.

Emerging technologies were often included in professional learning opportunities. iLC courses utilize many technologies in curriculum and delivery, while supporting personalization for students to find technologies that work for them outside of the course. Presenters of

professional learning used multimodalities throughout their instruction by engaging in technology. For example, presenters provided videos, interactive power points, podcasts, choice boards, discussion boards with links, and gestural/special representation through video and audio sources. Presenters then asked the students to use multimodalities in their work by implementing the same methods above, and to research and use additional multimodal resources and technologies. Kristen corroborated:

> I found Nearpod and Pear Deck which have templates. It's helpful for teachers. I can search for an SEL type of activity. Let's do that first to get them engaged, and there are many to choose from. Access to the internet is immensely helpful for teachers and students to learn. It gives them exposure to different ways, different means.

While multimodalities aid and expand that process, there must be meaning (Kalantzis & Cope, 2005).

Providing multiple means of application abounded in the iLC course curriculum and assignment submissions. One such submission was Belinda's Learn and Apply assignment (https://drive.google.com/file/d/1eMPrTzKwoG-REm27XVje-HxuH9Dx30lu/view). The assignment provided an opportunity to understand the implementation of content via multimodal delivery. Support such as immersive readers, instructor office hours, diverse resources, and multiple means of proving understanding allowed for presenters of professional learning and teachers as students to consume information, remix their learning, and present their learning in ways that were meaningful and memorable to themselves as well as their peers. Mountain Goat mentioned:

> Teachers need to ask their students good questions. "Have you thought about trying this, or have you thought about these?" Let me try to ask questions, to know about the learners

> and what needs to be taught. You're hoping that teachers are thinking about all the different learning needs in their classroom.

Using multiple "hows" helped support UDL concepts by implementing differing ways to access information and show learning. Janet continued:

> Teachers present things in a UDL framework focusing on how to do things. Students may process the learning in a way that they're not so good at. Then they're going to be able to learn it in a way that they're really good at. And that way, they're going to be able to remember it. Not only are they getting that repetition, but they're getting the multiple types of learning, and then, it kind of flip flops, and learning occurs.

Meaning was conveyed through video, audio, imagery, language, spatial representation, and gestures. Janet painted a picture of her multimodal teaching grammar as she applied multimodalities:

> I really like to do visuals, I have a slide presentation where I'll have the visual information I put up, especially vocabulary words or bullet points of things that I'm going over. I do pictures or diagrams of things that I'm talking about. I talk about real-world examples where they might see it or experience it. I have them give me examples. So, I might start with an example, and then I say, "Okay, Where? What else?" if this is what I'm talking about. And here's an example. "Example A. Can you give me B or C or D?"

Requiring application of multimodalities supported teachers as students to make meaning of multimodal usage and allowed them to have agency. They were provided with opportunities and resources to learn, and in turn, remixed ideas to demonstrate what they had learned. This process was identical to what teacher leaders expected of their students. When this concept was coupled with modeling personalization and providing flexible access, the answer to research

question three was presented. Providing Flexible Access, Modeling Personalization, and Requiring Application were the three themes that emerged to answer research question three, how are presenters of professional learning for teachers using multimodalities in their instruction? Flexibility allowed for learners to access the learning environment in varied ways, modeling personalization exemplified catering multimodalities to varied learners, and applying learning showed what teachers have learned in varied contexts.

Conclusion

The findings of my study led to an understanding of what multimodalities are, how they are learned, and how they manifest in teacher professional learning. Participant interviews, course analysis, and artifact analysis provided answers to the research questions. Visual, auditory, written, oral, spatial, and gestural modes are defined through personalization, transferability, and engagement. Influences that shaped teacher leaders to use multimodalities were meeting student learning needs, instructional modeling, peers, and students. Presenters of professional learning for teachers used multimodalities in their instruction through providing flexible access, modeling personalization, and requiring application.

CHAPTER V

DISCUSSION, IMPLICATIONS, AND CONCLUSION

The purpose of this study was to better understand multimodal usage in teacher professional learning. The multi-faceted semiotic grammar of multimodal content and delivery required a robust data collection process in two iLC professional learning courses. I learned that multimodalities were a means to represent learning in ways that all teachers and learners may utilize, individualize, and make meaning of in their own way. While my study focused on presenters of professional learning, I was able to better understand the students in the courses and their multiple roles of student and of teacher to their students. Participants' personal journeys, work in education, flexibility, and their own students became influences that affected multimodal usage. I gained understanding of not only how the participants became emboldened through multimodal usage, but how technology and multimodalities are a consistently emerging linguistic system that brings opportunities and access to education. This study posited three questions to help best understand making meaning of multimodalities in teacher professional learning.

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

The research questions focused on how stakeholders define, understand, and implement multimodalities. The findings of my study were designed to aid the field of education, which is vast, contains many roles, and is continually being remade. My phenomenological case study

was designed to better understand participants' meaning making process in two professional learning courses through interviews, course analysis, and object analysis. Phenomenology allowed for the application of learning in the constructionist realm, as meaning was made from participants' perspectives, best-practice examples, and the world of experiences in a dynamic interplay (Creswell & Poth, 2018). Incorporating the world of experience, construction, and interpretation led to understanding and attributing meaning (Paudel, 2021).

The three research questions led to semi-structured interview questions, course design analysis, and artifact analysis as data collection methods. Anonymity was implemented through the usage of pseudonyms as participants shared how they use multimodalities, why they use multimodalities, and how they define multimodalities. The discussion and usage of these multimodality components were thick and rich. The participants showed a desire to learn more about multimodalities and to put them in practice through in-person opportunities and online ecosystems. Participants thrived in the professional learning setting as they were presenters of professional learning, students as teachers, and teachers. Having multiple roles allowed for the shifting of teacher to student, and back, as student to teacher, all the while manifesting multimodal usage in content, delivery, and remixing of skills to submit their assignments.

Presenters of Professional Learning and Multimodal Teaching

Presenters of professional learning use multimodalities and rarely need to define multimodalities. By enacting visual, audio, written, oral, spatial, and gestural modalities throughout their courses, multimodal design and implementation occurred, showing how technology innovated and supported curriculum and delivery methods. Presenters of professional learning understood that the students in the study needed to learn multimodal, semiotic grammar. The students held two roles throughout the course, first as consumers of knowledge, being

students as teachers in an andragogical relationship. The second role was then as a teacher in their K-12 classrooms, as they needed to model the semiotic grammar in a pedagogical relationship. Theresa and Mountain Goat understood that their students navigated these roles and subsequently designed and taught multimodalities as such in personalized, transferable ways.

The participants' work included concepts in the literature review such as transmodal, intermodal, and intramodel usage of multimodalities, synesthesia, transductive moments, and identities. Navigating these spaces showed how multimodalities transcended learning environments, were found in technology, and allowed for relevancy in personalized learning. Participants used multimodalities as versatile, evolving, and generalizable means of communication to convey learning content and delivery methods, even as they changed. Kress (2010) stated that "the world of communication has changed and is changing still, and the reasons for that lie in a vast web of intertwined social, economic, cultural, and technological changes" (p. 5).

