

Bridging Professional Development Gaps in PACRAO Through Gamification

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Abstract

This study examined the extent to which a gamified professional development platform can foster skill development, knowledge application, and engagement among members of the Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO). Grounded in the principles of humanism (Rogers, 1969) and andragogy (Knowles, 1990), and operationalized through gamification (Kapp, 2012), this study evaluated whether game-based mechanics aligned with adult learners' professional development needs within a geographically dispersed regional association. To address these constraints, a prototype gamified platform, *PACRAO University*, was developed to provide a flexible, self-paced, and contextually relevant learning environment. Using a quantitative, within-subjects repeated measures design, this study assessed changes in participants' professional decision-making across paired scenario-based assessments, as well as patterns of behavioral engagement captured through embedded gameplay metrics. Overall, findings did not provide inferential evidence of measurable gains in decision quality across the two scenario sets, but descriptive patterns and substantial participant variability suggest potential differences in how participants engaged with and benefited from the platform. This study contributes an applied test of theory-informed gamified professional development within a regional higher education association context and offers implications for iteration, scaling, and future evaluation designs.

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Chapter 1: Introduction and Background

The Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO) is a non-profit professional development association representing more than 350 regionally accredited 2-year, 4-year, and graduate/professional schools, with membership made up of approximately 1,500 professional admissions officers and registrars. PACRAO is a state/regional branch of the National Organization, the American Association of Collegiate Registrars and Admissions Officers (AACRAO). As one of AACRAO's state and regional associations, PACRAO provides a localized framework through which member institutions complement and adapt national initiatives and standards to the unique institutional landscapes of the western region.

Serving the US states of Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, and Washington; the Territory of Guam; and the provinces of Alberta, British Columbia, Manitoba, and Saskatchewan, Canada, PACRAO supports academic and enrollment services professionals by providing advocacy, networking and resource-sharing across a diverse range of higher education institutions. According to PACRAO's website (2025), the organization's mission is to "... provide its members opportunities to learn, engage, collaborate, inform, gather, contribute, and promote the best practices and general advancement of higher education and our professions," a mission PACRAO carries out by cultivating a regional community of practice that encourages collaboration, transparency, innovation, and professional growth.

To fulfill this mission, PACRAO offers a suite of professional development resources tailored to the evolving needs of the region and its members. These resources include an annual conference and business meeting, periodic training and professional development opportunities throughout the region, a diversity and inclusion book club, and a Leadership Development Institute (LDI). The PACRAO LDI “will expose Cohort participants to the possibility of a transformative journey that will both provide critical knowledge that higher education leaders must possess in order to be effective in their roles. Additionally, the LDI should create inspiration in each participant to be difference-makers and change agents in every community they belong to” (PACRAO, 2025).

As a geographically widespread and diverse organization, PACRAO faces distinct challenges in providing professional development opportunities. Organizations like PACRAO often find traditional professional development, such as frequent in-person training or expensive annual events, are often not feasible or are attempted with an abundance of caution. These constraints require PACRAO to explore alternative, cost-effective strategies to meet the evolving professional development needs of its members. While born out of necessity, this commitment to contextual innovation reflects a deliberate effort to adapt to the region's unique challenges.

This approach may also benefit other regional affiliates that find traditional professional development models lacking in substance or relevance. PACRAO was selected as the community partner for this study because its regional scope, member diversity, and commitment to professional development closely align with the study’s purpose to explore scalable, learner-centered approaches within real professional contexts. A copy of the Community Partnership Agreement is available in Appendix A.

PACRAO's Professional Development Context

Currently, PACRAO's professional development options include an annual conference and business meeting and a series of additional opportunities throughout the year. The annual event spans two and a half days and features content sessions, networking, and vendor engagement opportunities. The annual meeting rotates between subdivisions of the region, and PACRAO generally plans it three years in advance. Member attendance at the conference fluctuates from year to year and participation in sessions varies widely based on topic and relevance. While some sessions focus on the larger community, others are highly specific, which may reduce relevance for certain members.

PACRAO, like many regional professional organizations, emphasizes collegiality, institutional collaboration, and the sharing of practical, experienced-based knowledge across enrollment services domains. PACRAO's activities most visibly reflect values of service, community connection and commitment to access and equity in higher education. Professional development sessions typically focus on functional skills, compliance updates, and emerging challenges in areas like registration, records, systems and admissions. Because conference presentations frequently rely on didactic formats, PACRAO's offerings often prioritize information delivery over reflective or developmental engagement, revealing a need for more dynamic, learner-centered approaches.

Professional Development Challenges and Rationale

While PACRAO's current professional development offerings provide meaningful opportunities for synchronous learning and community engagement, they

provide limited support for ongoing, self-directed learning. The annual conference and other opportunities offer valuable content, but their fixed schedules, forms of feedback, and format constraints limit opportunities for flexible, on-demand engagement that meet the needs of a diverse population of adult learners.

This presents a growing challenge in a region as geographically widespread and financially constrained as PACRAO. With limited budgets, volunteer leadership, and a dispersed membership base, traditional professional development models can be difficult to establish, operate, and maintain. PACRAO requires a flexible, scalable, and self-paced professional development platform that can foster skill development and knowledge application in an engaging, learner-centered environment. I examined this challenge from both an organizational perspective, and an individual professional-development perspective.

From an organizational perspective, such a platform could supplement traditional offerings by expanding access, supporting ongoing engagement, and aligning more intentionally with member needs (Rogers, 1969). By offering on-demand, self-paced, context-specific content, the platform would allow members to participate on their own schedule, accommodating the demands of institutional and personal calendars that characterize the region (Knowles, 1990). This flexibility could help reach professionals who were otherwise excluded by time, cost, or geography. This platform could be designed to support differentiated and autonomous learning, allowing users to explore content most relevant to their specific roles while encouraging reflection, skill development, and knowledge application. At the same time, it is intended to enable professionals, regardless of their position, title, or experience, to gain insights into other

areas of the industry, fostering a broader understanding of the academic and enrollment services profession.

From a professional development perspective, the needs exhibited by PACRAO members aligned structurally with Carl Rogers's (1969) humanist principles of autonomy and personal relevance and Malcolm Knowles's (1990) emphasis on self-directed problem-centered learning as drivers of meaningful professional growth. Because of the annual nature of the conference and business meeting, as well as the scheduling of additional opportunities for engagement, members could not control the pace of the learning experience, the format, or the outcomes of the experience. Presenters could share important content, but there was limited opportunity for practical application of the information and no follow-up to reinforce learning. The didactic nature of the content sessions left members few opportunities to meaningfully engage in skill development or knowledge application. Rather than trying to adapt existing models, or replacing existing offerings, this tool acted as a complementary bridge that extended PACRAO's impact across the service region, while addressing the limitations of its then-current professional development model. To test whether a learner-centered, gamified platform could address these constraints, the present study developed and evaluated a prototype platform—

PACRAO University.

I built a simulated professional development environment, *PACRAO University*, to address the organizational needs of PACRAO while simultaneously providing a structure designed to meet the professional development needs of adult learners in the records and academic services industry. The platform used gamification theory (Kapp, 2012) to address organizational challenges in delivery and content, implemented basic

assumptions of adult learning into the gameplay (Knowles, 1990), and grounded the environment in an experience that fostered autonomy, relevance, and freedom to learn (Rogers, 1969). *PACRAO University* modeled a fictional university where the participant oversaw the environment. For the purposes of this study, I assessed one specific level within a larger structure, allowing a close examination of skill development, knowledge application, and engagement in alignment with professional competencies.

Purpose Statement

The purpose of this study was to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members. Specifically, the study assessed whether the platform, grounded in andragogical (Knowles, 1990) and humanistic (Rogers, 1969) principles, supported self-paced, relevant, and problem-focused learning experiences that enhanced skill development and knowledge application in professional scenarios. In doing so, the project sought to expand access to professional development for higher education professionals who were underserved due to institutional, geographic, or resource limitations, thereby supporting more inclusive participation across the region.

Each research question was intentionally designed to reflect a core dimension of the gamified professional-development platform, skill development, knowledge application and engagement. Together these constructs represent measurable indicators of learning grounded in adult-learning and humanistic principles, emphasizing growth through experience, reflection and autonomy. The study's design connects these constructs directly to the gamified platform's embedded learning mechanisms, allowing

for systematic examination of skill development, knowledge application, and engagement as professional-development outcomes within a higher-education professional context.

Research Questions

This study examined the extent to which a gamified platform supported professional development within a regional higher-education context. I grounded the research questions in the alignment between gamification mechanics and adult learning theory, particularly the principles of andragogy and humanism. Through embedded gameplay scenarios and feedback, the study tested whether this approach promoted meaningful learning outcomes for records and academic services professionals. The overarching goal of this study was to explore whether a gamified platform could serve as an effective professional development tool for adult learners in a regional higher education context. To operationalize this aim, I explored the following research questions:

RQ1. To what extent does the gamified platform foster skill development in professional scenarios?

RQ2. To what extent does the gamified platform foster knowledge application in professional scenarios?

RQ3. To what extent does the gamified platform foster engagement among PACRAO members?

RQ4. What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

For RQ1 (skill development), I used each participant's decision -quality score on paired domain items (Q1-Q4, Q2-Q5, Q3-Q6), which captured improvement in professional

judgment within the same domains across time. RQ2 (knowledge application) I computed composite decision scores compared across the two scenarios. I compared Scenario 1 (Q1-Q3) compared to Scenario 2 (Q4-Q6) to reflect transfer and integration of learning. RQ3 (engagement), I measured engagement through time-based behavioral metrics, including total session duration and per question time, with specific attention to time spent interacting with the feedback. For RQ4, I extended this analysis by examining engagement as a predictor variable. Using the total *time-on-task* composite (aggregated across all six scenario questions, Q1-Q6), I analyzed associations between those time-based engagement indicators and the performance measures used for RQ1 and RQ2.

These questions reflected the study's emphasis on self-directed learning and reflective practice and were evaluated through embedded performance measures within the platform. The findings were intended to offer insight into the potential for gamification to enhance existing professional-development practices in the records and academic services profession.

To contextualize the results beyond statistical significance, this study also established practical-significance thresholds for each construct. These thresholds defined what constituted a meaningful change in skill development, knowledge application, and engagement, ensuring that the findings reflected substantive professional growth rather than minor statistical variation. Details of these thresholds and their analytic criteria are described in further detail in Chapter 3 under *Measures*.

Significance of This Study

For many professionals in the region, especially those constrained by institutional policies and calendars, workload, or geography, traditional models of professional

development did not support sustained or personalized learning. I addressed PACRAO's identified structural and professional development challenges by introducing and evaluating a complementary approach that could integrate with the existing structure and extend its reach and impact. The gamified professional development platform was designed to align with humanistic (Rogers, 1969) and andragogical (Knowles, 1990) principles, using gamification (Kapp, 2012) as a mechanism to implement the framework. The platform provided PACRAO with data-driven insights on how alternative modalities might serve its members more effectively. This study not only created an opportunity for PACRAO to test an innovative professional-development approach but also to model data-informed, member-centered learning strategies that may influence other AACRAO regional associations. The findings may inform other professional associations seeking to diversify their development pathways.

More broadly, this research contributes to the growing body of literature on gamification-based learning in professional development by examining how game-based mechanics intersected with humanistic (Rogers, 1969) and andragogical (Knowles, 1990) principles. The findings may offer scalable insights for other regional or national organizations seeking to modernize their professional-development pathways while remaining responsive to the learners' needs. To ensure clarity in how key ideas were applied throughout the study, the following section defines essential terms.

Definition of Terms

To support clarity and consistency throughout this dissertation, this section defines key terms as they are used in the context of the study. These definitions are

grounded in relevant literature and aligned with the theoretical framework and methodological design outlined in this chapter.

Andragogy

Andragogy is a model of adult learning outlined by Malcolm Knowles (1990), built on six assumptions: Self direction, life experience, readiness to learn, problem-centered orientation, internal motivation, and the need to know. This study applies these assumptions as a lens for evaluating professional development alignment with adult learner needs.

Engagement

In this study, engagement is defined as the behavioral investment a participant demonstrates while interacting with the professional development content embedded within the gamified platform. This study focuses on behavioral engagement as evidenced through time-based metrics which aligns with gamification theory (Kapp, 2012), and reflects andragogical principles (Knowles, 1990) and humanism (Rogers, 1969), in the emphasis on self-direction, persistence, relevance and internal motivation.

Gamification

Kapp (2012) defined gamification as “using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems” (p.10). Within this study, gamification structures learning by acting as the mechanism that operationalizes andragogical principles through progressively unlocked content, decision-based feedback, and real-world scenarios.

Humanism

Humanist learning theory is grounded in the work of Carl Rogers (1969). This theory emphasizes personal growth, autonomy, and self-direction. The theory supports the design of learner-centered environments and underpins the andragogical model.

Knowledge Application

In this study, knowledge application will be defined as the process by which learners transfer or implement what they have previously learned into real-world or job-specific scenarios. This construct will be operationalized through participants' ability to integrate previously encountered concepts and apply them in varied decision-making contexts. This definition aligns with andragogical principles of self-directed and problem-centered learning (Knowles, 1990), and humanist perspectives that emphasize reflection, growth, and the capacity to improve through meaningful feedback (Rogers, 1969).

Professional Development

Professional development in this study is defined as any formal or informal activity designed to enhance job-related knowledge, skills, and reflective capacity for higher educational professionals. This includes, but is not limited to, conferences, webinars, training modules, and gamified platforms. Aligned with Knowles's (1990) model of andragogy, effective professional development should be self-paced, problem-centered, and practical, supporting autonomy and immediate application in professional contexts.

PACRAO

The Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO) is a regional professional organization that supports higher education

enrollment, records, and academic services professionals across the western United States and Pacific territories. Member institutions represent a diverse range of two-year, four-year, public, private, and graduate institutions located within states of Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, and Washington; the Territory of Guam; and the provinces of Alberta, British Columbia, Manitoba, and Saskatchewan, Canada. PACRAO provides professional-development opportunities through its annual conference, workshops, and virtual programming, promoting collaboration, innovation, and leadership development among professionals responsible for academic records, admissions, and enrollment management functions.

Skill Development

In this study, skill development is defined as the progressive improvement of domain specific professional decision-making across key areas of records and academic services functions. It will be assessed through participants' performance on paired scenario-based questions within the same domain, with responses scored using a 1-4 decision quality scale aligned with AACRAO proficiencies. This definition reflects andragogical principles of problem-centered learning (Knowles, 1990), humanist emphasis on growth through authentic experience (Rogers, 1969), and gamification's focus on challenge-based skill progression (Kapp, 2012).

Theoretical Framework

I drew on humanistic learning theory, with andragogy providing the mediating structure necessary to operationalize adult learning. In the study, gamification served as the mechanism that translated the framework components into a usable professional development-platform. Humanistic learning theory emphasizes intrinsic motivation,

personal and professional growth, and reflective learning. Andragogy frames these principles around the unique needs of adult learners, such as self-direction, practical application, and problem-solving. Within this study, gamification was the mechanism by which these unique needs were addressed, via a platform that fostered self-directed learning, intrinsic motivation, engagement, and professional growth.

Humanist Learning Theory

Building on humanistic psychology, Carl Rogers (1969) framed education as a process of personal growth supported by a learning environment that fosters self-direction and respect for the learner's autonomy and individuality. Rogers (1969) emphasized that meaningful learning occurs when learners feel psychologically safe, respected and free to direct their own learning journey. In contrast to traditional models, the educator is positioned to serve as a *facilitator* that creates conditions that support autonomy, empathy and personal relevance. This humanist orientation offered a foundational framework for adult learning by shifting the emphasis from external teaching to internal reflection and discovery and creating the climate for learning to occur.

In *Freedom to Learn*, Rogers (1969) noted that one of the most important conditions to the facilitation of learning is the “attitudinal quality” of the relationship between the facilitator and the learner (p.126). He noted the most effective attitudes being “transparent realness in the facilitator, a willingness to be a person” and “to be and live the feelings and thoughts of the moment” (Rogers, 1969, p.126). He also articulated some guidelines for the facilitation of learning that blend philosophical commitments with practical strategies.

Rogers (1969) outlined some guidelines for the facilitation of learning that included the facilitator's connection to the climate of the experience, supported learning in clarifying the purpose of the experience, and relied on the learner to implement those purposes. Such practices created a learner-centered environment in which individuals not only facilitated the experience, but also took an active role in facilitating their own learning. Rogers (1969) also emphasized the importance of a wide range of resources and the recognition of the facilitator as a resource. He described recognizing and responding to both the intellectual content and the emotional attitudes in the experience, and the facilitator taking an active and transparent role in the experience. These guidelines centered the learner as active, capable and responsible for the learning experience. Recognizing and accepting limitations as the facilitator was also important in that it established an inward transition to reflective practices (Rogers, 1969).

Rogers (1969) also outlined the essential conditions for meaningful educational experiences. He called for a shift from traditional teaching to facilitation through the use of realistic problem-centered experiences that provided for an environment that promoted autonomy in learning. He presented the means of creating this autonomy, or “means of building freedom,” as practical components of a learning environment that encourages self-directed learning through the use of approaches and strategies such as problem-centered scenarios, curated resources, contracts, group dynamics, simulations, programmed instruction, self-evaluation and facilitation of inquiry (Rogers, 1969). These techniques are not just instructional tools, but expressions of a learning philosophy that prioritizes the learner’s agency, lived experience, and autonomy within the learning environment.

Grounding this study in Rogers's (1969) humanism is essential because it establishes the *climate* in which gamified adult learning becomes possible. The emphasis on self-directed learning and holistic learner development provides a theoretical anchor point to ground adult learning and gamified professional development. Rogers's "means of building freedom" connects to the principles of andragogy (Knowles, 1969), which outline how to apply these means and facilitate learning in adult contexts. Adult professional development can express Rogers's concepts of facilitation of learning and learning freedom by shifting from didactic teaching to holistic models of adult learning facilitation that centers the learner as active in the process, invested in the outcomes, and motivated by internal needs.

Andragogy

In his book, *The Modern Practice of Adult Education: From Pedagogy to Andragogy*, Malcolm S. Knowles (1980) defined andragogy and outlined four main principal assumptions. Originally conceived as the "art and science of helping adults learn," Knowles expanded this definition by framing andragogy as a model of assumptions for adult learners, different from pedagogical assumptions (Knowles, 1980, p. 43). In later works, he expanded on the framework and added two additional assumptions to create the largely accepted final andragogical framework. This study will consider the full six-principle model.

The first assumption states that adult learners are self-directed. Knowles (1980) highlights that, for adult learners, this shift marks a transition from a dependent personality to one that is self-directed. Implications of this assumption include the learning climate, the diagnosis of needs, the planning process, conducting learning

experiences and evaluating learning outcomes. This assumption directly connects back to humanism through autonomy and competency-driven learning. However, this assumption is not culturally universal and must be contextualized.

While self-direction is often seen as a hallmark of adult learning in Western educational systems, it may not align with cultural contexts that emphasize authority, collective learning or respect for age and experience. Merriam and Kim (2008) note that Western adult education theories frequently assume individualism and autonomy, which may contrast with more collectivist or authority-centered cultures. As such, educators' application of this assumption should consider cultural norms around autonomy, learner-teacher dynamics, and perceptions of education responsibility.

The second assumption focuses on the role of experience. "As people grow and develop they accumulate an increasing reservoir of experience that becomes an increasingly rich resource for learning-for themselves and for others" (Knowles, 1980, p.44). This assumption introduces several implications for practice, notably an emphasis on experiential techniques, an emphasis on practical application and learning to learn from experience. These elements connect back to Rogers's (1969) concept of experiential learning, where reflective practice and personal context can deepen engagement and learning.

The third assumption focuses on readiness to learn, in that people become ready to learn when they experience a need to learn it in order to cope with real-life situations that occur through the evolution of social roles (Knowles, 1980). Knowles (1980) emphasizes the importance of timing and learner groupings. For a teachable moment to occur, curriculum must be in line with their developmental tasks. Differences in the

developmental tasks of different groups of learners need to be considered in order to provide the flexibility needed for the experience to be conducive to learning. This assumption aligns with Maslow's framework suggesting that motivation is a fundamental element of adult learning by means of the fulfillment of unmet needs.

The fourth assumption states that adults have an orientation to learning, in that "their time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly, their orientation toward learning shifts from one of subject-centeredness to one of performance-centeredness" (Knowles, 1980, p. 45). This shift occurs as a response to pressures from their adult life situations and directly impacts their views of learning and subsequent decision-making, moving the participant into a problem-centered frame of reference. This connects back to Rogers's models by reinforcing the importance of participant autonomy and the value of real-world, context-specific scenarios for learners to engage in meaningful learning.

Knowles (1990) added two additional assumptions to complete his model. The fifth assumption states that adult learners are primarily motivated by internal factors. "While adults are responsive to some external motivators (better jobs, promotions, higher salaries, and the like), the most potent motivators are internal pressures (the desire for increased job satisfaction, self-esteem, quality of life, and the like)" (Knowles, 1990, p. 63). This assumption suggests that adult learning experiences should tap into these internal motivators by offering opportunities for mastery and meaningful engagement through autonomy, structured decision making, and reflective feedback that align with the learner's goals and is personally relevant.

Knowles (1990) highlights that adult learners are primarily motivated by internal factors, but Ryan and Deci (2000) explain that external motivators, such as pay raises and promotions, can be internalized and aligned with an individual's personal values or sense of self-worth. In this sense the distinction between internal and external motivation is fluid and context-dependent, not binary. In professional development contexts, extrinsic rewards often serve as catalysts with internal motivators sustaining deeper engagement.

The sixth assumption, the need to know, focuses on the idea that adult learners want to understand *why* they need to learn something before they will engage and commit to learning it (Knowles, 1990). Further, this is even more relevant when instructors clearly state the *why* up front and connect it to real-world scenarios. Knowles (1990) highlights the importance of raising learners' awareness of this need through techniques such as simulated experiences and real-world problem-solving. These approaches foster metacognitive engagement in the learner by encouraging reflection, identifying skill gaps, and evaluating the practical value of the learning experience.

The first four assumptions of the andragogical model reflect the humanistic structural and situational elements of adult learning, while the fifth and sixth assumptions reflect intrinsic dimensions that align with gamification. The andragogical model reflects the humanist concepts of self-actualization, autonomy, and experiential learning. This positions andragogy as a valuable framework for adult professional development. When tied to their professional experience and career goals, adult learners engage meaningfully with self-directed problem-based environments. This alignment between andragogical principles and learning design suggests that implementing strategies can further enhance professional development platforms through autonomous learning, reflective practice,

and feedback. Gamification provides a mechanism to operationalize these humanistic and andragogical principles within a structured yet flexible environment to promote deeper adult learning.

Gamification

In *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*, Karl M. Kapp (2012) puts forth the definition for gamification that will guide this research: “Gamification is using game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems” (Kapp, 2012, p. 10).

Game-based Mechanics. Kapp (2012) identifies and outlines usage for several core game-based mechanics that align to andragogical principles. Goals provide purpose and measurable outcomes and reinforce Knowles's (1990) principle of goal-directed learning through autonomy. “A goal gives the player the freedom and autonomy to pursue it using different approaches and methods” (Kapp, 2012, p. 29). This directly overlaps with Rogers’s (1969) humanist principles of autonomy and facilitation of learning through clear purpose. Rules and feedback provide an interactive structured learning environment that supports decision making and strategic thinking through interaction and reflection. Designers can gamify motivation and mastery through reward structures, such as leaderboards, points, and badges. By utilizing realistic real-world professional scenarios, storytelling can enhance conceptual and experiential learning in adults through direct application. Finally, replayability promotes mastery and self-directed learning by introducing the ability to fail. This allows the participant to reflect on prior experience and try new approaches to problem solving without fear of consequence.

Collectively, these core mechanics reinforce the principles of humanism (Rogers, 1969) by creating a climate of learning centered around autonomy, personal relevance, and the facilitation of learning, and andragogy (Knowles, 1990) through the use of reflective learning, and problem-solving within a structured and engaging learning environment.

Aesthetics. Aesthetics, such as aligned visuals, attention to detail, simple contrasts, or colorful backdrops, play an important role in the design and development of a game, or the use of gamification techniques, and ignoring them can reduce the overall experience of the participant (Kapp, 2012). “The key is that the cues and small details add to the game environment and convey meaning” (Kapp, 2012, p. 47). This directly relates back to andragogy (Knowles, 1990) through relevance, experience and problem-centered learning. These cues and details convey meaning that reinforces experience and learning relevance in a gamified professional development context. Additionally, embedded visuals act as a mechanism through which relevant details or key steps can be highlighted. This provides contextual feedback which further reinforces learning through the building of the learning climate (Rogers, 1969).

Game thinking. Kapp (2012) extends the definition of gamification to extend beyond traditional games, in that “the delivery of content-for purpose other than pure entertainment-using game-based thinking and mechanics” (p. 17). This broadens the definition of gamification to include structured learning environments that incorporate game elements to drive engagement. By presenting gamification as a process and not a product, he highlights the potential of gamification to create meaningful experiences in a professional development context. This is similar to how Rogers (1969) discussed

creating the climate of learning in which instructional designers can facilitate thoughtful experiences that use learner autonomy, motivation and engagement.

Motivation. Kapp (2012) references key motivational theories that support the design of gamified professional development platforms, mainly the taxonomy of intrinsic motivation developed by Lepper and Malone (Kapp, 2012, p.58). Through motivation and experience, gamification mechanics support humanist (Rogers, 1969) and andragogical (Knowles, 1990) principles by enhancing engagement and self-directed learning.

Promote learning. Designers need to align gamification techniques to the player's appropriate level of knowledge. "Learners who lack an understanding of the basic concepts needed to perform a procedure cannot be immersed in a gamification event focused on reaching those procedures; they don't have the requisite knowledge" (Kapp, 2012, p. 166). There are several ways that gamification can impart knowledge on the participant. There are specific design techniques to use, depending on the knowledge the designer intends to communicate.

Many organizations and institutions have specific facts, acronyms, jargon, and terminology that comprise base-level knowledge. Designers can teach declarative knowledge through gamification by using mechanics such as elaboration, organizing, association, repetition, stories, sorting, matching, replayability or trivia (Kapp, 2012). Instructional designers can convey conceptual knowledge by using gamification techniques such as metaphoric devices, examples, attribute classification, matching and sorting, and experience. These techniques connect back to Rogers's (1969) humanist concept of the facilitation of learning.

Building on declarative and conceptual knowledge, rules-based knowledge “expresses the relationships between concepts” and “provides parameters dictating a preferred behavior with predictable results” (Kapp, 2012, p. 177). Examples of gamification techniques include providing examples to illustrate cause and effect, role playing to apply concepts, experiencing consequences through exploration of strategy, and board games for their simplicity in experience. Procedural knowledge builds on components of rule-based knowledge. Designers can convey procedural knowledge through the use of gamification techniques such as big picture understanding, teaching the “how” and “why” of the procedure, and procedural demonstrations or tutorials. These techniques connect to humanism (Rogers, 1969) through the facilitation of learning with clear definition of expectations and outcomes.

Instructional designers can teach soft skills, or “non-sequential guidelines for dealing with social interactions,” through gamification techniques such as the use of analogies, role playing and social simulations (Kapp, 2012, p. 185). He notes how research testing pro-social games have shown evidence to support the use of games in influencing positive behavior changes. Designers can use techniques such as encouraging participation, demonstrating success, endorsements, and immersion to shape attitudes, interests, values, beliefs, and emotions.

While it may be less relevant in some contexts, designers can apply gamification to the psychomotor knowledge domain. Many organizations have positions where the interplay of the cognitive space and physical space is important for success. In professional settings, this could include the processing of forms or replying to an email.

Designers can use techniques such as observation, practice, demonstration, and haptic response to reinforce this type of knowledge acquisition (Kapp, 2012).

Solving Problems. Organizations have applied gamification across various industries to solve problems. Kapp (2012) notes that gamification can be applied to problem-solving strategies by “providing knowledge based on information needed to solve problems” and “through building the knowledge base within the person who is solving the problems” (p. 145). The capacity of gamification to support problem-solving reflects Knowles’s (1990) principles of experience, problem-centered learning, and self-direction. Immersive, authentic scenarios can reinforce experience and problem-centered learning that encourages building on prior knowledge. Gamification can also reinforce self-direction by giving learners control over their decision-making process.

Integrating the Frameworks

This study drew from three theoretical perspectives – humanism, andragogy, and gamification – to guide the design of a gamified professional-development platform that was learner-centered and contextually relevant for adult learners. Each theory contributes distinct elements and their overlap forms a cohesive foundation for a gamified, self-directed, problem-centered learning experience.

Humanism, grounded in the work of Carl Rogers (1969), emphasizes autonomy, intrinsic motivation, and experiential growth and serves as the theoretical base of the study. Rogers’s framework positions learning as a deeply personal process driven by the learner’s internal goals, capacity for self-reflection, and desire for meaningful engagement. In *Freedom to Learn*, Rogers (1969) outlines the “means of building freedom” through strategies like problem-centered learning, self-assessment, and the

facilitation of learner inquiry, which centralize learner agency in shaping the educational experience. This focus on autonomy and internal motivation aligns with professional development through ownership of the learning experience and outcomes. Humanism's emphasis on holistic learner development provides a philosophical foundation for andragogy (Knowles, 1990), which translates humanist principles into an adult-learning context.

Malcolm Knowles's (1990) andragogical model builds on humanism by translating humanist ideals into six practical assumptions about adult learners. These assumptions provide a practical structure to bridge humanist values and adult learning resulting in a learning experience that is learner-centered, relevant, autonomous, and reflective. Knowles's (1990) model not only articulates the conditions under which adults learn best but also offers a practical framework for designing educational environments that reflect these principles. A gamified professional development platform can function as an andragogically designed, humanist-aligned learning environment by supporting autonomy, personal growth, self-directed professional development and engagement (Knowles, 1990) through the use of highly structured and aesthetic challenges and feedback (Kapp, 2012).

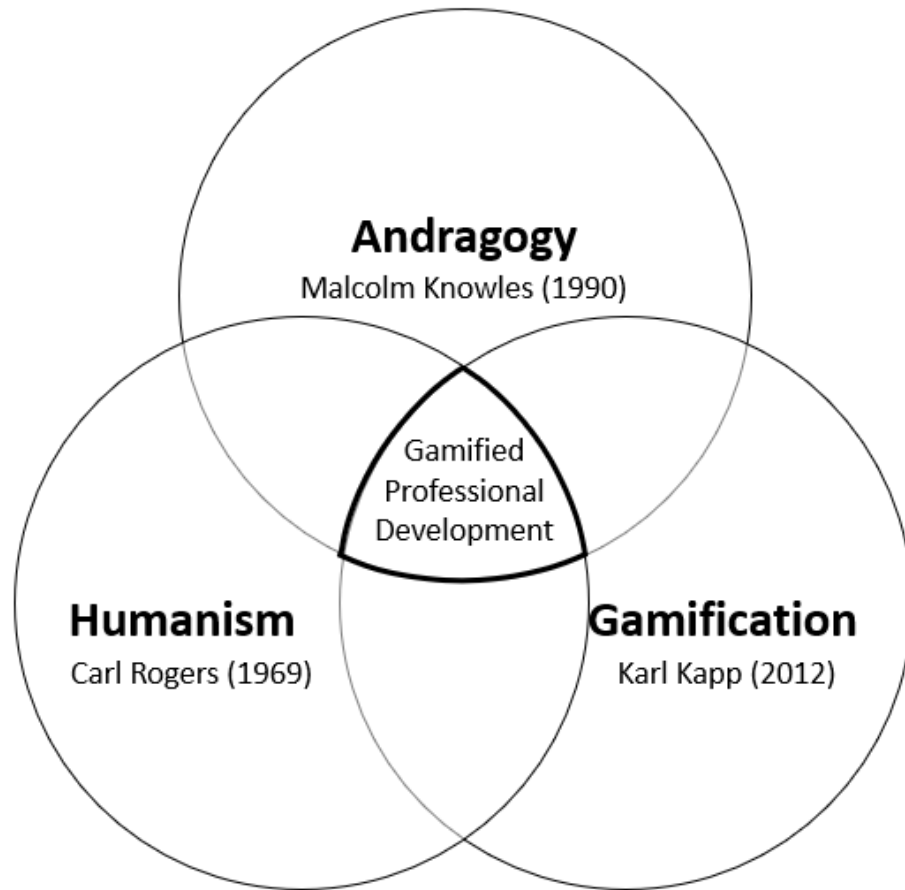
Kapp's (2012) gamification theory offers a practical design framework that transforms andragogical (Knowles, 1990) and humanist (Rogers, 1969) principles into engaging, autonomous, learner-centered experiences. Gamification can create an environment where adult learners can facilitate their own learning and reflect, adapt and grow through purposeful, immersive engagement. Kapp's model serves as the application layer that operationalizes both the motivational foundations of humanism and the

instructional strategies of andragogy. Through this combination, game mechanics like feedback, challenges, and reward structures provide a mechanism to implement and measure constructs like skill development, knowledge application, and engagement.

The convergence of humanism, andragogy, and gamification results in a professional development experience that is autonomous, intrinsically motivating, and grounded in problem-based, real-world application and facilitated by the learner themselves. The overlapping nature of these theories is illustrated in Figure 1.

Figure 1

Integrated Theoretical Framework



Note. This framework highlights the intersection of Humanism (Rogers, 1969), Andragogy (Knowles, 1990), and Gamification (Kapp, 2012) as the basis for the development of the gamified professional development platform.

This integrated framework informed the core design of the gamified professional development platform. This theoretical alignment allowed for the creation of an immersive environment where learners found motivation to engage, reflect on their decisions, and apply knowledge in a safe professional context. This integration created a

cohesive learning experience that drew on human motivation and engagement, adult learning principles, and game-based mechanics to support meaningful professional development and growth.

The connections between andragogy (Knowles, 1990) and humanism informed this design by establishing a foundation of learner autonomy, intrinsic motivation and respect for the individual's experiences. Rogers's (1969) emphasis on personal growth and psychological safety compliments Knowles's (1990) andragogical assumptions about adult learners' readiness for self-direction and problem-centered learning. Together they provided the relational and philosophical climate necessary for meaningful professional development.

The connection between humanism and gamification informed the emotional and motivational aspects of the platform's design. This ensured that the game elements served not just to entertain or reward, but to foster curiosity, reflection, and a sense of purpose while preserving learner agency. Gamification supported the facilitation of learning while simultaneously acting as the facilitator by supporting learner agency and creating engaging, learner-centered experiences that felt authentic and empowering.

Finally, the overlap between andragogy and gamification supported the practical application of learning through challenge-based scenarios, immediate feedback, and an engaging environment. These elements align closely with adult learners' desire for relevance, timeliness, and real-world practicality. Gamification (Kapp, 2012) served as a mechanism by which andragogical (Knowles, 1990) principles were implemented. Together, these intersecting frameworks informed a professional development platform

that was grounded in autonomy and motivation, guided by learner needs, and designed to engage both the intellect and the whole person.

By synthesizing the theoretical contributions of Knowles's (1990) andragogy (essence of the experience and facilitation of learning), Rogers's (1990) humanism (practical structure supporting adult learning), and Kapp's (2012) gamification (mechanisms needed for implementation), this study positioned gamified professional development as a viable pathway to engage adult learners in records and academic services through strategies that fostered skill development, knowledge application and engagement.

Research Design and Methodology Overview

In this study, I used a quantitative, non-experimental, within-subjects, repeated-measures design (Keppel & Wickens, 2004) to assess the gamified platform for PACRAO members. All participants accessed the same platform, which delivered a series of scenario-based challenges grounded in real-world enrollment services functions. Key measures were embedded directly within gameplay, allowing for the assessment of skill development, knowledge application, and engagement. I used paired-samples *t*-tests to evaluate these constructs over time through the responses to the scenarios.

Participants' responses before and after feedback were compared using paired samples *t*-tests to evaluate the effectiveness of the feedback. This design emphasized autonomy, reflection, and problem-solving, consistent with andragogical and humanist principles. The gamified platform was delivered through a GitHub Pages hosting site, and the platform captured the exempt research informed consent process, demographic

information, and gameplay data. A copy of the exempt research information sheet informed consent is provided in Appendix B.

Strengths and Limitations

While this study presented an opportunity to explore innovative approaches to professional development through gamification, it is important to acknowledge certain limitations that may have influenced the interpretation and generalizability of findings. First, the voluntary nature of participation may have introduced self-selection bias, as those who opted to engage with the platform may have been predisposed to positive attitudes toward technology or alternative learning methods. Their perspectives may not have fully represented the broader PACRAO membership. Second, the platform assumed a baseline level of digital access and comfort with browser-based tools. Although the platform was broadly accessible by design, variation in participants' technological resources or digital literacy could have created barriers to engagement for some users.

Finally, while the platform's gameplay and scenario structure were developed to mirror realistic industry challenges, this complexity might have discouraged users who were less familiar with gamified or self-directed learning environments. This study addressed these limitations through intentional strategies, including accessible platform design to minimize technical barriers, open participation invitations to reduce selection bias, and scenario scaffolding to ease users into gameplay.

Despite these limitations, this study offered several strengths. The gamified platform was intentionally designed to reflect real-world professional challenges in enrollment services and, to the best of my knowledge, represented the first tool of its kind within this professional context. By aligning the actual decision-making, compliance, and

situational complexity faced by professionals, the platform offered a unique opportunity to explore applied learning in context. The platform's scalability and delivery outside institutional systems made it a flexible and replicable model for professional development across varied higher education contexts. Additionally, the study was grounded in established theories of adult learning and instructional design, providing a strong conceptual foundation for its structures and measures. These strengths position the study to contribute meaningful insights to the role of gamification in fostering skill development, knowledge application, and engagement within higher education professional development.

Chapter Summary

This chapter introduced the problem of practice facing PACRAO's professional development structure and presented a proposed solution grounded in humanism (Rogers, 1969), andragogy (Knowles, 1990), and gamification (Kapp, 2012). The study aimed to determine whether a self-directed, game-based platform could enhance professional development learning outcomes through engagement, reflection, and application. Chapter two reviews the relevant literature, further situating the study within the fields of adult learning, gamified learning, and professional development.

Chapter 2: Literature Review

This chapter explores the existing body of literature at the intersection of gamification, professional development, andragogy, and engagement to establish a conceptual and empirical foundation for this study. The first goal of this review is to evaluate how these domains interact to support adult learning in professional development settings. The second goal of this study is to identify the gaps in the literature where theoretical alignment, practical application, and learner experience remain disconnected.