Applying these ideas to multimodalities in professional learning led to meaning in all its appearances and, thus, allowed for individual specificity in lesson design and learning. Specifically, my study addressed andragogy and how dynamic relationships utilize systemic functional linguistics. Pedagogy was also relevant as teachers as students pivoted to teachers as teachers for their courses and transferred what was learned to their students. Students as students in K-12 settings consumed the information and, at times, pivoted to students as teachers, remixing learned concepts to their instructors. This cyclical nature is at the heart of education and is replicated lesson after lesson, year after year, with opportunities for new learning and delivery.

Emerging Technologies and Learning Ecosystems

New technologies, such as choice boards, emerged, and participants were put to the task of learning them and implementing them. The process of the presenters sharing the technology through examples, written resources, and additional webpage resources allowed me to track how curriculum was designed, shared, assigned, addressed, personalized, and submitted. Once the students were able to review the emerging technology, which included the multimodal resources language, writing, video, and audio, they completed the assignment by choosing aspects that were relevant to them. Participants created and submitted their own choice board that would be part of their K-12 classroom assignment, modeling personalization and transferability. This process supported learning objectives, enabled peer learning opportunities, and refreshed professional opportunities in fun and applicable ways.

By supporting personalized learning through the iLC course learning management system (Canvas), the participants "used their own strategies to learn and progress through learning goals at their own pace and demonstrated their knowledge in unique ways" (Reiser & Dempsey, 2012, p. 177). Artifact analysis affirmed that teachers must evolve to the creation of interactive, collaborative, and personalized learning opportunities (Darling-Hammond, 1993; Fishman & McCarthy, 2000; Yoon et al., 2007). Artifact analysis allowed for a deep understanding of how multimodalities led to a plethora of affordances, which are the qualities that define possible uses. Exploring multiple affordances helped to better understand the breadth and depth of multimodalities. There is no limit to remixing, synesthesia, or knowledge making. The only constraint is not being aware of a process, skill, or opportunity. Being aware of these affordances leads to a deeper and wider breadth of resources to draw upon.

Timing posed some challenges to the asynchronous courses (Cunningham et al., 2017), and Kate voiced frustration about some posts in discussion boards being outdated. However, many participants preferred the flexibility of starting the course in their own time frame. The student participants were blending their professional and personal time management to incorporate professional learning when it worked for them (Gee & Gee, 2007). The learning ecosystem allowed multimodal resources to appear throughout the content and for a variety of uses. Teachers relied upon online resources and built their lessons around those resources, which were multimodal in nature, such as the internet, virtual lessons, and video or audio resources such as podcasts (Grisham et al., 2000). However, one participant stated that an issue for online teachers to navigate was that their students can turn off their camera so they were not seen by the teacher or the other students in the class. This posed a myriad of challenges from involvement in the lesson to making sure the student was present and paid attention and responded in a timely manner (Wages, 2021). Additionally, this removed the gestural modality from the viewpoint of peers and students.

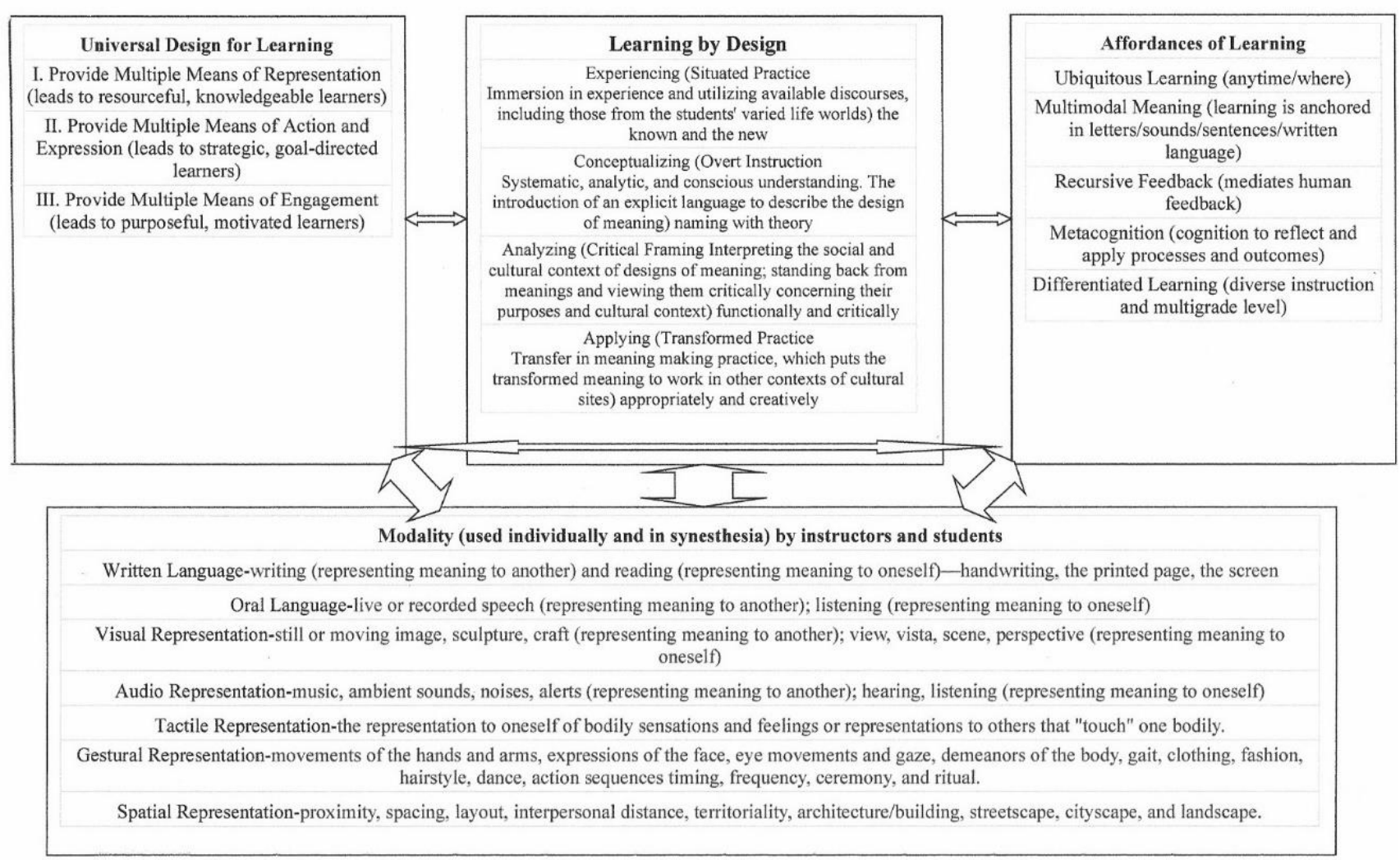
My study identified participant appreciation of flexibility in the learning ecosystems. The participants voiced gratitude for learning on their own terms, on their own time, and at their own pace in the interviews. Autonomy and choice helped professional relevancy and interest (Elmore, 2004) for teachers as students in the courses. Finally, online learning ecosystems and emerging technologies go together because an online environment provides a perfect opportunity to try new technologies. By discussing presenters of professional learning, teaching multimodalities, learning ecosystems, and emerging technologies, I have shown how educators use multimodalities as a conduit to construct knowledge through universal design, learning by design, and affordances of learning opportunities.