Specifically, this review explored how gamification has been used to support adult learning and professional development, and how well those implementations align with established andragogical (Knowles, 1990) principles such as self-directed learning, real-world relevance, and reflective practice. It also explores engagement as an observable outcome of gamified learning and assesses how gamification influences skill development and knowledge application, critical components of meaningful professional development.

By conducting this systematic review of peer-reviewed research across these intersecting domains, I explored where the literature offers support for using gamification as a tool for adult professional growth, where it falls short, and how these findings could inform the design of a gamified platform tailored to the records and academic services industry. This review not only guided the development of this study's theoretical

framework but also shaped the design of the gamified platform by identifying specific elements that support adult learner success. The following section outlines the search and selection process that guided this review.

Search and Selection Methods

I conducted a systematic review to identify, evaluate, and synthesize the existing body of literature on the intersection of gamification, professional development, and andragogy. This review establishes the theoretical foundation for the development of a gamified professional development platform and identifies gaps in current knowledge related to gamification's effects on engagement, skill development, and knowledge application in professional settings. Notably, Mahat and colleagues (2023) found that many gamified professional training platforms lack strong theoretical foundations, underscoring the need for further research grounded in adult learning theory, particularly humanism and andragogy.

I developed a structured search strategy to narrow the results to the intersection of gamification, professional development, and andragogy. I conducted the search using the ERIC, PsychINFO, Web of Science, ProQuest, and Business Source Complete databases to ensure comprehensive coverage of educational, psychological, and professional development research. I used the following Boolean search strings to capture core focus areas of the study: (1) "gamification" AND "andragogy", (2) "gamification" AND "professional development", (3) "gamification" AND "engagement" AND "professional development", and (4) "professional development" AND "andragogy". I applied additional filters to limit the results to peer-reviewed articles published within the last 10 years.

After initially screening titles and abstracts and removing duplicates, I saved the remaining studies to fully evaluate their relevance to the study's focus. I used the following inclusion and exclusion criteria to direct the selection process:

Inclusion Criteria:

- Peer reviewed empirical studies and theoretical papers, dissertations/thesis
- Studies within the last 10 years to reflect current trends and practices
- Studies using gamification in adult learning or professional development contexts
- Focused on engagement, skill development motivation and reflective practice

Exclusion Criteria:

- Studies that were focused solely on k-12 setting
- Research specifically focusing on teachers or teacher preparation
- Non-peer review articles
- Studies that did not directly relate to learning
- Research not available in English

The use of 'and' logic across the inclusion criterion was deliberate. This strategy ensured that only studies at the intersection of gamification, professional development, andragogy and engagement were selected for full review. It reflects a commitment to maintaining conceptual alignment with the study's theoretical framework. Using 'or' logic would have allowed studies with only partial relevance, weakening the coherence of the thematic synthesis and introducing findings not directly aligned with the problem of practice.

The systematic search resulted in an initial yield of 98 studies. After duplicate removal and initial review, a total of 54 studies were selected and downloaded for full-text review. Following the full text review, 21 studies were selected for final inclusion. The remaining body of work formed the foundation for the thematic analysis and synthesis related to gamification, professional development, and andragogy.

To supplement the database search, I conducted a hand search of two peer-reviewed journals: *Computers & Education* and *Adult Learning*. Using online institutional access to the journals, I reviewed all issues published from January of 2023 through March 2025. This search ensured that recent articles not yet indexed in databases were considered. While a few studies showed surface-level alignment to gamification, andragogy, engagement, and professional development, upon full review they did not meet the inclusion criteria due to a focus on k-12 populations, pre-service teachers or policy-level discussions. No additional studies were added to the literature review as a result of this hand search.

To ensure the completeness of the literature review, I conducted an ancestral search using the reference lists of several foundational studies included in this review. Specifically, I explored the citations from Zainuddin and colleagues (2024), Kapp and colleagues (2020), and Hope and colleagues (2023) as these studies were central to the categories of gamification, andragogy, and engagement and professional development. I screened the references for additional peer-reviewed studies that aligned with the established inclusion criteria. Several references addressed related topics, but none met the full criteria for inclusion due to differences in learner populations or focus areas. As a result, no new studies were added to the review based on this ancestral search.

I used a structured thematic analysis to identify patterns and relationships across the literature. I developed my Boolean search strings based on key concepts from my research focus- gamification, andragogy, engagement and professional development- and organized my Zotero database using those exact search combinations. These same categories guided my coding process to ensure consistency and fidelity throughout the review. As I evaluated each article, I focused on how these core categories appeared in the findings and discussions where they intersected with engagement, motivation, learner autonomy, decision-making, and knowledge application. These themes align with andragogical principles as described by Knowles (1990). This process allowed me to trace how the literature supported or challenged the principles of adult learning and gamification while keeping the analysis focused on the key components of the theoretical framework and underlying gamification mechanics.

I identified several limitations to help clarify the scope of the findings and effectiveness of gamified learning. First, I limited the search and review to studies published in English within the last 10 years, which may have excluded relevant research conducted in other languages or prior to the established inclusion point. Second, the focus on higher education and professional development contexts may limit the generalizability to other industries. Lastly, differences in study design, sampling, and specific gamification elements may introduce variability in the reported outcomes.

To maintain consistency between the search strategy and the analysis process, I organized the literature review around four core categories derived from my Boolean search strings. These categories reflect the central intersections of gamification, professional development and andragogical theory that guide this study. This structure

helped me trace how the literature connects to the study's theoretical framework and problem of practice. The following sections present the findings grouped by these categories, highlighting how each category aligns or challenges the central concepts guiding the study.

Gamification and Andragogy

This category explores how gamification aligns with core andragogical principles such as engagement, motivation, learner autonomy, decision-making, and knowledge application. Understanding these connections is critical to evaluating how gamification mechanics can support adult learners in a professional development setting.

Zainuddin and colleagues (2023) were able to show a connection to gamification and andragogical principles. Quantitative analysis showed that participants in the gamified groups reported higher motivation on post-questionnaire surveys. The study suggested that weekly gamification-based assessments led to greater achievement than their counterparts who only received traditional scores through the Moodle platform. This research indicates that the application of weekly gamification-based assessments could promote greater internal motivation and professional growth.

In addition to the quantitative findings, Zainuddin and colleagues (2023) also conducted a qualitative analysis that aligned with Knowles's (1990) andragogical principles. Their results showed that students viewed gamification as capable of supporting adult learning, including learning motivation, learning experiences, learning orientation and self-concept. Participants reported that the gamification strategies kept them motivated and invested in the process, reinforcing Knowles's emphasis on learner-centred growth (Zainuddin et al., 2023).

Building on previous work, Zainuddin and colleagues (2024) developed and validated the Gamification for Adult Questionnaires (GAQ) scale to assess how gamification aligns with Knowles's (1990) andragogical principles. Their results indicated that the GAQ scale is a valid and reliable tool for evaluating gamification in adult learning contexts. Their findings reinforce the idea that gamification can provide meaningful experiences aligned with adult learning needs, such as challenge, curiosity, and autonomy. As demonstrated, rigorous testing confirms that gamification effectively supports andragogical principles (Zainuddin et al., 2024).

These studies demonstrate strong connections between gamification and andragogy; however, it is important to note specific limitations. Zainuddin and colleagues (2023) report that specific reporting of platform constraints, small sample size, more questions regarding feedback and lack of instructor perspective pose challenges to the generalizability of their findings. Similarly, issues with sample size and lack of reporting platform constraints have been noted with an emphasis on collecting feedback from adult learners on the instructional weaknesses of the concept. Together, these studies demonstrate effective operationalization of gamification within adult learning contexts. This research highlights a gap in translating the principles into scalable professional development tools that can adequately address the nuance of adult learning environments.

Gamification and Engagement

This category explores the relationship between gamification and learner engagement, while acknowledging that the two are inherently connected. Gamification refers to the intentional use of game mechanics in learning environments and engagement reflects a learner's internal and external reactions to those mechanics. In this review,

engagement serves as an umbrella term to describe how gamified strategies affect motivation, learner autonomy, decision-making, and knowledge application in adult learning contexts. Though gamification and engagement are often seen as interchangeable, this category positions engagement as an observable outcome in the literature to better understand how gamification influences adult learning.

Several studies explore how gamification influences engagement in adult learning contexts, beginning with the broad concept of serious gaming. Cain and Piascik (2015) define serious gaming as the application of game principles for learning, skill development and training through elements of engagement. If the game is well designed, the student is likely to become engaged, stay engaged beyond what is required, and interact with learning materials in an engaging way. Their research demonstrates that when done properly, game principles can be effective in nuanced professional development environments, such as pharmacy education.

Serious gaming offers a structured, goal-oriented experience, while casual gaming provides for a more flexible approach to engagement that can still meaningfully impact adult learners. Kapp and colleagues (2020) looked at the use of casual gaming in the workplace with retail staff and their results suggest that learners were significantly more motivated to return and engage with the learning platform when playing a game was an option. Learners who were involved with the gamified condition viewed their report card more often than learners in the no-game condition and volunteered to do significantly more. The results from Kapp and colleagues (2020) indicated that incorporating casual gaming before a learning activity produced significant levels of engagement with the learning platform. Learners exposed to the gamified condition not only interacted more

with the material but also demonstrated higher levels of participation over a relatively long term of 12 months.

Collectively, the reviewed studies demonstrate how gamification can meaningfully enhance adult learner engagement. Across contexts, game elements that operationalize engagement as an outcome motivate learners through feedback, motivation, learner autonomy, decision-making, and knowledge application. These outcomes support the idea that engagement is not just a byproduct of gamification, but a key indicator of learning within adult professional development contexts. This understanding shaped the current study's platform design by emphasizing the differences between gamification and engagement, using engagement as an observable outcome to evaluate how game mechanics support adult learning and professional development.

Gamification and Professional Development

This category explores how gamification supports professional development by examining the most commonly used gamification elements in learning environments and their associated outcomes. The reviewed literature highlights how gamification fosters motivation, learner autonomy, decision-making, and knowledge application. To organize these findings, this section is divided into two parts. The first part synthesizes common gamification elements such as motivation and feedback. The second explores how these elements influence professional development.

Gamification may be experienced individually or collectively, depending on the design. While some platforms focus on personal progress through badges, points, or self-paced challenges, others foster collective engagement through team-based activities, peer collaboration or public competition with leaderboards. These collective elements play an

important role in professional development by promoting community, accountability and shared learning. At the same time, individualized gamification elements are equally important, as they allow learners to engage at their own pace, set personal goals, and receive recognition tied to their specific achievements.

Gamification Elements

Research consistently identifies motivation, engagement, and feedback as central outcomes supported by gamification in professional development (Calza-Perez et al., 2024; Dikcius et al., 2021; Gonzalez-Fernandez et al., 2022; Hope et al., 2023; Moon et al., 2024; Newcomb et al., 2019; Papakostas, 2024). These factors drive adult learning by increasing learner engagement, autonomy, and agency. Gamified experiences incorporate structured challenges, goal setting and social dynamics to affect motivation, while feedback mechanisms reinforce learning over time.

Goal-setting emerged as a key element driving motivation in gamified professional development. Studies showed that gamification supports motivation by introducing structured challenges, clearly defined completion paths, and progress-tracking tools tied to incentives and feedback. Gamification has also been shown to support professional development, specifically when tied to goal-setting (Gonzalez-Fernandez et al., 2022; Newcomb et al., 2019; Papakostas, 2024). Across these studies, goal-setting and structured challenges reinforced and supported motivation by creating clearly defined pathways for growth. Beyond goal-setting, several studies emphasized the effects of social dynamics on motivation.

Motivation was also reinforced in these studies through creative problem-solving and peer recognition (Dikcius et al., 2021; Gonzalez-Fernandez et al., 2022; Moon et al.,

2024; Newcomb et al., 2019). Gamification elements, such as leaderboards, collaboration, and friendly competition, fostered accountability and fulfilled needs for recognition and mastery. For example, Gonzalez-Fernandez and colleagues (2022) reported increases in motivation among participants exposed to gamified tasks. Studies consistently linked peer collaboration and social reinforcement with increased motivation and deeper professional engagement and growth.

Feedback and recognition were also central to motivation. Papakostas (2024) emphasized that immediate, constructive feedback prompts learners to reflect on their performance. Newcomb and colleagues (2019) found that awarding badges led to both increased perceived competence and small but moderate compensation increases. These results highlight how recognition reinforces skill development and motivation. Badges, emojis, points, leaderboards and immediate feedback are effective recognition tools that can reinforce professional competence and encourage reflective learning and intrinsic motivation (Dikcius et al., 2021; Gonzalez-Fernandez et al., 2022; Hope et al., 2023; Moon et al., 2024; Newcomb et al., 2019; Papakostas, 2024; Tay et al., 2022).

Professional Development Outcomes

Studies also highlighted gamification's impact on broader professional development outcomes. Newcomb and colleagues (2019) observed lower turnover rates and stronger employee performance for 15 months after implementing a gamified development system. Papakostas (2024) demonstrates how game mechanics could align with learning goals, transforming gamified platforms from entertainment into purposely designed learning environments for the attainment of certain specified learning outcomes.

Hope and colleagues (2022) found that participants who engaged with a gamified pharmacy consistently earned higher course grades and exhibited greater professional competence, confidence, communication and collaboration. The gamified simulation encourages active learning by motivating students to act as “if they were pharmacists”. This type of engagement tapped into underlying needs for recognition and mastery in order to affect motivation. In a follow-up study, they were able to show that gamified journaling and debriefing activities were linked to measurable gains in learning.

Other researchers found that gamification supports skill development and learning transfer. Calza-Perez and colleagues (2024) demonstrated that integrating games with learning effectively boosted motivation to learn and leveraged game features to develop key skills. Sandi-Delgado and colleagues (2022) demonstrated the use of serious games can positively impact professional development by supporting the acquisition of digital competencies among higher education faculty, with participants expressing strong support for continued use.

Gamification has been consistently shown to be an effective strategy for improving professional development outcomes. Goal setting and structured challenges increase intrinsic motivation to engage more deeply with learning material, while collaborative problem-solving and peer-recognition reinforced professional competencies and self-directed growth. This evidence suggests that gamification enhances knowledge acquisition and strengthens decision-making in professional settings. These findings further support the broader argument that gamification serves as a practical and adaptable medium for professional development across diverse industries and environments.

Professional Development and Andragogy

Professional development and andragogy are closely linked in the literature, particularly in fields like healthcare, coaching, education and workplace training (Barath & Ross, 2024; Callary et al., 2021; Green & Huntington, 2017; McCray, 2016; Roe, 2023; Tessier et al., 2021). These studies emphasize andragogy as a useful framework for designing adult learning experiences that prioritize learner autonomy, reflection, and real-world application. Despite differences in setting and participant roles, several themes emerged including experience and self-directed learning (Green & Huntington, 2017; McCray, 2016; Roe, 2023; Tessier et al., 2021), implementation challenges (Barath & Ross, 2024; Callary et al., 2021; Green & Huntington, 2017; Tessier et al., 2021), career performance outcomes (Green & Huntington, 2017; McCray, 2016; Roe, 2023; Tessier et al., 2021), and the influence of technology (Callary et al., 2021; Green & Huntington, 2017; Tessier et al., 2021).

Experience and Self-Directed Learning

Across the studies, professional development has been shown to be effective when tied to real-world situations that reflect career relevant outcomes (Green & Huntington, 2017; McCray, 2016; Roe, 2023; Tessier et al., 2021). This is evident across industries and experience levels. For example, Roe (2023) explored a media advocacy program for graduate students and found that participants viewed the experience as both meaningful professional engagement and as preparation for future career advancement. Participants also reported that the experience helped them develop essential skills and build self-efficacy aligned with their long-term career goals.

Looking at online professional development for nurses, Green and Huntington (2017) demonstrated the importance of experience and self-directed learning in that the traditional ‘one-size-fits-all’ approach does not allow for the flexibility needed to take into account prior learning and current knowledge. Similarly, McCray (2016) looked at gallery educator training and professional development, positioning adult learning as the mechanism by which personal process shifts the outcome from content to learning.

Tessier et al. (2021) explored the usability of the Andragogical Process Model for Learning (APML) to develop workplace communication training. Their findings show that although applying the APML in its entirety posed practical challenges, each element still provided valuable guidance for designing, delivering, and evaluating adult learning activities that accounted for learner experience. Participants appreciated the model’s structured approach, even when full implementation was not feasible. These findings suggest that while the APML can be difficult to apply completely in practice, its core components remain highly relevant and reinforce the value of andragogy in professional development.

Barath and Ross (2024) demonstrated the importance of self-directed learning in continuing professional development (CPD) in audiologists. Participants viewed CPD as their personal responsibility and actively engaged in both formal and informal learning to acquire new skills and confidence. This emphasis on autonomy, accountability, and learning through practical experiences strongly aligns with andragogical principles by highlighting proactive engagement, self-directed learning, and reflective practice of experience as key for improving professional skills and knowledge. As this research illustrates, self-directed learning remains a foundational element in effective professional

development, offering clear principles for design and implementation. By offering an interactive space for reflection and self-directed decision-making, the current study's gamified platform cultivates the same sense of ownership over learning outcomes as observed in Barath and Ross's (2024) findings.

Implementation Challenges

Researchers noted several challenges in the implementation of professional development ranging from motivation and engagement (Barath & Ross, 2024; Callary et al., 2021; Green & Huntington, 2017), to institutional/organizational barriers (Green & Huntington, 2017; Tessier et al., 2021), and technological barriers (Callary et al., 2021; Green & Huntington, 2017).

Barath and Ross (2024) were able to show that internal motivation was a key component of adult learning when it involved solving significant problems or contributed to their career advancement. Further, they reported sub themes that emerged with regards to internal motivation including fear of consequence, improved clinical practice and personal accountability. Callary and colleagues (2021) report a “failure” in providing professional development to coaches, noting that even though the development approach was andragogically aligned, there was a need to explore the alignment of the development with participants level of engagement, understanding of learning, and abilities and interest to co-construct learning.

Institutional or organizational constraints were noted, including the type of delivery platform, online access, digital literacy gaps, and the time and effort in engaging with professional development platforms (Callary et al., 2021; Green & Huntington, 2017; Tessier et al., 2021). On one side, the time and effort in assessing learner needs and

developing the appropriate learning environment is time intensive and can be expensive for organizations to implement. On the other hand, negative assumptions about those engaging in technologically supported professional development can also be detrimental to organizational operations. Green and Huntington (2017) note how organizations can take steps to promote online learning by creating dedicated spaces and actively working to create a culture of learning.

Together, these implementation challenges reinforce the need for professional development platforms that are not only grounded in andragogical principles but are also adaptable to the diverse needs, constraints, and motivational drivers of adult learners. To address these challenges, the current study's gamified platform is intentionally designed to be flexible, responsive, and learner-centered. This supports self-directed learning while reducing common institutional and organizational barriers.

Career Performance Outcomes

Professional development has been shown to be connected to core professional outcomes like performance and skill acquisition (Green & Huntington, 2017; McCray, 2016; Roe, 2023; Tessier et al., 2021). Green & Huntington (2017) suggest that it is imperative to allow staff to determine their current level of skill and to support them in determining additional competencies. Similarly, Roe (2023) noted that participants gained skills in communication, negotiation, prioritization, problem-solving, teamwork, and strategy development through engagement in professional development and that these skills are highly valued by employers.

McCray (2016) demonstrated that when museum educators modeled adult learning practices with gallery educators, it enhanced the educator's ability to reflect on

their own work and improve how they engaged with visitors. Since organizations often use external trainers, a needs assessment can aid external trainers in developing rapport with participants and develop training platforms that are in line with participant expectations and industry performance standards. Building on this, Tessier et al. (2021) highlight the importance of assessing individual needs in order to ensure the outcomes of the professional development experience are in line with the expectations and skill level of the participant. This alignment between professional development and career outcomes underscores a core andragogical principle in that adult learners are more engaged when skill-building activities are directly connected to professional competencies and career trajectories.

These findings reinforce the importance of aligning professional development with real-world expectations. When adult learners recognize a direct connection between skill building and career advancement, they are more likely to engage more deeply with the content. The current study's gamified platform mirrors these findings by emphasizing skill building through realistic, content driven scenarios designed to improve decision making, professional competencies and motivation.

Supportive Environments

Technology plays a role in the delivery and support of professional development experiences by taking on the role of facilitator of learning (Rogers, 1969). Digital tools such as help desks, online modules, and tutorials can improve access and efficiency; however, their effectiveness depends on thoughtful design and implementation. The literature presents both the benefits and drawbacks to integrating technology in adult learning environments.

Technological tools such as help desks and tutorials can support the successful implementation of professional development platforms (Green & Huntington, 2017); several studies also highlight how technology can create barriers to engagement. Callary and colleagues (2021) noted that even though technical support was available through an external source, the participants experienced problems logging into the platform which could have made the experience intimidating. These findings underscore how technology can hinder engagement when poorly designed and implemented.

Tessier and colleagues (2021) further emphasized the importance of trust and mutual respect in the trainer-learner relationship and how the training climate can enhance the delivery of the training. Their findings demonstrate that the training environment, including how support is delivered and perceived, play a role in learner success. Without a supportive and responsive environment, technology can inadvertently create barriers to participation or magnify existing ones. This means that environments that are not thoughtfully designed may actually decrease engagement with the platform. These findings directly inform the current study's gamified platform, which prioritizes accessibility, psychological safety, intuitive navigation, and learner-centered design.

Synthesis of Findings

This systematic review aimed to explore how gamification, professional development, and andragogy interact to support adult learning in professional development settings and to identify gaps in the literature where theoretical alignment, practical application, and learner experience remain disconnected. Across the reviewed domains, a consistent thread that emerged is the importance of learner-centered design,

real-world professional contexts, reflective practice, and autonomy. A summary of these findings can be found in Table 1.

Table 1

Summary of the Literature Review Key Findings

Domain Area	Key Insights
Gamification	Gamification techniques can support professional development by promoting motivation, offering appropriate challenges, and supporting learner autonomy. Platforms should be both scalable and relevant.
Engagement	Engagement is both a process and an outcome that is influenced by game mechanics, feedback and reflective interaction.
Andragogy	Andragogy emphasizes the importance of autonomy, real-world application and learning experiences that adapt to learners' prior knowledge and career goals.
Professional Development	Professional development is most effective when it supports job-specific skill application, reflective growth, and learner control.

The literature demonstrates that gamification (Kapp, 2012) can meaningfully support professional development by promoting engagement and motivation through structured challenges, goal-setting, and feedback. These elements provide strong conceptual alignment with Knowles's (1990) andragogical model, especially self-directed learning, relevance to real-world contexts, and reflection as a form of knowledge application. Equally important, this review highlighted how professional development and andragogy overlap in terms of experience, motivation, and learner capacity.

Barriers like inadequate institutional support, technological limitations, and disengagement highlight the need for tools that are not only theoretically sound, but also practically usable. In particular, digital tools and platforms must be designed with

learner-centered values at their core. These findings connect directly to the humanist (Rogers, 1969) framework grounding this study. Several studies emphasized the role of the environment in shaping learning success, especially in digital contexts (Callary et al., 2021; Green & Huntington, 2017; Tessier et al., 2021). This has a strong conceptual alignment to Rogers's (1969) facilitation of learning and the crafting of the learning climate. Poorly designed platforms can undermine learner confidence and autonomy, disrupting the psychologically safe, facilitative climate essential for meaningful learning. In this way, technology itself becomes the "facilitator," which requires a humanist design approach that prioritizes trust, psychological safety, intuitive navigation and learner respect.

While the literature supports the intersection of gamification, engagement, professional development, and andragogy, it also exposes several limitations. Many reviewed studies drew from narrow contexts or had relatively small sample sizes, which may limit broader generalizability. Although most of these studies acknowledge adult learning principles, few offered concrete strategies for measuring influence on sustained engagement, skill development or knowledge application. Noticeably absent in the literature is a robust exploration of gamification within higher education, specifically records and academic services, leaving a gap in understanding how these principles operate outside teaching or clinical contexts. This is significant given the increasing demand for scalable, relevant professional development tools in higher education support roles.

Taken together, these findings provide both a conceptual rationale and practical direction for the design of the gamified professional development platform tailored to the

needs of the records and academic services industry. I used this review to guide the selection of key gamification elements such as autonomy, challenge, and feedback, but also ensured the platform aligned with both andragogical (Knowles, 1990) and humanist (Rogers, 1969) principles. By addressing a gap in the literature and designing for real-world usability, this study will contribute a field-specific model for adult professional development through gamification.

Informed Design

The findings from this review provide a theoretical rationale for the development of a professional development platform that utilizes gamification (Kapp, 2012) techniques and aligned with both humanist (Rogers, 1969) and andragogical (Knowles, 1990) principles. Similar to the findings of Zainuddin and colleagues (2023, 2024), I designed the structure and mechanics of the present study's gamified platform to support the core principles of gamification and andragogy by fostering self-directed, reflective learning that is professionally relevant. The limitations noted in Zainuddin and colleagues (2023, 2024) demonstrate the need for a broad and scalable gamified platform.

To address these gaps, this study's platform incorporates a flexible and adaptable professional development experience that reinforces skill development and knowledge application through autonomy, relevance, strategic thinking and reflective practice. Drawing on Knowles's (1990) andragogical and Rogers (1969) humanist frameworks and supported by this review, the platform emphasizes learner-centered pacing, real-world scenarios, and psychologically safe design choices. For example, learners have control over the pace, sequence, and repetition of activities to reinforce agency and ownership of learning, core tenets of self-directed learning. Realistic scenarios were intentionally

crafted to mirror common challenges in records and academic services, ensuring the content is goal-relevant and immediately transferable to the workplace.

In alignment with Rogers's (1969) emphasis on the climate of learning, the platform avoids overly punitive measures and instead promotes low-stakes exploration. This intentional design fosters a supportive and non-threatening environment, which can facilitate learning without fear or failure. Feedback mechanisms are structured to be formative rather than evaluative, prompting users to reflect on their reasoning and consider using alternative approaches rather than simply registering right or wrong answers. These features collectively support a psychologically safe, learner-centered climate essential for deep learning.

To distinguish surface-level participation from deeper engagement, I will collect timestamp data, such as *time-on-task* and total duration. These metrics will offer insight into whether participants pause to reflect, rush through content, or disengage at a particular point, providing a more nuanced understanding of engagement through reflective thinking and self-regulation. Scenarios are designed not only to test knowledge but also to stimulate reflection-in-action, requiring learners to weigh options, consider context, and apply judgment in ways that mirror professional realities.

Each research question in this study was informed by these theoretical foundations. RQ1 examining skill development, reflects Knowles's (1990) andragogical principle of learning through problem-centered experience. RQ2, focused on knowledge application, aligned with Rogers's (1969) humanist view that learning is strengthened through reflection and autonomy. RQ3, which explores engagement, is grounded in Kapp's (2012) gamification framework that emphasizes motivation through feedback and

challenge. Finally, RQ4 integrates these perspectives to examine how engagement behaviors relate to measurable learning outcomes within the professional development context. Interpretive thresholds for practical significance and effect sizes are specified in Chapter 3 under *Measures*.

Chapter 2 Summary

This study addresses those gaps by adapting gamification specifically to the professional realities of records and academic services where self-paced, reflection-driven learning is both necessary and underdeveloped. With insights from this literature review, I designed a gamified platform that incorporates feedback, autonomy, and real-world decision-making scenarios to support skill development, knowledge application, and engagement. This design will contribute a field-specific model for gamified professional development that is aligned with humanism and andragogy and is flexible enough to address the institutional and organizational implementation challenges documented in this review. The following section outlines how this gamified platform will be implemented and assessed as the central intervention for the study.

Chapter 3: Methods

This chapter outlines the research methods I used to explore the newly developed gamified professional development platform designed for the members of the Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO). The purpose of this study was to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members. Guided by humanistic and andragogical principles, I integrated a gamified, design-based intervention with embedded assessment to measure real-time professional development.

The chapter details the research design, followed by a description of the participant population and recruitment process. Next, I describe the development and delivery of the gamified platform, including its instructional design, scenario structure, and internal feedback mechanisms. The chapter then outlines the operationalization of key constructs, data collection procedures, and analytic strategies that I used to assess participant outcomes. Finally, this chapter addresses strategies to ensure validity and reliability, ethical considerations, and potential limitations to this study.

Research Questions

In this study, I explored the extent to which a gamified platform could foster skill development, knowledge application, and engagement within a regional higher education professional development context. I grounded the research questions in the alignment

between gamification mechanics and adult learning theory, specifically humanism and andragogy. Through embedded scenarios, feedback mechanisms, and timestamp data, I assessed whether the gamified platform's design approach promoted meaningful learning outcomes for professionals working in the records and academic services industry.

The overarching goal of this study was to explore whether a gamified platform could serve as an effective professional-development tool for adult learners in a regional higher-education context. The following research questions guided this study:

RQ1. To what extent does the gamified platform foster skill development in professional scenarios?

RQ2. To what extent does the gamified platform foster knowledge application in professional scenarios?

RQ3. To what extent does the gamified platform foster engagement among PACRAO members?

RQ4. What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

To ensure analytic coherence and alignment, I mapped each research question to a single measurable construct and its corresponding platform metric(s). Table 2 presents the crosswalk between the research questions and the operational definitions used in the analysis. I derived all variables from the session-level dataset produced through the Firebase Cloud Firestore export and flattening procedure (see *Data Preparation and Handling*).

Table 2*Crosswalk of Research Questions, Constructs, Measures, and Analytic Plan*

RQ # / Focus	Research Question	Construct	Operational Definition (platform measure)	Variable labels in CSV	Primary Analysis
Overarching	To what extent can a gamified platform serve as an effective professional development tool for adult learners in a regional higher education context?	Overall PD effectiveness	Synthesis of skill/knowledge outcomes and engagement indicators to evaluate overall professional-development effectiveness	Summary of Q1-Q6 scores, Q1-Q6 Time, Q1-Q6 time on feedback, session ms	Descriptive synthesis across Q1-Q6 outcomes
RQ1-Skill Development	To what extent does the gamified platform foster skill development in professional scenarios?	Applied skill performance	Alignment/improvement in scenario decisions following embedded feedback	Q1-Q6 Score (Decision alignment score per question)	Paired within-domain comparisons; descriptive means
RQ2-Knowledge Application	To what extent does the gamified platform foster knowledge application in professional scenarios?	Knowledge synthesis/transfer	Application of decision-making strategies across multiple professional domains following feedback, as evidenced by improvement between composite scores	Composite score comparison between Scenario 1 and Scenario 2 (paired-sample test); internal consistency across domain-level items	Paired-Sample <i>t</i> -test of composite means; internal consistency check
RQ3-Engagement	To what extent does the gamified platform foster engagement among PACRAO members?	Behavioral engagement	Total time-on-task and time interacting with feedback and scenarios, reflecting persistence and depth of engagement	Time composite comparison between Scenario 1 and Scenario 2 (paired-sample test); internal consistency across domain-level	Paired-Sample <i>t</i> -test of time composite means; internal consistency check

RQ4-	What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?	Engagement-outcome association	Association between time-based engagement measures and performance composites.	items Constructed composites for engagement, skill development and knowledge application	Pearson r correlations; regression analysis
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Note. All variables were derived from the session-level dataset exported from Firebase Cloud Firestore and flattened using custom Python script. Composite and time-based metrics were calculated within the gamified platform to align with each construct and corresponding research question. Abbreviations: ms = milliseconds, Qn = scenario question number.

These questions emphasized self-directed learning and reflective practice. I evaluated them through embedded performance measures within the platform, which provided insight into the potential for gamification to enhance professional development practices in records and academic services.

Setting

The Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO) served as the community partner for this study. PACRAO is a professional association representing over 350 regionally accredited 2-year, 4-year, and graduate/professional schools across the Pacific region, including states of Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, and Washington; the Territory of Guam; and the Canadian provinces of Alberta, British Columbia,

Manitoba, and Saskatchewan. With an active membership base of approximately 1,500 higher-education professionals in records and academic services, PACRAO provides a regional network for collaboration, training, support, and professional development, making it a highly relevant context for this gamified intervention.

Community Partner Role

PACRAO's role in this study included promoting the platform to its membership by distributing recruitment materials through its official communication channels (email, newsletters, and social media). The organization did not manage or access participant data and had no role in evaluating or influencing this study's outcomes. I selected this partnership intentionally due to PACRAO's existing infrastructure, professional aims, and persistent challenges with member engagement in traditional professional development formats. The organization's interest in exploring innovative solutions ensured access to the target population and contextual relevance. This alignment positioned PACRAO not only as a conduit for recruitment, but as a meaningful stakeholder in the future application of gamified professional development strategies.

I launched this study in formal partnership with PACRAO during its 2025 annual meeting and conference in Spokane, Washington. This collaboration provided direct access to a professional community of practice via PACRAO's membership roster. The PACRAO conference served as the initial deployment site for the gamified platform. The association's support included communication to its membership, distribution of participation invitations, and contextual alignment with ongoing PACRAO professional-development initiatives. PACRAO also provided a conference session as an informational session about the study. I did not conduct recruitment during the

presentation session. Conducting the launch within this community ensured ecological validity and strengthened the connection between the study's design and its intended audience of academic and enrollment services professionals. A copy of the Community Partnership Agreement outlining PACRAO's support and recruitment role is included in Appendix A.

Researcher in This Context

As the developer of the gamified platform and a former embedded leader within the Rocky Mountain Association of Collegiate Registrars and Admissions Officers (RMACRAO), I brought both insider knowledge and sustained institutional engagement to the study. I served on the RMACRAO Board of Directors for multiple years, including two years as Vice President of Records and Registration, and two years in the presidential sequence, and I was fulfilling my term as Past President leading up to the study. These roles provided deep insight into the organization's professional development challenges, member engagement patterns, and cultural dynamics.

While this embeddedness enhanced contextual understanding and supported practical alignment between the platform and participant needs, it also introduced potential risks of bias. These risks included confirmation bias in that my relationship with the organization could lead me to interpret results in a more favorable light or to be perceived as less objective. To preserve neutrality and ensure professional distance, I formally stepped back from active RMACRAO leadership roles directly after IRB approval, particularly as RMACRAO members received discounted registration offers to the PACRAO's annual conference as part of inter-organizational collaboration unrelated to study participation. This intentional separation helped establish a clear ethical

boundary between my ongoing professional affiliations and my role as a researcher. My deep knowledge and familiarity with the professional context may also have introduced potential interpretive bias. These overlapping perspectives may have introduced positional bias, in which institutional loyalties or prior commitments may have influenced perceptions of neutrality.

To mitigate these risks, I did not access individual participant gameplay during the collection period. I based all analyses solely on de-identified, timestamped data retrieved from Firestore. This approach ensured participant anonymity and reinforced the integrity of this study's findings. The platform automatically scored all performance data within the platform itself, removing the possibility of subjective interpretations in scoring. I did not collect open-ended responses or qualitative feedback during gameplay, further reducing the influence of my interpretations. I was transparent in documenting and reflecting on my positionality in the discussion of the findings, acknowledging how my role may have shaped the research design or participant engagement, even in subtle ways.

Additionally, my prior work developing a RMACRAO-endorsed mentorship program and professional micro-credential informed the design of this study, particularly its emphasis on accessible, flexible learning opportunities for professionals in the region. For example, scenario topics were drawn from recurring professional challenges identified through the mentorship program, and the self-paced design reflects feedback gathered from members during the micro-credential rollout. However, the gamified platform under evaluation in this study is a new, standalone intervention that has not been previously deployed within RMACRAO or evaluated in a research context.

Study Design

I employed a nonexperimental, within-subjects repeated-measure design (Keppel & Wickens, 2004) to explore the effectiveness of a newly developed gamified professional-development platform designed for PACRAO members. I used the design to assess the platform's impact on participants' skill development, knowledge application, and engagement. I selected this design because researchers cannot easily establish a true control group in a professional development context, and it allows for direct measurement of individual changes over time.

Participants

The target population for this study included approximately 1,500 individuals across 350 institutions. PACRAO serves higher education professionals in academic and enrollment services in the Pacific region of the United States and Canada. PACRAO recruited participants through established organizational communication channels including direct emails, newsletters, social media, and the organization website.

I used a convenience sampling method, drawing from individuals who voluntarily engaged with the platform during the open study period. Participation was open to all active PACRAO members, regardless of their professional role or past experience with professional development or technology. Participation was completely voluntary, and participants could withdraw from the study at any time without consequence. Although the power analysis indicated a minimum required sample of 34 participants ($d_z = 0.50$, $\alpha = .05$, power $\geq .80$), I targeted a sample range of approximately 50-60 participants to account for incomplete sessions or attrition (Faul et al, 2009; Keppel & Wickens, 2004). Final analytic sample counts are reported in Chapter 4.

Platform Development

I developed the gamified platform used in this study to address the professional development needs of PACRAO members identified through the problem of practice. I built the platform on adult learning principles and integrated gamification mechanics to support self-directed learning, strategic decision-making, and knowledge application in realistic professional contexts. I aligned the platform design with core records and academic services competencies articulated in AACRAO professional competency frameworks and supported professionalization within the field. This section outlines the platform's technical and instructional design, including the development environment, access and delivery, scenario structure, question design, and feedback mechanisms.

Development Environment

I built the gamified platform using a combination of HTML, CSS, and JavaScript to create an interactive and responsive experience that could run independently of institutional or organizational systems. I manually coded the gamified platform in a text-based editor using an iterative testing process to refine and adjust the platform logic. I built the platform in a single file using a cumulative-build approach where new features were layered onto the existing structure and no formal version-control system was used. I relied on a browser-based preview process in which the HTML output was refreshed after each coding adjustment to observe how the edits impacted the functionality and user experience.

This low-barrier approach reflected the study's self-directed nature and reinforced the principle of accessible design by ensuring that the platform could be created, tested, and refined without requiring specialized software or technical infrastructure. By

minimizing reliance on advanced tools or proprietary systems, I designed the platform to be approachable and replicable for other professionals in higher education or related fields with basic coding knowledge, independent of any specific implementation artifacts.

To ensure scalability and real-time data capture, I hosted the platform through Firebase Cloud Firestore. Firestore offers secure, cloud-based storage and supports the back-end needs of the platform, including the potential for data logging, authentication, and future expansion. I selected Firestore because of its compatibility with JavaScript-based applications and its ability to operate independently from any institutional or organizational IT infrastructure. This was an important consideration for PACRAO's regionally dispersed and multi-institutional members.

Access and Delivery

Participants accessed the gamified platform through a direct link distributed to active PACRAO members via PACRAO's communication channels, including email, social media, and the organization's website. Appendix C provides examples of PACRAO communications. The link directed users to a GitHub-hosted landing page, which provided an introduction to the platform and research, embedded informed consent process, and basic instructions for accessing the game.