Multimodal, Universal, Design, Affordance Framework

By incorporating UDL and the Learning by Design and Affordances of Learning frameworks to multimodalities, I have developed a framework that aids in understanding their interaction, relationships, and adherence to a universal, accessible, transformative curriculum process that is built upon multimodality usage (see Figure 2). Synthesizing these concepts has led to the MUDA Framework. Universal design for learning encompasses multiple means of representation, provides multiple means of action and expression, and provides multiple means of engagement. Additionally, the Learning by Design framework allows for experiencing, conceptualizing, analyzing, and applying. Finally, the Affordances of Learning framework allows for ubiquitous learning, multimodal meaning, recursive feedback, metacognition, and differentiated learning. By implementing multimodal usage, such as written language, oral language, visual representation, audio representation, tactile representation, gestural representation, and spatial representation, the means of achieving best practices in education are defined, supported, and built upon. This immersive experience is education. By understanding the components, educators and students can better understand the concepts, objectives, and outcomes that lead to best practices in learning for all.

Figure 2

Multimodal, Universal, Design, and Affordance Framework



Implications of Findings for Practitioners

Multimodalities are omnipresent in education and, therefore, there are multitudes of implications of findings for practitioners in my study. Roles such as presenters of professional learning, stakeholders in personal learning networks, collaborators in PLCs, teachers as students, college students, K-12 students, college faculty, board members, and designers of curriculum can parlay the findings of my study into their careers, curriculum, and academic goals. Because the themes that emerged encompass the realm of education, the data can be drawn from to inform best practices for teaching and learning (Netolicky, 2020). Some implications for practitioners follow.

Regarding presenters of professional learning, implications abound and include collaborating with course designers to address multimodal content and delivery to focus on personalization, engagement, and transferability. In doing so, learning emergent technologies will be implemented. Additionally, learning ecosystems will be enhanced and collaborative opportunities will flourish. A more thorough understanding of semiotic resources and grammar usage in courses will lead to bridging of content, delivery, and student success.

Implications of my study lead to students of professional learning implementing multimodalities in diverse and multiple ecosystems. Upon doing so, students take on the role of teacher through instructional modeling, providing flexible access, modeling personalization, and requiring application. This implication allows for the recursive process for the students of professional learning to implement what was learned in their roles as students and as teachers.

Peer relationships flourish in education, which is a collaborative concept. By embracing peer relationships that are formal and informal, teachers can teach their peers, themselves, and

their students to channel multimodal usage. Technology has enhanced peer opportunities for collaboration and subsequently is an implication of my study.

The findings of my study have implications for administrators, curriculum designers, and lawmakers, who would benefit by learning about the emergence of multimodal learning. By specifically addressing multimodal concepts and prioritizing educator training in the area, they may develop funding models that provide access for all educators to learn multimodalities as well as provide unlimited access to professional learning opportunities.

The emergence of the MUDA Framework is a graphic organizer to aid educators and students in the usage of multimodalities as they utilize UDL and the Learning by Design and Affordances of Learning frameworks. Through MUDA Framework's vast, versatile, comprehensive, theoretical design, all components of education and learning are addressed.

By providing opportunities for practitioners to consume the knowledge of this study, they may remix the learning components into their own personalized learning opportunities. Subsequently, the learner can then transfer, engage, meet learning needs, model instruction, collaborate with peers, be students, offer flexible multimodal access, model personalization, and apply their learnings within the MUDA Framework. Additional opportunities for further research abound with the MUDA Framework and themes of my study.

Implications of Findings for Future Research

Making meaning of multimodalities in professional learning for teachers is fused with the ever-changing fields of education and technology. Successful professional learning opportunities impact teachers and students, reinforce prior knowledge, and may incorporate new skills, technologies, and concepts. Future studies that should be researched based on my findings are as follows.

Exploring synesthesia and the relationships between modes would be beneficial to better understand the implementation and impact of multimodalities. By exploring the blending of transmodal (text elements that reach across modes), intermodal (containing links between modes that stand alone but cross-reference each other), and intramodal/synesthesia (combine to make meaning) opportunities, making meaning with multimodalities can be explored.

Focusing on the remixing of multimodal presentations would be intriguing and allow for a better understanding of multimodal usage, assessment, and how multimodalities combine to complete a project. Specifically, learning about how multimodal concepts and ideas are presented by student populations (teachers as students in professional learning opportunities, preservice teachers, K-12 students in general classrooms, K-12 students in unique settings such as special needs, second language learners, or gifted/talented settings) and applied.

Future research could be applicable to multimodal usage in school leadership areas, such as principals, school boards, and PLNs/PLCs. Based on leadership components from Northouse (2007), leadership: (a) is a process, (b) involves influence, (c) occurs within a group process, and (d) involves goal attainment. Exploring how multimodal usage impacts school leadership and school district leadership may lead to a better understanding of semiotic grammar in school leadership settings. Learning about how multimodalities manifest in educational settings that may be separate from a classroom environment may show multimodality saturation and usage. My research leads to exploring how multimodalities flourish specifically in leadership roles and how they support educators in those leadership roles. Taking my findings to an additional space of focusing on the informal and formal roles of teacher leadership would aid in exploring the loosely defined field of teacher leadership and how multimodal grammar manifests in that space.

An additional implication for future research is to explore the funding options in professional learning and how funding is prioritized, defined, and resources such as time and technologies are allocated for support. My study touched on access, equity, and inclusion. Yet, there are many concepts that still need to be addressed. For instance, how do students in professional learning have access to additional coursework and funding for that coursework? The cost for college tuition seems to be constantly increasing and may price out some educators. How are teachers supposed to remain current if they are unable to afford continuing their education? Similarly, what costs are prohibitive to students in American communities and around the world that want to use technology, but are not able to do so?

Learning more about peer feedback and collaboration regarding multimodal usage in peer settings, such as PLNs, PLC, and professional courses should be explored. Peer-to-peer work embodies multimodal usage, so exploring collaborative work would allow for a better understanding of group dynamics and education with multimodalities.

K-12 or college student understanding of multimodal technologies, learning environments, and remixing would provide a window into the student perspective on how multimodalities are learned, understood, and used in a K-12 setting or college setting. By situating the research through the phenomenon of the student experience, a researcher could learn more from the perspective of students as well as how students learn and then teach multimodalities.

Making learning relevant for teachers and students is rife for future research opportunities. Teaching seems to consistently have additional challenges in the classroom and beyond. Because retaining teachers is a consistent issue, it is important to support teacher learning in ways that are personally and professionally relevant to them. This concept also rings

true for students. Societal issues such as parent involvement, weapons in schools, funding for technology, access, equity, inclusion, and curriculum are some of the arenas that are of concern for stakeholders in education. Putting a research lens on these topics, as relatable to multimodalities, may provide opportunities to better understand how to recruit, retain, and revive educators and students.

Learning ecosystems allows for the nurturing, supporting, and growing of multimodal learning. Differing delivery techniques provide more access for a wider range of learners and, therefore, abound with research opportunities. Challenges such as students turning off their screens, access to technology, and attendance open the door to additional research opportunities. Concentrating multimodal learning within specific content areas, special needs, language acquisition, and teacher leadership roles would allow for a myriad of research studies The intersection of multimodalities to differing settings, tools, and concepts could aid the understanding of their impact and best practices.

Multimodalities as grammar allow for the understanding of a new systemic functional linguistics that is allowing educators to communicate in different, expedited ways that mirror society. This new, diverse, flexible grammar supports intertwining of learning and society with content and delivery, moving away from monolinguistic culture. The impact of this grammar is worldwide, while also being individual. Focusing on frameworks such as UDL, Learning by Design, and Affordances of Learning allows for researchers to comprehend and understand prior research and may then build on that foundation in different directions of importance. These frameworks allow for research to continue in varied ways that will help presenters of professional learning, teachers, and students maximize learning opportunities and best practices.

Limitations

Limitations in this study occurred, yet rigor was not compromised. Implications need to be acknowledged as they may limit transferability in some instances. The limitations of this study included the course offerings, diversity of participants of the study, regions of the study, place in time of the study, and researcher stance. These limitations will be addressed in succession.

Course offerings from iLC were presented in the spring of 2023 from mid-January through mid-May. The courses were separate and had different curricular goals. Subsequently, their delivery was similar, and the content was diverse. This aided in the thick, rich description of the study. Because of the vast difference of course offerings of iLC, with over 50 courses to choose from, one of the other 48 courses may have provided different, but similar views on the world of multimodalities in professional learning.

An additional limitation was that of the participants. A diverse population was sought through purposeful sampling (Creswell, 2008). The participants self-identified as female and White. This led to a limitation in diversity that must be acknowledged. Through the outreach process, there were eight people that replied that were interested in the study, and for that I am thankful; those people moved forward and continued through the study. However, differing cultures, viewpoints, and genders may have provided differing results and, similarly, a greater opportunity for transferability.

The regions of the study were addressed through the course offerings as were the reasons for taking the iLC courses. Two regions were covered--that of the entire state of Colorado, for the Culturally Responsive Educator and Personalized Learning Innovations course, and that of the Introduction to Data Analysis for Tiered Students course, at an online school in Arizona.

Though different settings amongst the two offerings, the course regions of the United States do not include most locales. State departments of education have differing laws and goals, so the prior course may or may not be necessary according to those state departments of education. Each school across the United States has differing priorities and professional learning needs so the later course may or may not be relevant in those settings. However, the concepts of making meaning of modalities in professional learning were addressed in this study and, therefore, are relevant to educators and students in varied roles nationally.

Because this was a case study and was bound in time, there are points in time yet to come that may provide differing insights in multimodal technologies as they emerge. Because education and technology are both evolving and affecting each other, there may be unknown future opportunities that help or hinder multimodalities in education. For instance, at one point in time of this study, emergency remote teaching by way of the Covid epidemic was one of the main issues of teaching. While that era's impacts will last for some time, new phenomena have emerged, such as ChatGPT. The future is yet to be seen, and educators and students will use their skill sets to understand the technologies at hand and use them to their benefit. Therefore, the limitation of place in time may resonate regarding transferability for future research.

The final limitation related to the personal experience that I have as an educator and student through my educational and technological experiences. I disclosed my stance as a researcher and shared my experiences that led me to have interest in this topic. I bracketed my past and current professional, academic, and personal lives from the study. As research was conducted, as sampling occurred, and as codes emerged, I was able to separate my experiences from those of the participants. I then implemented member checking, a thick, rich description of the data, utilized a research journal, and aimed for best practices in triangulation. Therefore, the

results were presented to the reader with my researcher stance being excluded for affecting the results and data analysis. The reader is, therefore, able to read this study and know that it is credible, dependable, transferable, and confirmable.

The limitations of this study include the course offerings, diversity of participants of the study, regions of the study, place in time of the study, and researcher stance. The reader has been provided these limitations openly and transparently and is able to assess the rigor and transferability of the study.

Concluding Summary

My goal in my study was to understand the phenomena of making meaning of multimodalities in teacher professional learning. The data collected and analyzed were determined to emerge in 10 themes: (a) personalization; (b) transferability; (c) engagement; (d) meeting student learning needs; (e) instructional models; (f) peers; (g) students, providing flexible access; (h) modeling personalization; and (j) requiring application. The themes helped me construct meaning and addressed the research questions:

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

Answering the research questions led to applications and implications for presenters of professional learning, teachers, and students. Participants defined multimodalities as content through written language, oral language, visual representation, audio representation, tactile representation, gestural representation, and spatial representation and that multimodalities deliver course content, support learning, and diversify means of representation. Multimodalities, in a manifested grammar, carry and convey meaning through content and methods. When applied to

differing frameworks and concepts, such as UDL and the frameworks of Learning by Design and Affordances of Learning, meaning was constructed for stakeholders through multimodal grammar. This grammar was reflexive and led to the creation of knowledge, thus creating additional learning and multimodal usages, in person and online, as it manifested in differing ecosystems, often through technological representation.

Educators were open to learning the skills and content necessary for multimodal usage as it pertained to their careers. Because technological tools abound in education, the world has, indeed, been remade as John Dewey stated in 1900.

> One can hardly believe there has been a revolution in all history so rapid, so extensive, and so complete. Through it, the face of the earth is making over, even as to its physical forms; political boundaries are wiped out and move about. . . . That this revolution should not affect education in some other than a formal and superficial fashion is inconceivable. (p. 7)

Human intelligence has allowed for technologies to help them, and through necessity, things have been invented. The current state of the human educational experience is built on past knowledge, conveyed through educational means, and leads us to where we are today. Presenters of professional learning, teachers, and students face challenges; however, multimodalities aid in meeting those challenges. The learning process is not always equitable, yet there are frameworks, multimodalities, and technologies in place that can nurture, support, and provide opportunities for all. As boundaries, whether physical or theoretical, are wiped out and the world is being made over through a technological revolution, educators embrace the revolution, make meaning through multimodal learning, and convey meaning of the world to their students. There is much to be learned, and through multimodalities and semiotic resource grammar, ways to construct

and convey content are flourishing. Professional learning abounds, and the world is in good hands with presenters of professional learning, teachers, and students.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

UNIVERSITY OF
NORTHERN COLORADO

Date: 01/25/2023

Principal Investigator: Jonathan Shaw

Committee Action: **IRB EXEMPT DETERMINATION – New Protocol**

Action Date: 01/25/2023

Protocol Number: 2212047025

Protocol Title: Making Meaning of Multimodalities in Teacher Professional

Learning Expiration Date:

The University of Northern Colorado Institutional Review Board has reviewed your protocol and determined your project to be exempt under 45 CFR 46.104(d)(701) (702) for research involving

Category 1 (2018): RESEARCH CONDUCTED IN EDUCATIONAL SETTINGS. Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational
practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Category 2 (2018): EDUCATIONAL TESTS, SURVEYS, INTERVIEWS, OR OBSERVATIONS OF PUBLIC BEHAVIOR. Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; (ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7).

You may begin conducting your research as outlined in your protocol. Your study does not require further review from the IRB, unless changes need to be made to your approved protocol.

As the Principal Investigator (PI), you are still responsible for contacting the UNC IRB office if and when:

- You wish to deviate from the described protocol and would like to formally submit a modification request. Prior IRB approval must be obtained before any changes can be implemented (except to eliminate an immediate hazard to research participants).
- You make changes to the research personnel working on this study (add or drop research staff on this protocol).
- At the end of the study or before you leave The University of Northern Colorado and are no longer a student or employee, to request your protocol be closed. *You cannot continue to reference UNC on any documents (including the informed consent form) or conduct the study under the auspices of UNC if you are no longer a student/employee of this university.
- You have received or have been made aware of any complaints, problems, or adverse events that are related or possibly related to participation in the research.