Participants reviewed the consent, completed a brief demographic questionnaire, and then entered the gamified platform via an internal modal structure. I collected demographic data prior to entering the gamified platform to ensure that baseline information was recorded. In order to prevent duplicate responses from participants, the platform generated a random, non-identifying, unique session ID for each participant at entry. The system stored this identifier locally within the browser session and used it

solely to distinguish individual sessions during data aggregation. The gamified platform checked Firestore for a matching participant ID upon entry. If the system had already marked the ID as in the database, access to the gameplay was restricted.

Participants had access to the platform for a 30-day window, during which participants engaged with the platform at their own pace, flexible pacing and voluntary progression through the platform. The design supported self-directed learning by allowing participants to progress through the content asynchronously and engage with tasks in the order and depth that aligned with their professional position, interests, or needs. I grounded this approach in andragogical principles of autonomy and learner-centered flexibility (Knowles, 1990), and the humanist emphasis on personal relevance and growth (Rogers, 1969).

I selected this layered delivery approach to provide a simple structured entry point for participants while ensuring the exempt research informed consent process was followed and consistent messaging was used across recruitment materials. Using the platform as the initial interface also supported data integrity by providing timestamped confirmation of participant entry into the platform environment. To maintain data quality, the analytic dataset included only sessions in which participants voluntarily completed both special scenarios. I excluded sessions that ended before completing both special sessions from analysis. I verified all remaining sessions for uniqueness based on Firestore-generated session identifiers prior to aggregation. I established these exclusion rules a priori to ensure that the analyses reflected genuine engagement and meaningful interaction with the platform.

Level Structure

I modeled the gamified platform after a *Diner Dash*-style progression system that centered around service desks commonly found in records and academic services offices. The interface used realistic visual elements such as a campus-inspired office background, desks, and student employees to reinforce contextual relevance, and immerse participants in a setting that mirrors their professional environment. At the same time, the stylized aesthetic created psychological distance, allowing participants to comfortably step into roles they may not typically hold (e.g., acting as a registrar) without fear of judgment or real-world consequences. This encouraged participants to safely explore their skills, test assumptions, and identify potential knowledge gaps.

Desk Unlocks. I structured the gameplay level around a central theme (FERPA) and had 10 desks that must be “unlocked” by answering a question tied to the intersection of the level’s central theme and the desk being unlocked. To unlock a desk, participants answered a question that connected the level’s theme with the desk’s function. (e.g., a FERPA + degree audit scenario to unlock the Degree Audit Desk). For the purposes of this study, individual desk unlocks involved single scenario-based questions, while special projects consisted of linked sets of three questions that together formed a broader meta-scenario. Once participants unlocked a desk, it produced incremental Core Service Points (CSP), the platform’s internal currency, through a timed click mechanism. Participants could automate each desk using CSP to maximize efficiency.

The desk unlock scenario types reflected a wide range of records and academic services functions, including Add/Drop, Degree Audit, Transcript Request, Enrollment Verification, Graduation Clearance, Academic Appeals, Health and Safety, Major Changes, Registrar Reporting, and Course Overrides. Each scenario drew on real-world

challenges or situations commonly encountered by PACRAO members and mirrored the cross-functional judgment required in the industry. Embedding these topics into the platform structure reinforced situational awareness and encouraged participants to make strategic decisions based on professional context. This alignment grounded the gamified platform in everyday records and academic services practices and supported meaningful skill development, knowledge application, and engagement through applied decision-making.

As participants progressed through the level, the desks increased in cost, CSP points, and the amount of time required for point generation. Participants could choose to click through the desks or automate them in any order they liked, reinforcing self-directed learning and autonomy. To complete the level, participants needed a minimum level of 2000 CSP in their active bank and to unlock and automate all desk stations. I designed the level to reinforce learner autonomy by allowing participants to complete tasks in any order and at their own pace, aligning with andragogical principles of self-directed learning. In addition to the core progression system, the level contained two special projects that opened up when the participant unlocked desks three and six in the progression. These special projects functioned as the embedded assessments aligned to this study's measurement goals.

Scenario-based Special Projects. I designed the platform's scenario-based special project questions to assess participants' decision-making quality through an internal scoring system. Each scenario presented four plausible response options, internally scored on a 1-4 decision quality scale. Appendix D contains a sample scenario-based special project question, including its four-tiered response structure to illustrate the

internal decision quality scale used in scoring. The highest scoring response (score of 4) reflected strategic decision-making and mastery of professional standards, while lower scores indicated partial understanding or misapplication of knowledge. Participants were not informed of the scoring structure to encourage authentic strategic reasoning rather than patterned gaming behavior.

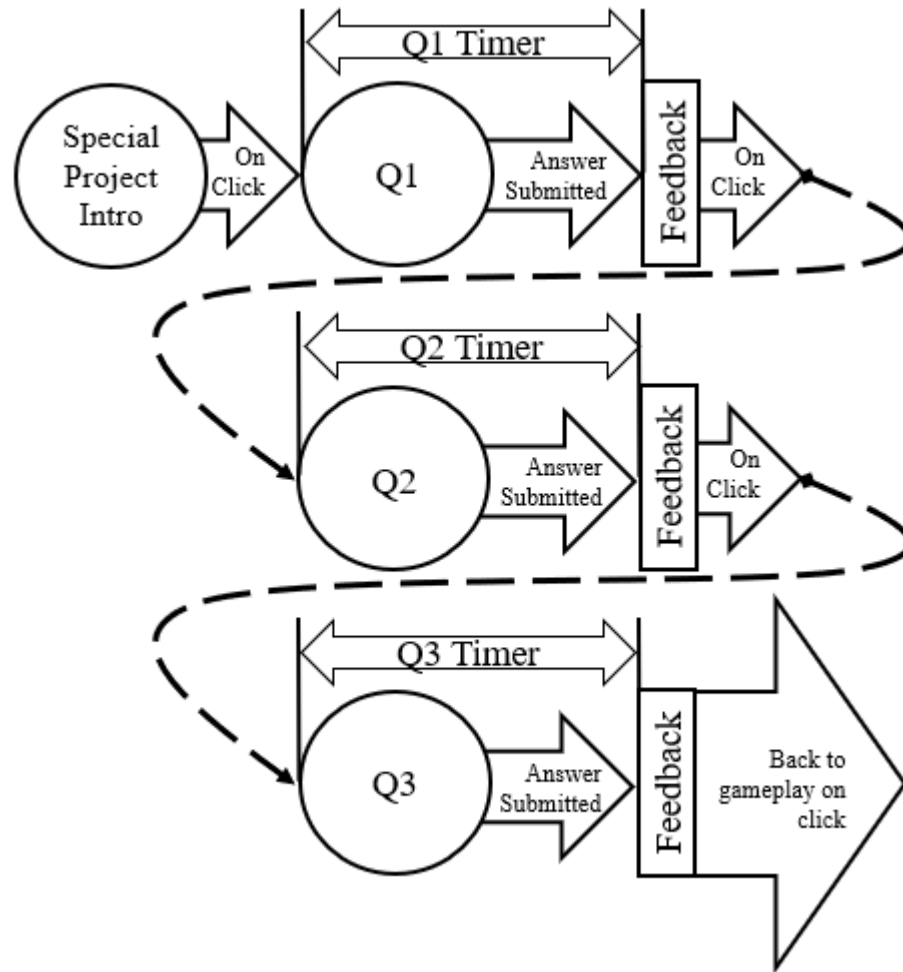
Within the level, two special projects unlocked and presented thematically linked sets of questions, forming a broader meta-scenario. Each meta-scenario consisted of three independent but interconnected decision points that followed the natural progression of a professional registrar challenge, such as identifying an emerging issue, advising leadership, and implementing corrective actions. While each question was scored individually based on decision quality, the collective structure provided insights into how consistently participants applied strategic judgment across related decisions, mirroring the complexity of real-world records and academic services work.

I crafted each set of response options to reflect professional capabilities in alignment with AACRAO's Core Competencies framework (AACRAO, 2025) and real-world records and academic services functions. A summary of the AACRAO competencies used for scoring is available in Appendix E. Higher quality responses are aligned with institutional and federal policy and professional development standards. Lower-scoring options embedded common mistakes or misconceptions professionals may encounter in practice. This alignment reinforced the development of professional judgment and situational awareness within realistic contexts.

Figure 2 illustrates the flow of the special project questions and feedback.

Figure 2

Flow of Scenario-Based Special Project Questions



Note. Dashed arrows represent optional progression between scenario questions.

Finally, a structured feedback strategy was embedded within the scenario questions to support participant growth. Participants received an immediate informational message that prompted reflection without significantly interrupting gameplay flow. This approach balanced the need for real-time instructional feedback with the gamified

environment's natural pacing, helping participants learn from errors while managing engagement.

Feedback

The platform incorporated feedback structured to support participant growth, encourage reflection, and reinforce decision-making without significantly disrupting gameplay flow. I incorporated two types of feedback mechanisms, each serving distinct purposes within the gamified platform.

Desk Unlock Feedback. Each individual desk unlock question provided immediate systemic feedback based on the participant's selected answer. If a participant selected a correct answer, the platform unlocked the desk and gameplay continued. If the participant selected an incorrect answer, the platform displayed a brief message indicating the answer was incorrect, and the platform applied a time penalty of 30 seconds before the question could be retried. Participants could retry desk unlocks as many times as needed, and each attempt enabled them to continue progression through the level.

I designed this systemic feedback structure to allow participants to recover from errors and make repeated attempts without being blocked from advancement. This mirrored the real-world consequences of senior-level records and academic services strategic decision-making, where professional missteps can be corrected over time. The structure also reflected Knowles's (1990) principle of benefitting from self-directed experiences and learning through mistakes, which enhanced reflection and supported professional development.

Scenario-based Special Project Feedback. For the scenario-based special projects, each decision point included targeted feedback that the platform delivered immediately after participants selected a response. In contrast to the systemic feedback in desk unlock questions, I designed this feedback to surface the competency misalignments underlying suboptimal decisions. Rather than simply indicating correctness, each message explicitly referenced the professional proficiencies that could elevate the decision to a higher quality. For instance, a response scored as a 2 on the 1-4 decision quality scale would trigger feedback pointing out the critical elements absent from the decision that are required for a top-tier response. This targeted feedback encouraged deeper reflection and strategic-self-correction while maintaining immersion and gameplay continuity.

I used this targeted feedback mechanism as the foundation for this study's measurement of knowledge application, as it captured participants' ability to adjust and apply decision-making strategies across complex interconnected scenarios. This approach aligned with andragogical principles (Knowles, 1990) that emphasize self-directed, experience-based learning, and reflected humanist learning theory (Rogers, 1969) through its focus on personal growth, reflective practice, and the learner's capacity for self-improvement when presented with meaningful feedback.

Measures

This study examined three primary outcome constructs, skill development, knowledge application, and engagement, as indicators of professional learning within a gamified professional development platform. These dependent variables captured distinct

but related dimensions of participant growth and interaction, reflecting both cognitive and behavioral aspects of learning performance.

The gamified platform served as the intervention environment through which these outcomes were recorded. It incorporated embedded scenario-based special projects, formative feedback to decision responses, and timestamp functionality to track engagement behavior. The platform operated as the independent variable (IV) within a nonexperimental, within-subjects, repeated measures design, providing a consistent environment for measuring change and participation over time.

I assessed skill development and knowledge application through scenario-based decision quality scores aligned to AACRAO professional standards. I operationalized engagement as a time-based behavioral measure representing participants' depth and persistence of interaction with the platform across two scenario sequences. Time-on-task data were captured in milliseconds and were retained at this level of precision to preserve analytic fidelity and relative variation across participants. Because engagement served a dual analytic role, I examined it both as an outcome variable (RQ3) and as a predictor variable (RQ4). The subsections that follow detail the operationalization, theoretical alignment and effectiveness criteria for each construct.

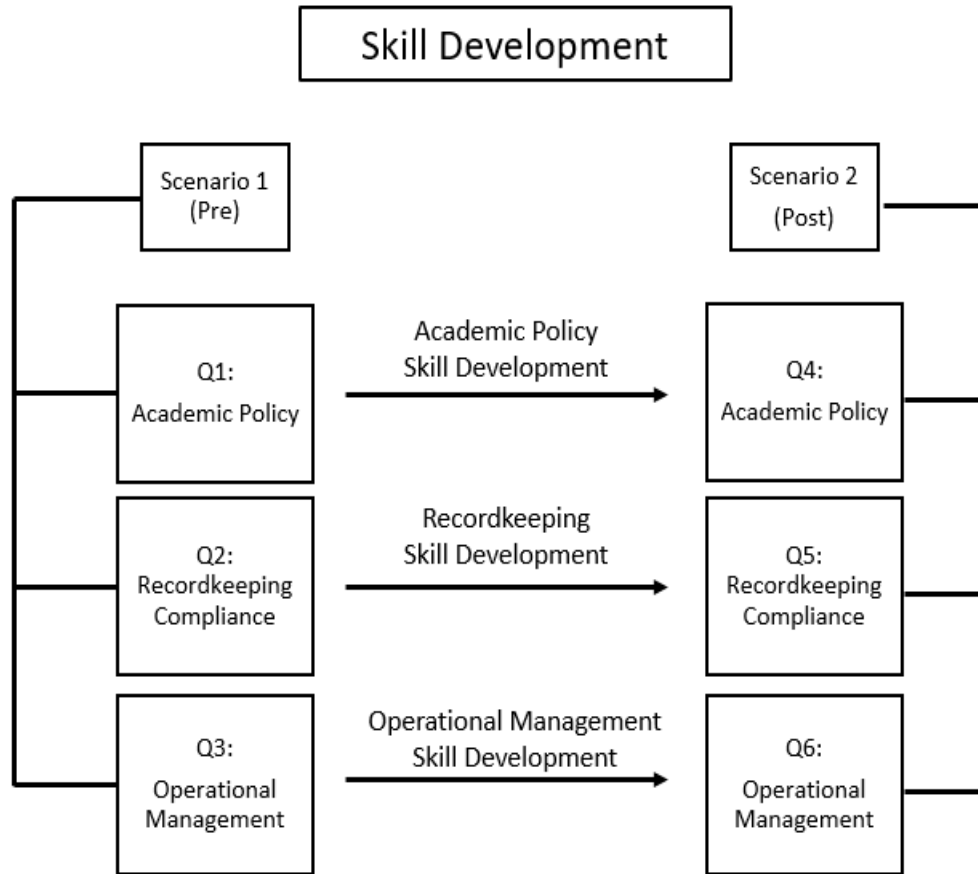
Skill Development

I operationalized skill development through participants' performance on two embedded sets of scenario-based questions within the gamified platform. Each set consists of three questions, with each question offering four plausible response options, internally ranked on a 1-4 decision quality scale aligned to industry standards and proficiencies as established by AACRAO (2025). The highest scores reflect strategic

decision-making and mastery of professional standards, while lower scores reflect partial understanding or misapplication of knowledge. Difference scores were calculated as Scenario 1 minus Scenario 2, such that negative values indicate higher performance in Scenario 2. The structure of this measurement approach is illustrated in Figure 3.

Figure 3

Skill Development Measurement Structure



Note. Skill Development Structure. Participants engaged with two scenario-based tasks per domain. Each arrow represents domain-specific skill development, with Scenario 2 tasks designed to evaluate participants' ability to apply the same professional judgment in a parallel context following prior task exposure and feedback.

Participants' responses to each question within the scenario question set were scored according to the internal ranking, and individual performance was evaluated

through direct comparison of responses within each domain pairing (Q1→Q4, Q2→Q5, Q3→Q6). Participants were not informed of the scoring structure to encourage strategic decision-making rather than pattern-based gaming. This data was stored in the Firestore backend for analysis.

Each scenario includes three questions aligned to key functional areas within records and academic services: academic policy, recordkeeping compliance and operational management. These applied domains represent applied skill areas critical to this industry, requiring not only technical knowledge, but policy interpretation and translation, evaluating compliance obligations, and strategic planning.

I assessed skill development by comparing participants' performance within each domain pair. Growth across these pairings will serve as evidence of incremental skill refinement from the first special project (early in gameplay) to the second special project (later in gameplay). This approach captures incremental growth in participants' ability to apply professional standards with greater precision and contextual understanding. By embedding measurement within real-world scenarios, this study aligned skill development evaluation with andragogical principles of problem-centered, experience-driven learning and humanist principles that emphasize personal growth and authentic learning.

I evaluated effectiveness for skill development by evidence of improved decision quality across domain pairings. I defined the platform effective when mean scores in the later scenario set (Q4-Q6) exceeded those in the corresponding earlier set (Q1-Q3), indicating refinement of professional judgment following exposure to decision feedback. I interpreted improvements as meaningful when the direction of change was positive and

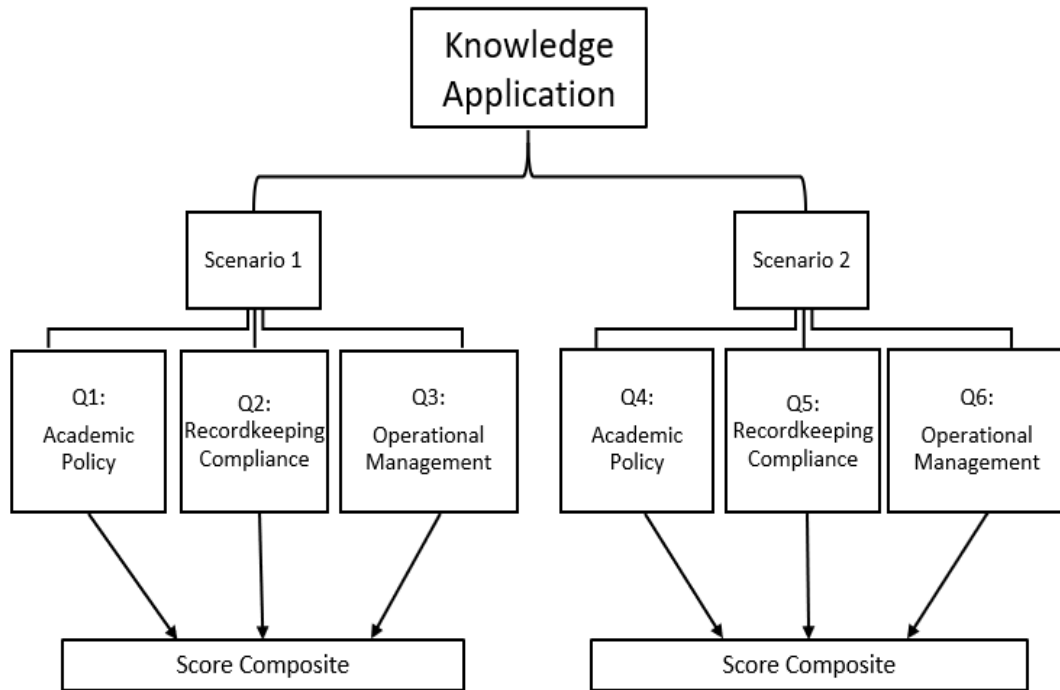
supported by statistically significant paired-sample results. I defined practical significance as $d_z \geq 0.50$, corresponding to a moderate effect consistent with Cohen's (1988) conventions and with the a priori power analysis, ensuring alignment between statistical planning and interpretation. This interpretation aligns with the Dreyfus and Dreyfus (1980) model of progressive skill refinement in professional space.

Knowledge Application

I operationalized knowledge application through participants' ability to synthesize and apply decision-making strategies across multiple professional domains when presented with parallel scenario-based special project questions. Each scenario contained three embedded questions (Q1–Q3 and Q4–Q6), each aligned to a different functional domain. The structure of this measurement approach is illustrated in Figure 4.

Figure 4

Knowledge Application Measurement Structure



Note. Participants will complete two full scenario sets. Composite scores will be calculated for Scenario 1 (Q1-Q3) and Scenario 2 (Q4-Q6) to evaluate participants ability to transfer and apply learning across domains when faced with parallel tasks.

Participants' responses were scored using the same internal 1-4 decision quality scale and were stored in the Firestore backend for analysis. I calculated composite scores separately for Scenario 1 (Q1, Q2, Q3) and Scenario 2 (Q4, Q5, Q6) by averaging the three domain-level question scores. I assessed knowledge application by comparing these two composite scores to evaluate the participants' ability to apply integrated knowledge across domains following exposure to feedback and multiple decision points.

This structure reflected the ability to synthesize learning gained across tasks and domains rather than improvement in a single domain. This structure directly aligned with the platform's humanist and andragogical design, emphasizing reflective practice and the iterative application of new knowledge to nuanced challenges. This measure supported andragogical learning (Knowles, 1990) by promoting experience-based, problem-centered learning, and aligned with humanist principles (Rogers, 1969) by emphasizing personal growth and the learner's capacity to apply professional judgment in novel, authentic contexts.

I evaluated effectiveness for knowledge application based on participants' ability to demonstrate higher composite performance scores in Scenario 2 compared to Scenario 1. I defined practical significance as $d_z \geq 0.50$, aligning with the moderate effect size used in the power analysis (Cohen, 1988).

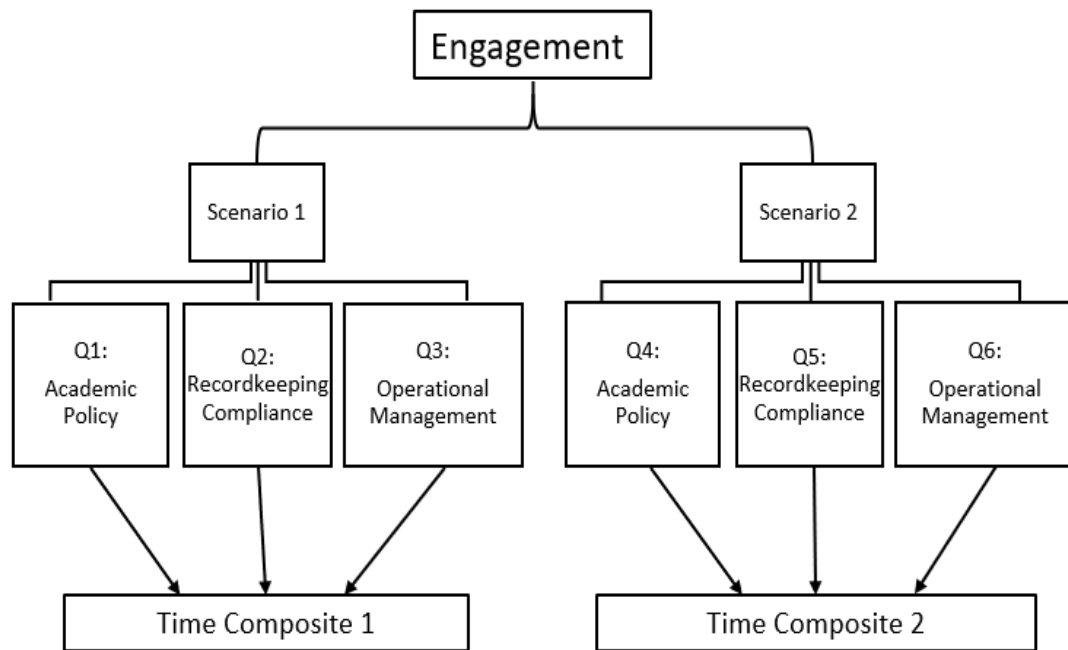
Engagement as an Outcome

I operationalized engagement through time-based behavioral metrics captured within the gamified platform. These metrics included the total session duration, time spent on individual scenario questions, and time spent on feedback. I collected timestamp data for each scenario-based special project question, and overall session duration, using JavaScript-based timing functions embedded in the platform. I stored this data in the Firestore backend for analysis. For each participant, I calculated total engagement time by summing the question and feedback durations within each scenario set (Q1-Q3 and Q4-Q6) to form two scenario-level engagement composites. These composite values served as indicators of participant depth and persistence of interaction with the platform,

providing a quantitative measure of engagement across the two gameplay scenarios. The structure of this measurement approach is illustrated in Figure 5.

Figure 5

Engagement as an Outcome Measurement Structure



Note. Participants' *time-on-task* was captured across two complete scenario sets.

Composite time scores for Scenario 1 (Q1-Q3) and Scenario 2 (Q4-Q6) were compared to evaluate sustained engagement over time.

The platform recorded *time-on-task* for each scenario question. I calculated composite engagement scores separately for each scenario by summing the total time spent on Q1-Q3 and Q4-Q6, respectively. The platform did not impose time constraints, allowing natural variation in pacing and effort. Increased time spent engaging with the

second set of questions may suggest deeper reflection or more thoughtful decision-making as participants internalize feedback and navigate complex decisions.

This measure supported andragogical (Knowles, 1990) principles by emphasizing learner autonomy and self-directed task persistence as evidence of personal investment in the learning experience. It also aligned with humanism (Rogers, 1969) by acknowledging the learner's freedom to allocate time based on personal interest, curiosity, and commitment to growth, and by using behavioral patterns as signals of meaningful, self-motivated engagement. The time learners choose to spend navigating complex tasks reflects their internal drive to explore, reflect and grow, key components of authentic, learner-centered development.

Consistent with established indicators of behavioral engagement, sustained or increasing *time-on-task* across scenarios has been theorized as evidence of meaningful, self-directed learning involvement (Hamari, et al., 2016). Accordingly, I examined changes in engagement composites across scenario sets in RQ3 to explore how participant engagement evolved over time. In addition to its role as a measured outcome (RQ3), I later employed the same engagement composite as a predictor variable in subsequent analyses (RQ4) to examine its relationship with learning outcomes.

Engagement as a Predictor

For RQ3, I examined engagement as a dependent variable to determine the extent to which participants demonstrated sustained or increased behavioral investment across the two gameplay scenarios. For RQ4, I used a total *time-on-task* engagement composite representing participants' cumulative *time-on-task* across all six scenario questions (Q1-Q6) as an independent variable in correlation and regression analyses. This composite

combined time spent on both decision and feedback interactions into a single continuous measure to capture each participants' overall behavioral investment with the platform. I modeled four learning outcomes as dependent variables. These included three domain-specific skill development change scores calculated from corresponding scenario pairs (Q1-Q4, Q2-Q5, Q3-Q6), as well as the overall transfer of learning across scenarios (Knowledge application) as calculated by the difference between Scenario 2 and Scenario 1 composite averages (Q4-Q6 to Q1-Q3). This dual treatment of engagement allowed for both descriptive evaluation of participation patterns and inferential testing of engagement as a predictor of professional learning performance.

To examine engagement as a predictor of professional development outcomes, separate simple linear regression models were specific with engagement as the independent variable. Each learning outcome was modeled individually as a dependent variable, including the three domain-specific skill development change scores and the Knowledge Application composite. The regression model was specified as follows:

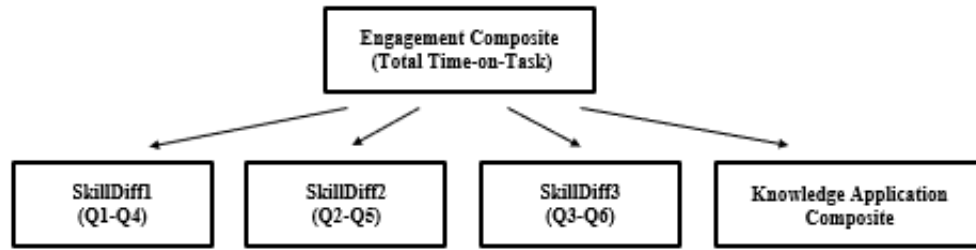
$$Y_i = \beta_0 + \beta_1 (\text{Engagement}_i) + \epsilon_i$$

In this equation, Y represents a single professional learning outcome, β_0 represents the intercept, β_1 the regression coefficient, and ϵ_i represents the residual error term.

The structure of this measurement approach is illustrated in Figure 6.

Figure 6

Engagement as a Predictor Measurement Structure



Note. Engagement represents the total time-on-task composite aggregated across all six scenario questions (Q1–Q6). SkillDiff1, SkillDiff2, and SkillDiff3 represent domain-specific change scores calculated from corresponding scenario pairs (Q1–Q4, Q2–Q5, and Q3–Q6). The Knowledge Application Composite reflects the difference between Scenario 2 and Scenario 1 composite decision-quality scores (Q4–Q6 minus Q1–Q3). Arrows indicate predictive relationships examined using correlation and simple linear regression analyses ($\alpha = .05$).

This operationalization of engagement is aligned with adult-learning theory by positioning engagement as an indicator of autonomous, self-directed behavior capable of influencing deeper professional learning outcomes. Consistent with andragogical principles (Knowles, 1990), learners who demonstrate greater behavioral persistence are presumed to invest more cognitive effort and reflection during task performance.

Humanistic perspectives (Rogers, 1969) suggest that individuals who freely allocate more

time to learning activities are exercising intrinsic motivation and personal growth orientation. Modeling engagement as a predictor variable reflects these theoretical assumptions by linking behavioral investment with potential learning gains.

I tested whether engagement was positively associated with learning outcomes. I used the engagement composite as the independent variable in both correlation and separate simple linear regression analyses, with the three domain-specific skill development change scores and the Knowledge Application composite entered individually as dependent variables. I used statistical significance ($\alpha=.05$), standardized regression coefficients (β), and explained variance (R^2) as indicators of predictive strength (Keppel & Wickens, 2004; Mendenhall & Sincich, 2014).

Procedure

PACRAO distributed recruitment materials through its communication channels directing participants to the GitHub-hosted landing page via an internal modal (pop-up window) structure. At the landing page (Phase 1), participants entered the platform, reviewed the exempt research information informed consent sheet, and provided electronic consent, by clicking an acknowledgement box and clicking continue, before proceeding to the demographic information. After providing consent, participants completed a brief demographic questionnaire designed to gather baseline characteristics. After completing the demographic questions, participants were directed into the gamified platform (Phase 2). The platform remained available for a 30-day window, during which participants could engage with the platform at their own pace.

This self-directed approach supported the study's alignment with andragogical principles by allowing participants to choose when and how they engaged with the

professional development material. Participation ended after participants completed the level progression within the gamified platform. I did not require any additional post-game survey or follow-up activity.

Phase 1: Modals

I collected the exempt research information sheet informed consent acknowledgement and demographic data for this study through an embedded modal structure. Participants first completed the exempt research information sheet, informed consent process, and demographic questionnaire, ensuring that I securely collected and timestamped participant baseline information prior to engagement with the platform.

Phase 2: The Gamified Platform

The platform greeted participants with a welcome screen, followed by basic instructions for how the game level worked. After reviewing this information, participants clicked a button to begin. At this point, the total session timer began and the platform displayed the gameplay area to participants. I did not collect additional data until the special projects were triggered.

I designed the gameplay to look like a registrar's office in a university from an overhead perspective. See Appendix F for screen shots of the gameplay area. The platform presented participants with a desk that was already unlocked. They clicked the unlocked desk to accumulate CSP to the point where automation was possible. Once participants accumulated a certain amount of CSP, the desk could be automated by “hiring a work study student.” If automated, the desk automatically accumulated CSP at a predetermined rate. If the participant chose not to automate the desk, they could continue

to manually click the desk to accumulate points. This gameplay would continue until the participant accumulated enough CSP to unlock the next desk station.

Once the participant reached enough CSP to unlock the next desk station, the platform activated a button prompting this purchase. When the button was clicked for purchase, the participant had to correctly answer a basic desk unlock question to proceed. If they answered correctly, the desk unlocked, and the gameplay continued. If they answered incorrectly, a 30-second time penalty was applied by the system before they could reattempt the question, and feedback indicating an incorrect answer was shown. Participants continued this process until the third desk was unlocked. When participants unlocked this desk, it triggered the first scenario-based special project.

Immediately after unlocking the third desk station, the platform displayed a button that appeared just under the gameplay area, indicating that a special project was available. These special projects contained the scenario-based questions aligned with this study's outcome variables of skill development, knowledge application and engagement. A participant had to choose to click on the special project button in order to trigger the associated metrics.

When a participant clicked on the special project button, the platform opened an information modal over the gameplay area. The platform presented participants with a real-world scenario common to the industry. After reading the scenario, they clicked a button to proceed to the next screen, which started the timer for the first question. This modal continued to display the scenario, while simultaneously presenting a question and four options to answer that question. Once the participant made a selection and submitted their answer, the internal question timer stopped and recorded, the platform displayed the

feedback prompt associated with that answer was selected, starting the time on feedback timer. The participant had a prompt to move them onto the next question. Clicking on this prompt stopped the feedback timer and started the timer for the next question.

This same process occurred with the second and third questions in the set. When the participant submitted the last answer, the platform displayed a final message about completing the challenge, or contextualized feedback, and the internal timer for the last question was stopped. The participant was returned to the gameplay area to continue unlocking desk stations, and the special scenario answers and question time stamp data were sent to the database backend. The platform returned participants to the gameplay to continue with the desk unlocking process until the participant unlocked the sixth desk, when the platform triggered the second set of scenario-based questions.

The second scenario and its questions appeared in the same format as the first set of questions, but the scenario had a slightly different situational context. The participant worked through the set of questions, with the platform internally recording each selection and time stamp. Similar to the first set of questions, when the participant submitted the last answer, regular gameplay continued, and the platform sent the data to the database backend. At that point, the participant had four desk stations to unlock before the end of level functions were triggered.

The platform triggered the end-of-level functions when the participant met a series of requirements, outlined at the beginning. These included unlocking and automating all ten desk stations, completing both scenario-based special projects, and reaching a minimum CSP total. Once all of these requirements were met, the platform displayed a congratulatory modal message stating that the level had been completed, and

that they could close the window. The platform stopped the internal total session timer and sent the data to the database backend. From initial testing estimates, it would take between 10-15 minutes to complete the level. For the purposes of this study, no further action was required from the participant. I excluded sessions that did not meet these progression criteria (e.g., incomplete scenarios or missing timestamp records) from subsequent analysis, consistent with the data-quality rules described previously.

Procedure Review

I designed the general gameplay of the level to provide needed situational context to ground the participant in the immersive environment, before presenting them with the special scenarios. The flow of the gameplay was completely up to how the participant engaged with the platform in that some participants could automate each desk immediately or choose to click the desks in order to generate CSP. This multi-level engagement and data collection strategy ensured that participants were central to the experience and that the platform captured data systematically, while aligning with the study's focus on humanist and andragogical principles and applied professional development outcomes. I used these data as the basis for subsequent statistical analysis to evaluate the platform's capacity to foster participant skill development, knowledge application, and engagement.

Data Analysis

I conducted quantitative analyses using SPSS to explore the effectiveness of the gamified platform in fostering professional development through skill development, knowledge application, and engagement. The primary tests were: three paired-samples t -tests for skill development (one per domain), a paired-samples t -test for knowledge-

application composites (Scenario 2 to Scenario 1), a paired-samples *t*-test for engagement time composites (Scenario 2 to Scenario 1), and correlations/regressions linking engagement to performance outcomes.

I exported all platform data from Firestore and flattened into a session-level dataset using a custom Python script prior to analysis. I used descriptive statistics, paired-samples *t*-tests, and targeted correlation or regression models to capture within-subjects change and explore relationships among behavioral patterns and outcomes.

I addressed each research question through a primary statistical test: paired-samples *t*-tests for within-subjects comparisons of skill development and knowledge application, and correlational and regression analysis to explore engagement relationships. All tests included descriptive statistics, assumption checks, and effect sizes with 95% confidence intervals (Cumming, 2012).

Alongside hypothesis testing, I reported effect sizes using Cohen's *d* to quantify the magnitude of observed change (Cohen, 1988). For interpretation, I treated values near 0.20, 0.50, and 0.80 as small, moderate, and large respectively (Cohen, 1988). Kirk (1996) emphasized that statistical significance alone does not guarantee meaningful change in applied settings, advocating for the complementary interpretation of effect magnitude and practical impact. To ground practical significance in educational research, I interpreted results with reference to Hattie's synthesis of educational interventions, which uses standardized effects as a common impact metric (Hattie, 2009). Ferguson (2009) emphasized that even small-to-moderate effects can hold meaningful applied value in behavioral and educational contexts when tied to real-world performance outcomes. In this study, I treated effects of $d \geq 0.5$ as educationally meaningful given the

brevity and light-touch nature of this platform, while still reporting exact d_z values and 95% confidence intervals for transparency (Cohen, 1988; Cumming, 2012; Ferguson, 2009). I excluded incomplete or aborted sessions (e.g., missing scenario data, missing timestamps, or implausibly short total duration) from analysis.

Data Preparation and Handling

I exported session-level data from Firestore and flattened using a custom Python script to produce a single CSV file containing all question-level and time-based variables (Q1-Q6, scores, feedback timestamps, and session duration). I merged and aggregated each participant's event data to create scenario-level composites for engagement (*time-on-task*) and learning outcomes (decision quality scores). Variable naming conventions in the analytic file mirrored the structure in Table 2. Prior to import into SPSS, I screened all variables for completeness, outliers, and formatting consistency. I verified data integration through random record checks between the flattened dataset and the source Firestore entries (Python script available upon request). Specific data anomalies and any resulting adjustments are reported in Chapter 4.

I duplicated the exported file on the device to create two versions: (a) an unaltered raw dataset preserved for auditability and reproducibility, and (b) a cleaned dataset used for screening, formatting checks, and statistical preparation. After the dataset was flattened from Firestore into a single Excel/CSV file using the extraction script, I identified 33 pre-launch system test entries by unique id and removed those from the dataset. I immediately transferred the file to a secure, non-internet connected USB storage device dedicated exclusively to this research. Only the cleaned version was imported into SPSS for analysis. The authoritative copy of the data remains stored in

Firestore and can be regenerated at any time using the flattening script. I stored all local files (raw and cleaned) securely on the offline device, accessible only to myself. The files will be retained for institutional recordkeeping in accordance with the established protocols for this research before being destroyed.

To support the accuracy and interpretability of the statistical analysis, I restricted the analytic sample for this study to participants who completed both scenario sequences within the gamified platform and provided valid responses to all six decision-quality items (Q1-Q6). Because the primary analyses relied on paired-samples statistical tests, fully matched observations were required to evaluate within-person change across scenarios. I excluded participants with incomplete scenario data, missing item responses, or invalid entries during the screening process. These inclusion criteria ensured that the resulting analytic sample reflected only those individuals who progressed through the full learning pathway and generated the complete data necessary for examining skill development, knowledge application, engagement, and predictive relationships. The final analytic sample is reported in Chapter 4.