If you have any questions, please contact the Research Compliance Manager, Nicole Morse, at 970-351-1910 or via e-mail at nicole.morse@unco.edu. Additional information concerning the requirements for the protection of human subjects may be found at the Office of Human Research Protection website - http://hhs.gov/ohrp/ and https://www.unco.edu/research/research-integrity-and- compliance/institutional-review-board/.

Sincerely,

Nicole Morse
Research Compliance Manager

University of Northern Colorado: FWA00000784

APPENDIX B

ANNOUNCEMENT FOR PARTICIPATION IN THE STUDY

December 15, 2022

Dear Potential Participant,

As part of my doctoral dissertation, Making Meaning of Multimodalities in Teacher Professional Learning, I would sincerely appreciate your participation in the project. The project is focusing on the questions:

- Q1 How are presenters of professional learning for teachers defining multimodalities?
- Q2 How are presenters of professional learning for teachers using multimodalities in their instruction?
- Q3 What means of influence have shaped teacher leaders to instruct multimodalities?

Because of your perspective in education, I would appreciate you taking part as a subject in the study.

This would entail about an hour of your time for an interview and allow for your coursework to be observed.

Would you consider taking some time to aid with this study? If possible, I would appreciate doing the interview in January of 2023

If you are interested in participating, please let me know what time works best for you.
The results of the study will be presented anonymously via the dissertation process.

Sincerely,

Jon Shaw

APPENDIX C

PARTICIPANT VOLUNTEER FORM

Participant Volunteer Form

December 15, 2022

Please read this carefully before signing this document

I wish to volunteer to help with the research project known as Making Meaning of Multimodalities in Teacher Professional Learning I understand that by volunteering, I am signing up to participate in:

- A one-hour virtual meeting interview, and potential follow up with answers.
- Allow for my work to be observed.

I understand that participation is voluntary.

I would like to participate on which evening between March 10-30, 2023.

_____ ____ _____

(Student Name) Age* (Date)

_____ _____

(Email) (Phone Number)

*You must be at least 18 years old to participate.

APPENDIX D

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH
UNIVERSITY OF NORTHERN COLORADO

Project Title: Making Meaning of Multimodalities in Teacher Professional Learning
Researcher: Jonathan Shaw, Doctoral Student, Higher Education and Student Affairs Leadership
Email Shaw5130@bears.unco.edu
Advisors: Linda Vogel and Matthew Farber
Phone Numbers: Linda Vogel-(970)-351-2119; Matthew Farber-(970)-351-1981
Emails: linda.vogel@unco.edu and matthew.farber@unco.edu

Purpose and Description: The primary purpose of this study is to understand how instructors of teacher professional learning and teachers make meaning of multimodalities in professional learning. Data will be conducted in an iLearn Collaborative course from instructors and teachers as students. One interview and coursework analysis will be used to understand multimodality instruction. This information can be applied to develop strategies regarding best practices in multimodalities and educational technology.

Through participating in the interview and allowing for your coursework to be observed, you will be invited to share your experiences and perceptions. Your experiences, along with other members of this study, will be transcribed and analyzed to develop several core themes describing this phenomenon. I estimate that the interview session will take approximately sixty minutes and you may be contacted for further clarification in confirming the accuracy of the interview or course materials. You will be sent transcriptions of the interview to check for accuracy one week after the interview takes place.

You may discontinue the interview or participation in the study at any time.

Your personal information will be altered as I will assign a pseudonym for you, or I will ask you for a pseudonym. Data that is collected will be shared with you for accuracy.

Data collected and analyzed for this study will be kept in a password protected file in the investigator's office. Only pseudonyms will be used to report data.

The cost for participating in this study is the time invested in participating in the interview. Potential risks are not greater than those that might be encountered in a classroom environment or a conversation with a colleague about one's career goals.

Please feel free to email Jonathan Shaw at Shaw5130@bears.unco.edu if you have any questions or concerns about this research and please retain one copy of this letter for your records.

Thank you for assisting with this research

Sincerely,
Jonathan Shaw

Participation is voluntary. You may decide not to participate in this study and if you begin participation, you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research. A copy of this form will be given to you via email to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Nicole Morse, Office of Research, Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

_____	_____
Participant's Full Name (please print)	Participant's Email
_____	_____
Participant's Signature	Date
_____	_____
Researcher's Signature	Date

APPENDIX E

PARTICIPANT DEMOGRAPHIC QUESTIONNAIRE

PARTICIPANT DEMOGRAPHIC QUESTIONNAIRE

Please answer these questions as you feel comfortable:

Pseudonym: _____

Age: _____

Identified Sex: _____

Highest Level of Education Completed: _____

Ethnicity: _____

Occupation: _____

Years Teaching and at what Grade Level(s): _____

Please include any other information you feel is important for us to know, in relation to your participation in this study.

_____

_____

_____

APPENDIX F

INTERVIEW QUESTIONS FOR ALL PARTICIPANTS (INSTRUCTOR AND STUDENTS)

UNIVERSITY OF NORTHERN COLORADO

QUESTIONS FOR PARTICIPANTS

To better understand making meaning of multimodalities in teacher professional learning, the following questions will pertain to the study:

Research Questions

Q1 How are presenters of professional learning for teachers defining multimodalities?

Q2 What influences have shaped teacher leaders to use multimodalities?

Q3 How are presenters of professional learning for teachers using multimodalities in their instruction?

Interview Questions

INSTRUCTORS

Tell me about your journey to become an instructional leader and how multimodalities influenced that journey?

What was your teacher training like regarding multimodalities? How would that look for preservice teachers today?

How do you feel multimodalities are best presented to teachers, and what is the best way for teachers to learn them?

When is a good time for teacher professional learning using and implementing multimodalities?

How do you use emerging technologies as they relate to multimodalities?

Do you feel that multimodalities work best in concert or individually? Why?

What do you look for as teachers implement multimodalities?

What feedback do you seek regarding your lessons and the subsequent implementation of your ideas?

What do you define as a mode/multimodality?

How do modes and multimodalities work best?

How do you use multimodalities in your instruction?

Where do you see the future of teaching going?

TEACHERS

Tell me about your journey to become a teacher and how multimodalities influenced that journey?

What was your teacher training like regarding multimodalities? How would that look for preservice teachers today?

How do you feel multimodalities are best presented to teachers, and what is the best way for teachers to learn them?

When is a good time for teacher professional learning using and implementing multimodalities?

How do you use emerging technologies as they relate to multimodalities?

Do you feel that multimodalities work best in concert or individually? Why?

What do you look for as teachers implement multimodalities?

What feedback do you seek regarding your lessons and the subsequent implementation of your ideas?

What do you define as a mode/multimodality?
How do modes and multimodalities work best?
How do you use multimodalities in your instruction?
Where do you see the future of teaching going?