Data Screening and Outlier Adjustment

I examined variables for distributional properties, extreme values, and anomalies prior to analysis. Because session and task duration (*time-on-task*) can vary widely in self-paced online environments, this variable received additional scrutiny. I identified one participant's question answer time as an extreme positive outlier that disproportionately influenced the mean and standard deviation relative to the rest of the sample. This value occurred on question two of the first scenario set, with all other values for this participant falling within the range observed for the remainder of the sample. The available system

data indicate only that the participant's response time on this item was substantially longer than other responses; no additional behavioral indicators suggested disengagement or data-entry error. The value was retained because sensitivity checks indicated that results and substantive interpretations were unchanged with and without this case.

In addition to the outlier screening procedures described above, I identified two participant records with complete scenario-level interaction data (Q1-Q6 and associated feedback events) but missing session-level timing fields. These omissions were traced to a technical logging interruption in which the session-timer trigger did not initialize on the participant's device, while all scenario-level timing and decision-quality logging operated normally. Because these records contained full and internally consistent item-level data, they were retained for all analyses. Only the session-level timing variable was unavailable for these two cases and was excluded from descriptive reporting accordingly.

Hypotheses

The following hypotheses corresponded to the study's core constructs: skill development, knowledge application, and engagement.

Skill Development

H₀₁: There will be no measurable difference in participant skill development scores between the first and second scenario sets.

H₁₁: There will be a measurable difference in participant skill development scores between the first and second scenario sets.

Knowledge Application

H₀₂: There will be no measurable difference in participant knowledge-application composite scores between the first and second

scenario sets.

H₁₂: There will be a measurable difference in participant knowledge-application composite scores between the first and second scenario sets.

Engagement (Outcome)

H₀₃: There will be no measurable difference in participant engagement between the first and second scenario sets.

H₁₃: There will be a measurable difference in participant engagement between the first and second scenario sets.

Engagement (Predictor)

H₀₃: Participant engagement will not be related to skill-development and/or knowledge application composite scores.

H₁₃: Participant engagement will be related to skill-development and/or knowledge application composite scores.

Assumptions Testing

To ensure the validity of statistical conclusions, I established and tested all underlying assumptions related to this study's design and analytic techniques prior to conducting hypothesis tests or interpreting results. The primary statistical guidance for this study drew from Keppel and Wickens (2004) for design, Frankfort-Nachmias and colleagues (2021) for paired samples *t*-tests, and Mendenhall and Sincich (2014) for correlation and regression methods. A summary of the analyses, the assumptions, and alternate tests is available in Appendix G.

Repeated Measures Design (Within-Subjects). This study used a nonexperimental, within-subjects, repeated measures design (Keppel & Wickens, 2004), which carried several assumptions. These included the normality of the dependent variable, the use of continuous data, the presence of related observations, the absence of significant outliers, and sphericity (when applicable). Because the primary analyses in this study involved paired comparisons, assumptions specific to multi-level repeated-measures ANOVA (e.g., sphericity) were not applicable (Keppel & Wickens, 2004).

Paired Samples *t*-Tests. I used paired samples *t*-tests (Frankfort-Nachmias et al., 2021) to compare paired observations within participants across scenario sets. This test assumes that the dependent variable is continuous and that the difference between paired observations is approximately normally distributed, particularly for samples smaller than 50. Independence of observation is required between participants, while within-subjects observations are expected to be related by design (Keppel & Wickens, 2004). These assumptions were checked using visual methods (e.g., histograms, Q-Q plots) and tests of normality (e.g., Shapiro-Wilk test).

Correlation. Assumptions for correlation analysis included continuous data, a linear relationship between the variables, normality of the distribution, and no significant outliers (Mendenhall & Sincich, 2014). Linearity was assessed using scatterplots, and normality via visual and statistical tests. If assumptions were substantially violated, Spearman's rho would be considered in place of Pearson's *r*.

Regression. Linear regression analysis assumes linearity between predictors and outcome, independence of errors, homoscedasticity (constant variance of residuals), normality of residuals, and absence of multicollinearity (Mendenhall & Sincich, 2014).

These were tested through residual plots, histograms, Durbin-Watson statistics, and variance inflation factors (VIF). Violations were addressed through transformations, robust standard errors, or alternative modeling techniques. Cases of multicollinearity were addressed through variable reduction or orthogonalization strategies.

Assumptions Testing Summary. All assumptions related to the design and analysis of this study were carefully evaluated prior to hypothesis testing. When assumptions were violated, appropriate corrective actions or non-parametric alternatives were considered to protect the integrity of the finding. A summary table of the assumptions for this study's design and analysis are available in Appendix G.

Skill Development

I analyzed skill development with within-domain pair comparisons. The first scenario set occurred early in gameplay, with the second occurring later in gameplay. The platform rated each question on a 1-4 internal decision quality scale that reflected alignment to AACRAO records and academic services proficiencies. For each participant, I paired scores from the later scenario items with their earlier counterparts (Q4 to Q1, Q5 to Q2, Q6 to Q3). I conducted three paired-samples *t*-tests (one per domain) and reported descriptive statistics for each item pair. For every test, I reported Cohen's *d* (paired-samples effect size) with 95% confidence intervals (Cumming, 2012). I interpreted directionally positive mean differences (later > earlier) as evidence of domain-specific refinement of professional judgment.

This analysis provided insight into participants' growth in applied records and academic services competencies such as academic policy, recordkeeping compliance, and operational management. Improved scores over time served as evidence of progressive

skill development and reflected the gamified platform's alignment with andragogical (Knowles, 1990) principles of problem-centered learning, and humanist (Rogers, 1969) emphasis on authentic, experience-based growth. Correlation and regression analyses were not appropriate for this measure, as it focused on a direct comparison of performance across time points rather than prediction or association.

Knowledge Application

I analyzed knowledge application using scenario-level composites. For each participant, I averaged the three domain scores in Scenario 1 (Q1-Q3) and the three domain scores in Scenario 2 (Q4-Q6) to form two composite scores on the same 1-4 scale. I compared these two composites using a paired-samples *t*-test and reported descriptive statistics, Cohens' *d*, and 95% confidence intervals (Cumming, 2012). I interpreted directionally positive mean differences (Scenario 2 > Scenario 1) as evidence of participants' ability to synthesize and apply decision-making strategies across domains.

This analysis aligned with this study's definition of knowledge application as the ability to adjust and apply decision-making strategies based on presented feedback. This analysis indirectly assessed adaptive expertise and reflective judgment, core principles of andragogy (Knowles, 1990) and humanist development (Rogers, 1969). Because the data structure reflected within-subjects improvement rather than inter-variable correlation, neither correlation nor regression were necessary unless further predictive modeling is pursued.

Engagement as an Outcome

I analyzed engagement using time-based composites drawn from the platform logs. For each participant, I summed time on question + time on feedback for each item, then averaged across items within Scenario 1 (Q1-Q3) and within Scenario 2 (Q4-Q6) to yield two scenario-level engagement composites (in seconds). I compared Scenario 2 to Scenario 1 with a paired-samples *t*-test and reported descriptives, Cohen's *d*, and 95% confidence intervals (Cohen, 1988; Cumming, 2012).

This analysis supported the framing of engagement as a behavioral indicator of self-directed learning and task persistence, consistent with andragogical principles (Knowles, 1990). It is aligned with humanist learning (Rogers, 1969) by interpreting learners' choices in how they spend their time as indicators of autonomy, reflection, and motivation. Behavioral patterns such as extended *time-on-task* offered insights into learner commitment and the depth of their interaction with complex professional scenarios. This analysis helped determine whether the gamified platform fostered engagement in ways that support meaningful professional learning.

This analysis addressed RQ3 by determining whether participants demonstrated sustained or increased engagement across gameplay scenarios, indicating the platform's effectiveness in promoting behavioral investment. Beyond this outcome analysis, I also modeled engagement as a predictor variable to examine its relationship with learning outcomes.

Engagement as a Predictor

I conducted correlational analysis to explore associations between engagement and learning outcomes (Mendenhall & Sincich, 2014). Specifically, I correlated the

engagement composite with each of the three domain-specific skill development change scores (SkillDiff1, SkillDiff2, SkillDiff3) and the Knowledge Application Composite. These analyses identified whether participants who engaged more deeply with the platform, by spending more time on scenario questions, also demonstrated stronger skill development and knowledge application. Additionally, I conducted separate simple linear regression analyses to examine whether the engagement composite predicted each learning outcome variable. These models helped determine whether behavioral measures of engagement could serve as indicators of future performance or professional growth within the platform.

Modeling engagement as a predictor was consistent with adult-learning theory in that learners who invest more self-directed time are presumed to engage in greater reflection and cognitive effort (Knowles, 1990). From a humanistic perspective, freely allocated time reflects autonomy, intrinsic motivation, and personal growth orientation (Rogers, 1969). If the platform fostered deeper behavioral investment, it should be observable as positive associations between engagement time and learning outcomes (Hamari et al., 2016). In this analysis, the engagement composite represented participants' total *time-on-task* across all six scenario questions (Q1-Q6), encompassing both decision and feedback interactions, to serve as a single continuous predictor of learning outcomes. Because the engagement composite used for RQ4 was aggregated across all six questions, it represented total behavioral investment rather than within-scenario change.

I evaluated predictive strength using Pearson correlations and separate simple regression analyses with the engagement composite as the predictor and each learning

outcome variable entered individually as an outcome. Evidence was based on statistical significance ($\alpha = .05$), standardized regression coefficients (β) and explained variance (R^2) (Keppel & Wickens, 2004). This analysis addressed RQ4 by testing whether behavioral engagement functioned as a measurable predictor of professional-learning performance within the gamified platform.

Data Analysis Summary

To synthesize this analysis plan across the study constructs, Table 3 provides a summary of the statistical techniques I applied to each construct, the corresponding data inputs, and the purpose of each test. This table provides a visual reference for understanding how the measures align with the analytic strategies I used to explore the effectiveness of the gamified platform in fostering skill development, knowledge application, and engagement among PACRAO members.

Table 3*Summary Table of Analysis Plan*

Measure	Analysis Technique	Data Source	Purpose
Skill Development	Descriptives, Paired Samples <i>t</i> -test, Cohen's <i>d</i>	Paired domain-specific decision quality scores	Assess improvement in professional proficiencies over time
Knowledge Application	Descriptives, Paired Samples <i>t</i> -test, Cohen's <i>d</i>	Scenario-level composite decision quality scores (Scenario 1: Q1-Q3; Scenario 2: Q4-Q6)	Assess applied professional decision making through scenario-based knowledge application
Engagement	Descriptives, Paired Samples <i>t</i> -test, Cohen's <i>d</i> , Correlation, Regression	Total Time-on-Task measures (Per-question duration, feedback duration)	Assess behavioral engagement patterns and examine engagement as both outcome and a predictor of learning outcomes

Note. All analyses were conducted using a within-subjects repeated-measures design.

To ensure the validity of the statistical results, I tested all underlying assumptions associated with the design and each analytic technique used for each construct in this study. These include assumptions relevant to paired-samples *t*-tests, correlation, and regression analyses. Appendix G provides a summary of these assumptions and how I evaluated them. Together, these analyses provided insight into the gamified platform's capacity to foster skill development, knowledge application, and engagement through decision refinement, knowledge transfer, and behavioral engagement. The following

sections address the steps I will take to ensure the validity, reliability, and ethical integrity of the study's design and data collection procedures.

Validity and Reliability

I ensured the validity and reliability of this study through multiple strategies grounded in established professional and research standards. I assessed the internal consistency of measures derived from the scenario-based scoring system using Cronbach's alpha (Cronbach, 1951). This analysis examined the degree of covariance among scenario-based items within each scenario sequence. Cronbach's alpha was used to examine internal consistency for scenario clusters constructed from multiple domain-specific items. I applied Cronbach's alpha only to constructs operationalized as scenario clusters and did not use it for paired single-item scenario comparisons. Results indicated low internal consistency, reflecting the intentional design of the platform in which each item assessed a distinct competency domain rather than multiple indicators of a single latent construct.

To ensure alignment with professional standards, I designed the scenario content and response scoring criteria in reference to AACRAO's core competencies and applicable federal policy frameworks, such as FERPA. I developed each scenario to reflect real-world industry challenges, with response options structured to represent a range of quality grounded in professional judgment and policy alignment. Content validity was supported by ensuring that participant decisions are evaluated in relation to authentic, standards-based practice. Additionally, I pursued content validation through expert review from a registrar professional, not associated with PACRAO, who reviewed

the scenario prompts and scoring matrix to confirm their relevance, clarity, and alignment with the study's intended learning constructs.

To further support content validity and construct alignment, an external reviewer with expertise in higher-education research and FERPA compliance examined the scenario prompts, response options, and embedded feedback within the gamified platform. This review confirmed that each scenario accurately reflected professional records and academic services practices, adhered to FERPA standards, and aligned with this study's intended learning constructs.

Together, the internal-consistency assessment, expert review for content alignment, and adherence to assumptions testing establish both the measurement reliability and analytic validity of this study. These procedures ensured that observed changes in scores and time-based engagement reflected genuine learning differences rather than instrument or data-quality error.

Ethical Considerations

I upheld the ethical integrity of this study by prioritizing participant autonomy, data anonymity, and inclusive design throughout the research process. The platform did not collect personally identifiable information and recorded all participant responses using unique identifiers. I stored all gameplay data in a secure Firestore database with access controls in place. Because the platform did not collect personal information and linked responses only to unique IDs, I cannot trace individual decisions back to any identifiable data. Participants were able to engage with the platform without risk to their privacy or identity.

Participation in the study was entirely voluntary. Participants were informed of their right to withdraw at any point without penalty, and the exempt research information informed consent process clearly outlined the nature of participation and data usage. No incentives, penalties, or institutional pressures were associated with completing or not completing the gameplay. This ensured alignment with ethical standards for adult professional development research.

I designed this study in partnership with PACRAO, which formally agreed to support recruitment and communication efforts. That partnership ensured this study remained contextually relevant and grounded in organizational trust. This study received exempt determination from the University of Denver Institutional Review Board (IRB) under 45 CFR 46.104(d)(2)(i) on September 30, 2025. This study posed minimal risk and aligned with typical criteria for exempt educational research involving adult learners. (See Appendix H for a copy of the IRB exemption letter).

In addition to procedural safeguards, I embedded inclusive and humanizing design features to reinforce the study's grounding in humanist theory. I generated the visual elements, including the work-study character images and office background, using AI tools to create diverse, inclusive representations. This approach allowed for the reflection of human characteristics without relying on real-world imagery or stock photos, avoiding the uncanny valley effect. These design choices aligned this study's theoretical framework through an emphasis on learner dignity, representation, and psychological safety.

Limitations

I acknowledged several limitations that may have affected the generalizability and interpretability of this study's findings. For clarity, I have broken these limitations into two categories, platform limitations and methodological limitations.

Platform Limitations

First, the voluntary nature of participation introduced potential self-selection bias. Participants who chose to engage with the gamified platform may have already had favorable attitudes toward professional development, technology, or innovative learning approaches. Their experiences may not fully reflect those of the broader PACRAO membership. Additionally, the study focused specifically on records and academic services functions, which limited the applicability of findings to other areas within the larger professional context of academic and enrollment services.

Second, the platform required basic digital access and familiarity with browser-based tools. While designed to be accessible across common devices, variability in participants' access to reliable internet or comfort with digital platforms may have influenced their engagement or performance. Variability in digital access and comfort with browser tools may have unintentionally created barriers for some. Third, the study's single-region focus on PACRAO members may limit the applicability of findings to broader higher educational contexts.

Third, while the platform design incorporated inclusive and humanizing elements (e.g., diverse visual representation, simplified language, and reflective feedback prompts), full accessibility testing and screen reader compatibility were not implemented in the tested iteration of the platform. As a result, users relying on assistive technologies

(e.g., screen readers or keyboard-only navigation) may have experienced limitations when interacting with the platform. I acknowledge this as a design limitation and the platform will be prioritized for future development to align more fully with WCAG 2.1 standards and universal access principles (*Web Content Accessibility Guidelines (WCAG) 2.1*, n.d.).

Finally, the platform's scenario structure and progression system may have presented a level of complexity that discouraged participation for some users. While I designed it to reflect real-world challenges, the layered decision-making and abstracted gameplay mechanics may not have appealed to all professionals, particularly those less familiar with gamified tools or self-directed learning environments. Despite these limitations, this study provided insights into how gamification can support skill development, knowledge application, and engagement in records and academic services professional development contexts.

Methodological Limitations

Keppel and Wickens (2004) note that the within-subjects design has both statistical and nonstatistical limitations concerned mostly with the independence of the observations. From a statistical sense, since the scores produced by an individual are more alike than are the scores from different subjects, the assumption of independence of the observation may be violated. Nonstatistical problems arise due to a vulnerability to incidental effects due to the independence of the observations and carry over effects based on the handling of the treatment. In this study, the feedback mechanism for the scenario-based special projects could cause a transient effect in the application of the feedback that is presented.

Because participation in the *PACRAO University* platform was anonymous and did not require user authentication, I could not verify whether an individual accessed the platform multiple times using different devices or access points (e.g., work and home computers or mobile devices). This design choice was intentional and aligned with the study's humanistic and andragogical emphasis on autonomy, low participation barriers, and voluntary engagement. While this approach limited the ability to confirm unique participation at the individual level, I addressed this limitation analytically by restricting within-subjects analyses to responses that could be linked across scenario sets using a consistent system-generated identifier, consistent with recommendations for transparent handling of analytic constraints in applied research (Cumming, 2012). As a result, the analytic sample reflects only participants with complete, linkable engagement data, mitigating the potential impact of duplicate entries on the reported findings.

Summary

This chapter outlines the research methods that I used to evaluate a gamified professional development platform designed to address engagement, skill development, and knowledge application among PACRAO members. Grounded in humanist and andragogical theory, the platform leveraged scenario-based challenges, embedded feedback, and game mechanics to operationalize self-directed learning, critical reflection, and applied skill development within realistic professional contexts.

This chapter detailed the study design, participant recruitment strategies, technical and instructional platform development, and the operationalization of constructs such as skill development, knowledge application and engagement. Data collection procedures and analytic strategies, including the use of paired samples *t*-tests, were selected to assess

participant outcomes over time. Measures were designed to assess how participants internalize feedback and apply knowledge in increasingly complex professional decisions.

By embedding performance measures directly into gameplay and aligning the experience with established professional competencies, this study offers a novel approach to assessing professional development outcomes in real-time. Validity, reliability, and ethical safeguards were addressed to ensure methodological integrity and potential limitations are acknowledged to frame the scope of the findings. This chapter establishes a foundation for assessing how gamification can strengthen professional development in records and academic services. It supports the broader aim of transforming passive engagement into active, reflective, and skill-building learning experiences addressing persistent gaps in traditional formats across higher education contexts, particularly within records and academic services.

Chapter 4: Results and Analysis

The purpose of this study was to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members. I designed the intervention platform, *PACRAO University*, to replicate authentic workplace decision-making within a simulated environment. Grounded in the principles of humanism (Rogers, 1969) and andragogy (Knowles, 1990), and operationalized through gamification (Kapp, 2012), the platform provided a self-paced, problem-centered learning experience aligned with the needs and motivations of adult professionals.