APPENDIX G

OBSERVATION INSTRUMENT

0 for "No"; 1 for "Yes"	Lessons
Modality	
Written Language	
Oral Language	
Visual Representation	
Audio Representation	
Tactile Representation	
Gestural Respresentation	
Spatial Representation	
Affordance of Learning	
Ubiquitous Learning (anytime/where)	
Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language)	
Recursive Feedback (mediates human feedback)	
Metacognition (cognition to reflect and apply processes and outcomes)	
Differentiated Learning (diverse instruction and multigrade level)	
Accessibility (addresses constraints to tools) *Immersive Reader only	
Learning by Design Framework	
Experiencing (Situated Practice) Immersion in experience and utilizing available discourses, including those from the students' varied lifeworlds.)	
*the known	
*the new	
Conceptualizing (Overt Instruction Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.)	
*by naming	
*with theory	
Analyzing (Critical Framing Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.)	
*functionally	
*critically	
Applying (Transformed Practice Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.)	
*Appropriately	
*Creatively	

Universal Design For Learning	
I. Provide Multiple Means of Representation (leads to resourceful, knowledgeable learners)	
1 options for perception *Immersive Reader	
1.1 Offer ways of customizing display information	
1.2 offer alternatives for auditory information (captions	
1.3 offer alternatives for visual information	
2. Provide options of language, mathematical expressions, and symbols	
2.1 Clarify vocabulary and symbols	
2.2 Clarify Syntax and structure	
2.3 Support decoding of text, mathetmatical notation, and symbols	
2.4 Promote understanding across languages	
2.5 Illustrate through multiple media	
3. Provide options for comprehension	
3.1 Activate or supply background knowledge	
3.2 highlight patterns, critical features, big ideas, and relationships	
Guide information processing, visualization, and manipulation	
Maximize transfer and generalization	
II. Provide Multiple Means of Action and Expression (leads to strategic, goal-directed learners)	
4. Provide options for physcial action	
4.1 Vary the methods for response and navigation	
4.2 Optimize access to tools and assistive technologies	
5 Provide options for expression and communication	
5.1 Use multiple media for communication	
5.2 Use multiple tools for construction and composition	
5.3 Build fluencies with graduated levels of support for practice and support	
6 Provide options for executive functions	
6.1 Guide appropriate goal setting	
6.2 Support planning and stragey development	
6.3 Facilitate managing information and resources	
6.4 Enhance capacity for monitoring progress	
III. Provide Multiple Means of Engagement (leads to purposeful, motivated learners)	
7 Provide options for recruiting interest	
7.1 Optimize individual choice and autonomy	
7.2 Optimize relevance, value, and authenticity	
7.3 Minimize threats and distractions	
8 Provide options for sustaining and persistence	
8.1 Heighten salience of goals and objectives	
8.2 Vary demands and resources to optimize challenge	
8.3 Foster collaboration and community	
8.4 Increase mastery-oriented feedback (is there feedback from facilitator?)	
9 Provide options for self-regulation	
9.1 Promote expectations and beliefs that optimize motivation	

9.2 facilitate personal coping skills and strategies	
9.3 Develop self-assessment and reflection	
Are there any noticeable Barriers?	
Ecology	

APPENDIX H

OBSERVATION INSTRUMENT FOR CULTURALLY RESPONSIVE EDUCATOR AND PERSONAL LEARNING INNOVATIONS CLASS

0 for "No"; 1 for "Yes"	CRE Syllabus	Unit 1: Self Awareness and Responsibility in a Culturally Relevant Classroom Video and Course Content	1.1 Peer Observation	1.3 Set Your Learning Goal
Modality				
Written Language	1	1	1	1
Oral Language	1	1	0	0
Visual Representation	1	1	1	1
Audio Representation	1	1	0	0
Tactile Representation	0	0	0	0
Gestural Representation	1	1	0	0
Spatial Representation	1	1	1	1
Affordance of Learning				
Ubiquitous Learning (anytime/where)	1	1	1	1
Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language)	1	1	1	1
Recursive Feedback (mediates human feedback)	0	0	1	1
Metacognition (cognition to reflect and apply processes and outcomes)	1	1	1	1
Differentiated Learning (diverse instruction and multigrade level)	0	1	1	1
Accessibility (addresses constraints to tools) *Immersive Reader only	0	1		

Learning by Design Framework				
Experiencing (Situated Practice) **Immersion in experience and utilizing available discourses, including those from the students' varied life worlds.)**	0	1	1	1
*the known	0	1	1	1
*the new	1	1	1	1
Conceptualizing (Overt Instruction **Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.)**	1	1		
*by naming	1	1	1	1
*with theory	0	1	1	1
Analyzing (Critical Framing Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.)	1	1	1	1
*functionally	1	1	1	1
*critically	1	1	1	1
Applying (Transformed Practice **Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.)**	1	1	1	1
*Appropriately	1	1	1	1
*Creatively	1	1	1	1
Universal Design For Learning				
I. Provide Multiple Means of Representation (leads to resourceful, knowledgeable learners)		1		
1 options for perception *Immersive Reader	0	1	1	1

1.1 Offer ways of customizing display information	0	1	0	0
1.2 offer alternatives for auditory information (captions	0	1	1	1
1.3 offer alternatives for visual information	0	1	0	0
2. Provide options of language, mathematical expressions, and symbols	0	0	1	1
2.1 Clarify vocabulary and symbols	0	1	1	1
2.2 Clarify Syntax and structure	0	1	1	1
2.3 Support decoding of text, mathematical notation, and symbols	0	1	0	0
2.4 Promote understanding across languages	0	0	0	0
2.5 Illustrate through multiple media	0	1	1	1
3. Provide options for comprehension	0	1	0	0
3.1 Activate or supply background knowledge	0	1	1	1
3.2 highlight patterns, critical features, big ideas, and relationships	1	1	1	1
Guide information processing, visualization, and manipulation	0	1	1	1
Maximize transfer and generalization	0	1	1	1
II. Provide Multiple Means of Action and Expression (leads to strategic, goal-directed learners)				
4. Provide options for physical action	0	0	0	0
4.1 Vary the methods for response and navigation	0	1	1	1
4.2 Optimize access to tools and assistive technologies	0	1	0	0
5 Provide options for expression and communication	0	1	1	1
5.1 Use multiple media for communication	0	1	0	0

5.2 Use multiple tools for construction and composition	0	1	0	0
5.3 Build fluencies with graduated levels of support for practice and support	0	1	1	1
6 Provide options for executive functions	0	1	1	1
6.1 Guide appropriate goal setting	1	1	1	1
6.2 Support planning and strategy development	1	1	1	1
6.3 Facilitate managing information and resources	1	1	1	1
6.4 Enhance capacity for monitoring progress	1	1	1	1
III. Provide Multiple Means of Engagement (leads to purposeful, motivated learners)				
7 Provide options for recruiting interest	0	1	1	1
7.1 Optimize individual choice and autonomy	0	1	1	1
7.2 Optimize relevance, value, and authenticity	0	1	1	1
7.3 Minimize threats and distractions	0	1	1	1
8 Provide options for sustaining and persistence	0	1	1	1
8.1 Heighten salience of goals and objectives	1	1	1	1
8.2 Vary demands and resources to optimize challenge	0	1	1	1
8.3 Foster collaboration and community	0	1	1	1
8.4 Increase mastery-oriented feedback (is there feedback from facilitator?)	0	1	1	1
9 Provide options for self-regulation	0	1	1	1
9.1 Promote expectations and beliefs that optimize motivation	1	1	1	1
9.2 facilitate personal coping skills and strategies	0	1	1	1

9.3 Develop self-assessment and reflection	0	1	1	1
Are there any noticeable Barriers?	0	0	0	0
Ecology	Asynchronous, online	Asynchronous, online	Asynchronous, online	Asynchronous, online

0 for "No"; 1 for "Yes"	1.7 Literacy Strategy Implementation	1.9 Four "A"s Text Protocol Student Agency	1.11 Learn and Apply	2.2 Choice Boards
Modality				
Written Language	1	1	1	1
Oral Language	0	0	0	0
Visual Representation	1	1	1	1
Audio Representation	0	0		0
Tactile Representation	0	0	0	0
Gestural Representation	0	0	0	0
Spatial Representation	1	1	1	1
Affordance of Learning				
Ubiquitous Learning (anytime/where)	1	1	1	1
Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language)	1	1	1	1
Recursive Feedback (mediates human feedback)	1	1	1	1
Metacognition (cognition to reflect and apply processes and outcomes)	1	1	1	1
Differentiated Learning (diverse instruction and multigrade level)	1	1	1	1
Accessibility (addresses constraints to tools) *Immersive Reader only				
Learning by Design Framework				
Experiencing (Situated Practice) Immersion in experience and utilizing available discourses, including those from the students' varied life worlds.)	1	1	1	1
*the known	1	1	1	1
*the new	1	1	1	1

Conceptualizing (Overt Instruction Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.)				1
*by naming	1	1	1	1
*with theory	1	1	1	1
Analyzing (Critical Framing Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.)	1	1	1	1
*functionally	1	1	1	1
*critically	1	1	1	1
Applying (Transformed Practice Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.)	1	1	1	1
*Appropriately	1	1	1	1
*Creatively	1	1	1	1
Universal Design For Learning				
I. Provide Multiple Means of Representation (leads to resourceful, knowledgeable learners)				
1 options for perception *Immersive Reader	1	1	1	1
1.1 Offer ways of customizing display information	0	0	0	0
1.2 offer alternatives for auditory information (captions	1	1	1	1
1.3 offer alternatives for visual information	0	0	0	0
2. Provide options of language, mathematical expressions, and symbols	1	1	1	1
2.1 Clarify vocabulary and symbols	1	1	1	1
2.2 Clarify Syntax and structure	1	1	1	1

2.3 Support decoding of text, mathematical notation, and symbols	0	0	0	0
2.4 Promote understanding across languages	0	0	0	0
2.5 Illustrate through multiple media	1	1	1	1
3. Provide options for comprehension	0	0	0	0
3.1 Activate or supply background knowledge	1	1	1	1
3.2 highlight patterns, critical features, big ideas, and relationships	1	1	1	1
Guide information processing, visualization, and manipulation	1	1	1	1
Maximize transfer and generalization	1	1	1	1
II. Provide Multiple Means of Action and Expression (leads to strategic, goal-directed learners)				
4. Provide options for physical action	0	0	0	0
4.1 Vary the methods for response and navigation	1	1	1	1
4.2 Optimize access to tools and assistive technologies	0	0	0	0
5 Provide options for expression and communication	1	1	1	1
5.1 Use multiple media for communication	0	0	0	0
5.2 Use multiple tools for construction and composition	0	0	0	0
5.3 Build fluencies with graduated levels of support for practice and support	1	1	1	1
6 Provide options for executive functions	1	1	1	1
6.1 Guide appropriate goal setting	1	1	1	1
6.2 Support planning and strategy development	1	1	1	1
6.3 Facilitate managing information and resources	1	1	1	1
6.4 Enhance capacity for monitoring progress	1	1	1	1

III. Provide Multiple Means of Engagement (leads to purposeful, motivated learners)				
7 Provide options for recruiting interest	1	1	1	1
7.1 Optimize individual choice and autonomy	1	1	1	1
7.2 Optimize relevance, value, and authenticity	1	1	1	1
7.3 Minimize threats and distractions	1	1	1	1
8 Provide options for sustaining and persistence	1	1	1	1
8.1 Heighten salience of goals and objectives	1	1	1	1
8.2 Vary demands and resources to optimize challenge	1	1	1	1
8.3 Foster collaboration and community	1	1	1	1
8.4 Increase mastery-oriented feedback (is there feedback from facilitator?)	1	1	1	1
9 Provide options for self-regulation	1	1	1	1
9.1 Promote expectations and beliefs that optimize motivation	1	1	1	1
9.2 facilitate personal coping skills and strategies	1	1	1	1
9.3 Develop self-assessment and reflection	1	1	1	1
Are there any noticeable Barriers?	0	0	0	0
Ecology	Asynchronous, online	Asynchronous, online	Asynchronous, online	Asynchronous, online

0 for "No"; 1 for "Yes"	3.1 Ready for Rigor Framework	Strategies for Teaching English Language Learners	Assessment and Progress Monitoring Strategies in Your Culturally Relevant Classroom	Learn and Apply and Peer Observation
Modality				
Written Language	1	1	1	1
Oral Language	0	0	0	0
Visual Representation	1	1	1	1
Audio Representation	0	0	0	0
Tactile Representation	0	0	0	0
Gestural Representation	0	0	0	0
Spatial Representation	1	1	1	1
Affordance of Learning				
Ubiquitous Learning (anytime/where)	1	1	1	1
Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language)	1	1	1	1
Recursive Feedback (mediates human feedback)	1	1	1	1
Metacognition (cognition to reflect and apply processes and outcomes)	1	1	1	1
Differentiated Learning (diverse instruction and multigrade level)	1	1	1	1
Accessibility (addresses constraints to tools) *Immersive Reader only				
Learning by Design Framework				
Experiencing (Situated Practice) Immersion in experience and utilizing available discourses, including those from the students' varied life worlds.)	1	1	1	1
*the known	1	1	1	1
*the new	1	1	1	1

Conceptualizing (Overt Instruction Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.)	1	1	1	1
*by naming	1	1	1	1
*with theory	1	1	1	1
Analyzing (Critical Framing Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.)	1	1	1	1
*functionally	1	1	1	1
*critically	1	1	1	1
Applying (Transformed Practice Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.)	1	1	1	1
*Appropriately	1	1	1	1
*Creatively	1	1	1	1
Universal Design For Learning				
I. Provide Multiple Means of Representation (leads to resourceful, knowledgeable learners)				
1 options for perception *Immersive Reader	1	1	1	1
1.1 Offer ways of customizing display information	0	0	0	0
1.2 offer alternatives for auditory information (captions	1	1	1	1
1.3 offer alternatives for visual information	0	0	0	0
2. Provide options of language, mathematical expressions, and symbols	1	1	1	1
2.1 Clarify vocabulary and symbols	1	1	1	1
2.2 Clarify Syntax and structure	1	1	1	1

2.3 Support decoding of text, mathetmatical notation, and symbols	0	0	0	0
2.4 Promote understanding across languages	0	0	0	0
2.5 Illustrate through multiple media	1	1	1	1
3. Provide options for comprehension	0	0	0	0
3.1 Activate or supply background knowledge	1	1	1	1
3.2 highlight patterns, critical features, big ideas, and relationships	1	1	1	1
Guide information processing, visualization, and manipulation	1	1	1	1
Maximize transfer and generalization	1	1	1	1
II. Provide Multiple Means of Action and Expression (leads to strategic, goal-directed learners)				
4. Provide options for physcial action	0	0	0	0
4.1 Vary the methods for response and navigation	1	1	1	1
4.2 Optimize access to tools and assistive technologies	0	0	0	0
5 Provide options for expression and communication	1	1	1	1
5.1 Use multiple media for communication	0	0	0	0
5.2 Use multiple tools for construction and composition	0	0	0	0
5.3 Build fluencies with graduated levels of support for practice and support	1	1	1	1
6 Provide options for executive functions	1	1	1	1
6.1 Guide appropriate goal setting	1	1	1	1
6.2 Support planning and stragey development	1	1	1	1
6.3 Facilitate managing information and resources	1	1	1	1
6.4 Enhance capacity for monitoring progress	1	1	1	1

III. Provide Multiple Means of Engagement (leads to purposeful, motivated learners)				
7 Provide options for recruiting interest	1	1	1	1
7.1 Optimize individual choice and autonomy	1	1	1	1
7.2 Optimize relevance, value, and authenticity	1	1	1	1
7.3 Minimize threats and distractions	1	1	1	1
8 Provide options for sustaining and persistence	1	1	1	1
8.1 Heighten salience of goals and objectives	1	1	1	1
8.2 Vary demands and resources to optimize challenge	1	1	1	1
8.3 Foster collaboration and community	1	1	1	1
8.4 Increase mastery-oriented feedback (is there feedback from facilitator?)	1	1	1	1
9 Provide options for self-regulation	1	1	1	1
9.1 Promote expectations and beliefs that optimize motivation	1	1	1	1
9.2 facilitate personal coping skills and strategies	1	1	1	1
9.3 Develop self-assessment and reflection	1	1	1	1
Are there any noticable Barriers?	0	0	0	0
Ecology	Asynchronous, online	Asynchronous, online	Asynchronous, online	Asynchronous, online

APPENDIX I

OBSERVATION INSTRUMENT FOR INTRODUCTION TO DATA ANALYSIS CLASS

0 for "No"; 1 for "Yes"	Syllabus	Topic 1: Getting your Hands on Strong Data	1.3 Assignment: Interm Assessment Examples	1.4 Assignment: Assessment Revision	1.7 Assignment: Personal Mission Statement
Modality					
Written Language	1	1	1	1	1
Oral Language	1	1	1	1	1
Visual Representation	1	1	1	1	1
Audio Representation	1	1	1	1	1
Tactile Representation	0	0	0	0	0
Gestural Respresentation	1	1	0	0	0
Spatial Representation	1	1	1	1	1
Affordance of Learning					
Ubiquitous Learning (anytime/where)	1	1	1	1	1
Multimodal Meaning (learning is anchored in letters/sounds/sentences/written language)	1	1	1	1	1
Recursive Feedback (mediates human feedback)	0	1	1	1	1
Collaborative Intelligence (learning beyond a single learner)	0	1	1	1	1
Metacognition (cognition to reflect and apply processes and outcomes)	1	1	1	1	1
Differentiated Learning (diverse instruction and multigrade level)	0	0	0	0	0
Accessibility (addresses constraints to tools) *Immersive Reader only	0	0	0	0	0
Learning by Design Framework					
Experiencing (Situated Practice	0	1			

Immersion in experience and utilizing available discourses, including those from the students' varied lifeworlds.)					
*the known	0	1	1	1	1
*the new	1	1	1	1	1
Conceptualizing (Overt Instruction Systematic, analytic, and conscious understanding. The introduction of an explicit language to describe the design of meaning.)	1	1	1	1	1
*by naming	1	1	1	1	1
*with theory	0	1	1	1	1
Analyzing (Critical Framing Interpreting the social and cultural context of particular designs of meaning; standing back from meanings and viewing them critically concerning their purposes and cultural context.)	1	1	1	1	1
*functionally	1	1	1	1	1
*critically	1	1	1	1	1
Applying (Transformed Practice Transfer in meaning making practice, which puts the transformed meaning to work in other contexts of cultural sites.)	1	1	1	1	1
*Appropriately	1	1	1	1	1
*Creatively	1	1	1	1	1
Universal Design For Learning					

I. Provide Multiple Means of Representation (leads to resourceful, knowledgeable learners)					
1 options for perception *Immersive Reader	0	1	1	1	1
1.1 Offer ways of customizing display information	0	1	1	1	1
1.2 offer alternatives for auditory information (captions	0	0	1	1	1
1.3 offer alternatives for visual information	0	1	1	1	1
2. Provide options of language, mathematical expressions, and symbols	0	0	0	0	0
2.1 Clarify vocabulary and symbols	0	1	1	1	1
2.2 Clarify Syntax and structure	0	1	1	1	1
2.3 Support decoding of text, mathetmatical notation, and symbols	0	0	0	0	0
2.4 Promote understanding across languages	0	0	0	0	0
2.5 Illustrate through multiple media	0	1	1	1	1
3. Provide options for comprehension	0	1	1	1	1
3.1 Activate or supply background knowledge	0	1	1	1	1
3.2 highlight patterns, critical features, big ideas, and relationships	1	1	1	1	1
Guide information processing, visualization, and manipulation	0	1	1	1	1
Maximize transfer and generalization	0	1	1	1	1

II. Provide Multiple Means of Action and Expression (leads to strategic, goal-directed learners)					
4. Provide options for physcial action	0	0	0	0	0
4.1 Vary the methods for response and navigation	0	1	1	1	1
4.2 Optimize access to tools and assistive technologies	0	0	0	0	0
5 Provide options for expression and communication	0	1	1	1	1
5.1 Use multiple media for communication	0	1	1	1	1
5.2 Use multiple tools for construction and composition	0	1	1	1	1
5.3 Build fluencies with graduated levels of support for practice and support	0	1	1	1	1
6 Provide options for executive functions	0	1	1	1	1
6.1 Guide appropriate goal setting	1	1	1	1	1
6.2 Support planning and stragey development	1	1	1	1	1
6.3 Facilitate managing information and resources	1	1	1	1	1
6.4 Enhance capacity for monitoring progress	1	1	1	1	1
III. Provide Multiple Means of Engagement (leads to purposeful, motivated learners)					
7 Provide options for recruiting interest	0	1	1	1	1
7.1 Optimize individual choice and autonomy	0	1	1	1	1

7.2 Optimize relevance, value, and authenticity	0	1	1	1	1
7.3 Minimize threats and distractions	0	1	1	1	1
8 Provide options for sustaining and persistence	0	1	1	1	1
8.1 Heighten salience of goals and objectives	1	1	1	1	1
8.2 Vary demands and resources to optimize challenge	0	1	1	1	1
8.3 Foster collaboration and community	0	1	1	1	1
8.4 Increase mastery-oriented feedback (is there feedback from facilitator?)	0	1	1	1	1
9 Provide options for self-regulation	0	1	1	1	1
9.1 Promote expectations and beliefs that optimize motivation	1	1	1	1	1
9.2 facilitate personal coping skills and strategies	0	1	1	1	1
9.3 Develop self-assessment and reflection	0	1	1	1	1
Are there any noticable Barriers?	0	0	0	0	0
Ecology	Asynchronous, online	Asynchronous, online	Asynchronous, online	Asynchronous, online	Asynchronous, online