Each construct represented a distinct but interrelated dimension of learning within the gamified environment. Skill development reflected participants' progressive improvement in domain-specific decision-making across parallel scenarios. Within the platform, skill development was reflected through participants' selection of higher-quality responses to complex professional problems, scored using a 1-4 decision-quality scale aligned to AACRAO professional proficiencies. I operationalized knowledge application as participants' ability to transfer what they had learned (including feedback and reinforcement from earlier decisions) into a later, parallel scenario that required applying the same underlying concept under slightly different conditions. In the platform, knowledge application was operationalized by comparing performance across matched

scenario pairs (Scenario 1 to Scenario 2) to determine whether participants applied prior learning to a new but conceptually aligned decision context.

Engagement represented the behavioral investment participants demonstrated while interacting with the platform. Measured through time-based metrics (session duration, *time-on-task*, time on feedback), engagement provided a quantifiable indicator of how participants interacted with the gamified platform. Within the analysis, engagement served a dual function. I first treated it as an outcome variable, reflecting the degree to which the gamified platform successfully captured and sustained participant attention. It was later examined as a predictor variable, allowing exploration of whether higher levels of engagement translated into improved performance across skill development and knowledge application measures. In this way, engagement became both a marker of experiential involvement and a potential mechanism for understanding the transfer of learning within the professional development context.

Collectively, these constructs aligned with the study's guiding framework. Humanism (Rogers, 1969) provided the climate of autonomy, relevance, and self-reflection; andragogy (Knowles, 1990) translated those values into adult learning structures emphasizing self-direction and problem-centered exploration; and gamification (Kapp, 2012) served as the mechanism through which the theoretical underpinnings were implemented in practice. The integration of these frameworks allowed *PACRAO University* to function as both a professional-development platform and a research instrument capable of capturing measurable indicators of adult learning in context.

Evaluation Approach

Drawing on the quantitative within-subjects design described in Chapter 3, the analysis in this chapter was organized around the four research questions guiding this study, which collectively examined how the gamified platform fostered skill development, knowledge application, and engagement:

RQ1. To what extent does the gamified platform foster skill development in professional scenarios?

RQ2. To what extent does the gamified platform foster knowledge application in professional scenarios?

RQ3. To what extent does the gamified platform foster engagement among PACRAO members?

RQ4. What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

To examine each of these questions, a quantitative, within-subjects repeated-measures design was used (Keppel & Wickens, 2004). Although the overall design is within-subjects, I conducted the primary inferential comparisons in this study using paired-samples *t*-tests across matched scenario sets rather than multi-level repeated-measures ANOVA.

This approach allowed for the comparison of each participant's performance across parallel scenario sets, highlighting changes in professional judgment as participants revisited similar decision contexts. The design was appropriate for detecting learning gains and behavioral changes that occurred within individuals as they progressed through the gamified platform. Analyses were interpreted in accordance with established

standards for statistical and practical significance, including the use of effect sizes, confidence intervals, and educationally meaningful thresholds (Cumming, 2012; Ferguson, 2009; Hattie, 2009; Kirk, 1996).

I drew data from three primary sources within the platform's architecture. Gameplay metrics recorded participants' decision quality, *time-on-task*, and completion data for each scenario. Scenario-based assessments were composed of paired decision items (scored on a 1-4 internal rubric aligned with AACRAO professional competencies) designed to capture shifts in professional judgment across equivalent contexts. Interaction data documented behavioral indicators of engagement, including persistence across activities and time spent on feedback.

Analyses included descriptive statistics, paired-samples *t*-tests, and comparison of composite measures to evaluate change across constructs. Correlational and regression analyses were conducted to assess whether engagement behavior predicted outcomes in skill development and knowledge application. This multi-level analytic strategy supported both evaluation of the platform's impact and exploration of the relational dynamics among variables.

These findings should be interpreted in light of several limitations. As participation was voluntary, the dataset could reflect a degree of self-selection bias among members more inclined toward technology, innovation, or professional development. Additionally, differences in technology access or digital fluency could have influenced participant performance or engagement patterns. Finally, the study's short implementation window limited conclusions about long-term learning retention or sustained behavioral change.

Analytic Sample Definition

To ensure the accuracy and interpretability of the statistical analyses, I restricted the analytical sample for this study to participants who completed both scenario sequences in the gamified platform. I included only participants with complete data for all six decision-quality items (Q1-Q6) for inclusion in the primary analyses. I established this criterion to support the use of paired-samples statistical tests, which required fully matched observations to evaluate within-person change across scenario sets (Keppel & Wickens, 2004).

Of the 100 participants who initially entered the platform, 58 completed the first scenario set and were included in the broader analytic pool. Of those 58 participants, 38 completed both scenario sequences and met criteria for inclusion in the paired-samples analyses. These 38 participants represent a subset of participants drawn from the larger group who engaged with the platform and were retained for all inferential analyses. This analytic sample reflected the subset of PACRAO members who progressed through the full learning pathway, providing complete data for evaluating skill development, knowledge application, engagement, and predictive relationships.

This decision to restrict analyses to this complete-case sample was directly aligned with the study's a priori power analysis. As outlined in Chapter 3, a minimum of approximately 34 paired observations was required to detect moderate effects ($d_z = .5$; Cohen, 1988) with adequate statistical power ($1 - \beta = 0.80$; Faul et al., 2009) at $\alpha = 0.05$. The final analytic sample therefore met the power threshold necessary to evaluate the study's primary research questions with methodological rigor.

System Interaction and Engagement Patterns

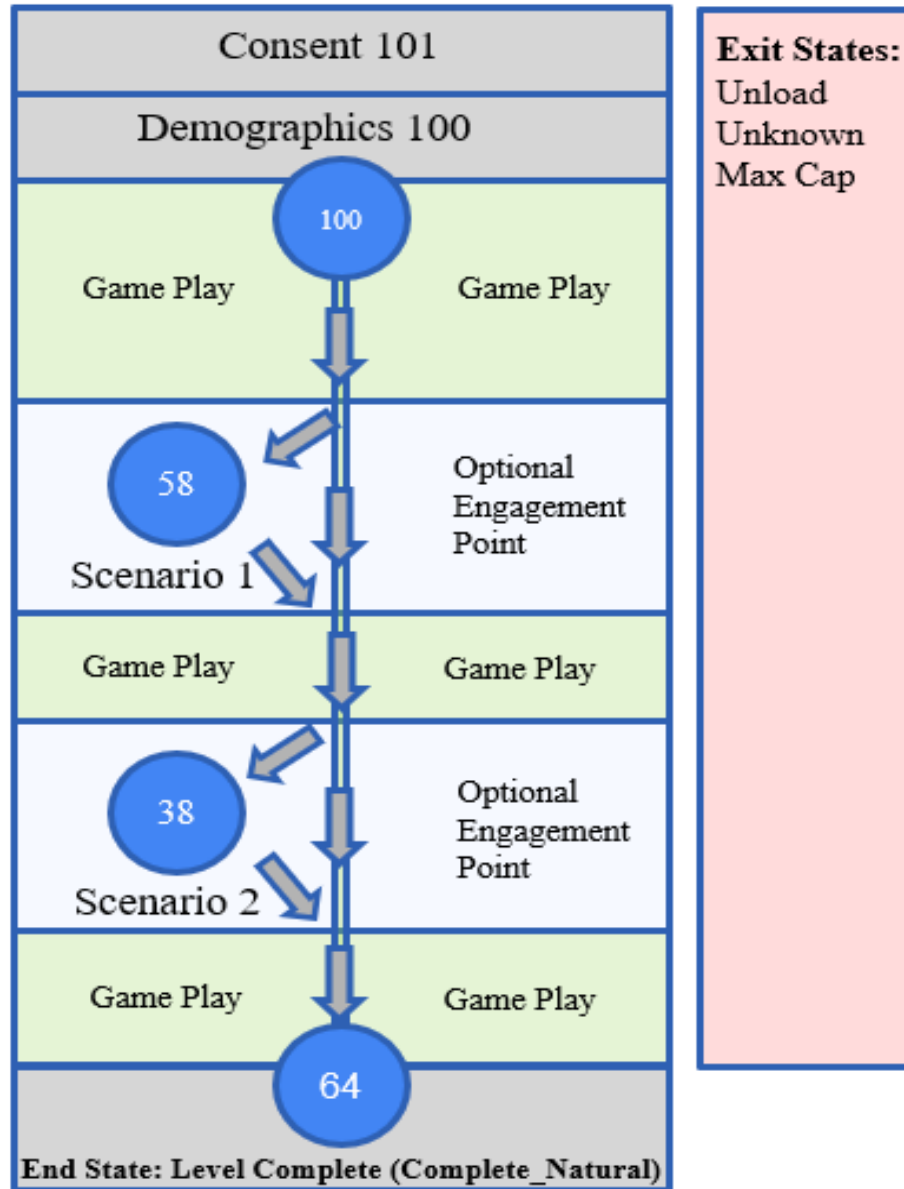
In addition to the primary analyses addressing RQ1-RQ4, this section provides supplementary behavioral and system-level analyses that describe how participants interacted with the platform. Whereas subsequent sections are focused on measurable learning outcomes, the analyses I present here examine the underlying engagement mechanics that shaped those outcomes, including participant flow and observed engagement trajectories.

Participant Flow

Using system-generated interaction data, this section explored how participants progressed through each stage of the platform from demographic entry to scenario completion, and identified where engagement was maintained, dropped, or reinitiated. Figure 7 provides a schematic overview of the platform's interaction architecture, illustrating programmed stages, optional engagement points, and system-logged exit states.

Figure 7

System Interaction Architecture and Optional Engagement Pathways



Note. Non-completion states reflect system-logged session terminations (e.g., Max Cap, Unload, or Unknown) and are not instructional outcomes. Scenario engagement was optional, and program completion was not contingent on scenario participation.

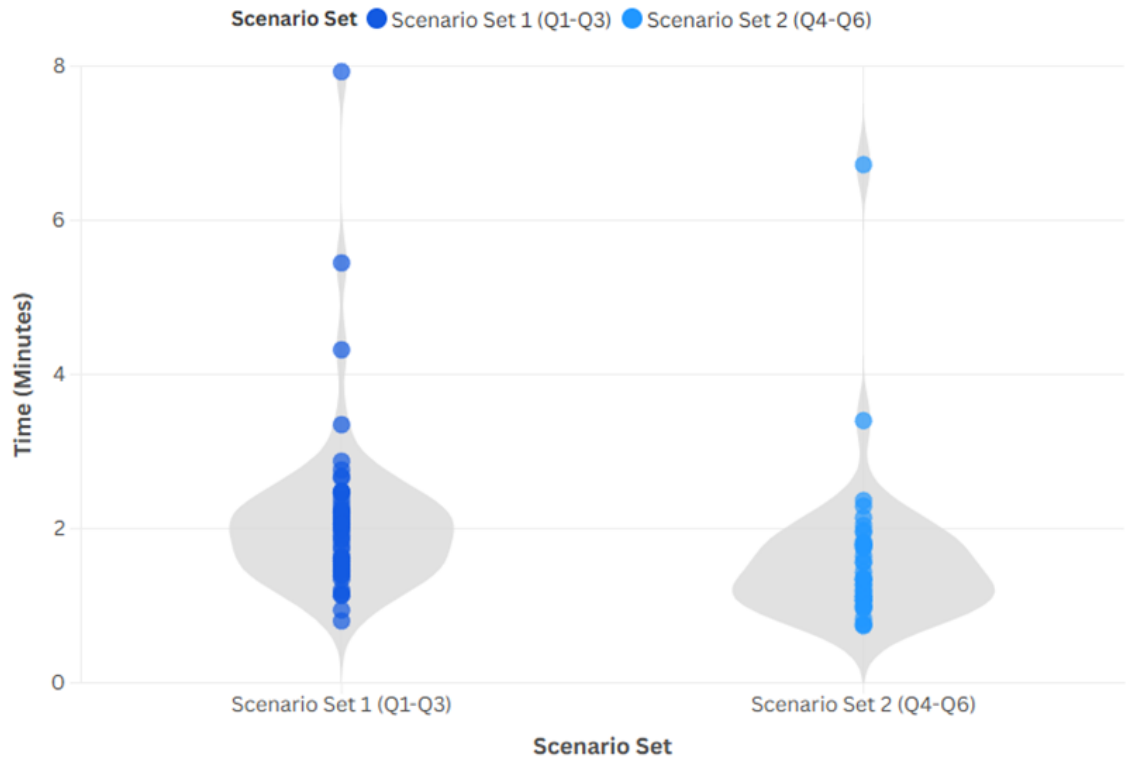
This figure depicts the structural flow of participant interaction within the platform, including programmed stages of participation, optional scenario engagement points, and system-logged exit states. The figure illustrates how participants progressed through the platform independent of learning outcomes, distinguishing between successful level completion and non-completion terminations. These patterns provide structural context for the engagement measures reported in subsequent analyses.

Violin Plot Analysis

Figure 8 presents violin plots illustrating the distribution of participant *time-on-task* for Scenario Set 1 (Q1-Q3) and Scenario Set 2 (Q4-Q6). Time values are displayed in minutes and represent cumulative interaction time across all questions within each scenario set. The violin plots combine density estimations with individual data points which allow for visualizing both overall distribution shape and participant-level variability in engagement (Hintze & Nelson, 1998).

Figure 8

Violin Plot Analysis for Time-on-Task by Scenario Set



Note. Time-on-task values are displayed in minutes. One extreme outlier (38.68 minutes in Scenario Set 1) reflecting a time-out situation was excluded from the visualization to improve interpretability of the distribution. This adjustment was applied to the figure only and did not affect any statistical analyses.

Across both scenario sets, *time-on-task* distributions were positively skewed, with most participants clustering between approximately 1-3 minutes per scenario set. Scenario Set 1 demonstrated a broader distribution and higher upper range, indicating greater variability in engagement during initial exposure to the platform. In contrast, Scenario Set 2 showed a more compact distribution, with engagement times more tightly clustered around the lower end of the scale.

This pattern suggested that participants generally spent more time navigating and responding during Scenario Set 1, consistent with initial orientation, decision calibration, and familiarization with the platform's mechanics. Reduced variability and slightly lower distributional center in Scenario Set 2 indicated increased efficiency as participants progressed through later scenarios, reflecting procedural fluency rather than disengagement. Individual data points overlaying each violin further illustrate that while a small number of participants engaged for longer durations, most completed scenario sets within a relatively narrow time window. This consistency supports the interpretation that observed engagement patterns reflect purposeful interaction rather than random or erratic behavior.

Collectively, the violin plot analysis indicated that engagement time decreased and stabilized as participants advanced through the platform. This progression aligns with principles of adult learning and self-directed engagement, suggesting that once participants understood the decision environment, they were able to apply learned strategies more efficiently in subsequent scenarios. These findings provide additional system-level evidence that the platform supported sustained, goal-directed interaction without introducing cognitive overload or structural impediments.

Observed Engagement and Score Trajectories

Because observable score movement occurred among a relatively small subset of participants, the patterns described here are descriptive in nature and intended to provide contextualized insight into engagement behavior rather than support generalizable claims. System logs identified a small number of participants ($N = 6$) who launched the special scenarios but did not engage with decision or feedback content. Five of these sessions

were classified as *Complete_Natural*, and one exited via system unload (closing the browser).

Additionally, one participant opened the first scenario but did not engage, then finished the level with a *Complete_Natural* flag, not engaging with Scenario 2. Because no scores were recorded, these cases were treated as non-engagement sessions and excluded from the analytic sample. Their presence underscores the distinction between scenario access and active participation and reinforces the importance of behavioral engagement measures beyond session completion alone. A table containing the full analytic data set, including these additional participants can be found in Appendix I.

Across the analytic sample, division-quality scores were predominantly clustered at the upper end of the scale, with most participants selecting the highest-quality response for the majority of the scenarios. Observable score movement occurred among a smaller subset of participants and was concentrated primarily in the first scenario. This pattern is consistent with early calibration, in which participants aligned their decision-making with the evaluative framework of the platform during initial exposure (Knowles, 1990; Rogers, 1969). When score movement occurred, it was generally directionally positive. Participants who selected lower-scoring responses in earlier scenarios demonstrated improved performance in later scenarios, suggesting contextual refinement rather than random fluctuations.

Examination of item-level patterns also revealed localized complexity within the second scenario set, particularly in Question 5. This item exhibited a small clustering of lower scores ($N = 4$), including among participants who otherwise demonstrated high engagement and ceiling-level performance across other questions. Given the governance-

and compliance- oriented nature of the decision context, this pattern could reflect competing institutional practices or professional heuristics rather than disengagement or misunderstanding of core principles.

Integrated Interpretation

Taken together, the participant flow patterns, engagement timing distributions, and observed score trajectories present a coherent and internally consistent picture of how participants interacted with the gamified platform as a learning environment. Across these behavioral indicators, the system demonstrated strong structural stability. Participant progression followed expected pathways, and session terminations occurred primarily through *Completed_Natural* end states rather than system-enforced exits. This pattern suggests that departures reflected participant choice rather than technical failure or navigational obstruction, indicating reliable system performance throughout the study.

The behavioral engagement data also aligned closely with the principles of adult learning that guided the platform's design. Patterns of progression and pacing reflected autonomy, self-direction, and reflective engagement, consistent with humanistic (Rogers, 1969) and andragogical (Knowles, 1990) frameworks. Participants navigated at their own speed, selected their own stopping points, and demonstrated decision-making behaviors indicative of self-regulation. This was particularly evident among individuals who completed only the first scenario set but did so with a *Completed_Natural* status. This behavior aligns more with autonomous boundary-setting than with disengagement or confusion.

Among those who continued into the full analytic sample, engagement patterns remained highly coherent. Violin plot analysis of *time-on-task* indicated higher central

tendency and greater variability during Scenario Set 1, followed by tighter distributions and slightly reduced median engagement time in Scenario Set 2. This shift suggested an orientation and familiarization phase early in the platform experience, followed by increased procedural fluency and efficiency as participants progressed through later scenarios. Importantly, this pattern reflects adaptation rather than disengagement, reinforcing the interpretation of sustained cognitive involvement across the learning sequence.

Observed score trajectories further contextualized these patterns, with learning gains emerging episodically through early calibration and domain-specific refinement rather than uniform change. Localized item-level complexity within certain scenarios appears to reflect contextual professional judgment rather than disengagement or misunderstanding. Together, these patterns reinforce the situated nature of decision-making within the platform and support its use as a reflective, practice-based learning environment rather than a linear assessment tool.

Collectively, these behavioral patterns help contextualize the learning outcomes presented later in this chapter. Stable system performance, participant-controlled pacing, and context-sensitive engagement patterns provide an essential backdrop for understanding how learning gains emerged within the platform. Overall, the integrated evidence indicated that *PACRAO University* functioned as a stable, accessible, and behaviorally coherent space capable of supporting self-directed professional learning and accommodating varied engagement strategies among higher-education practitioners.

Demographic Analysis

Understanding who engaged with the gamified platform was essential for interpreting the study's outcomes in context. This section outlines the participant characteristics that frame subsequent analyses, including institutional type, professional role, experience level, and state (optional). These variables anchored the study within the diverse professional landscape of higher education and supported assessment of whether observed effects reflected differences in participant background or universal features of the platform.

Measures

Four demographic indicators were collected to contextualize participant engagement patterns within the gamified platform. Participants first identified their primary professional role, selecting the option that best represented their functional area. The drop-down menu contained five categories including *Registrar/Records*, *Admissions/Enrollment Services*, *Advising/Student Success*, *IT/Data/Institutional Research*, and *Other*. This measure allowed the study to examine whether engagement patterns differed across professional domains commonly represented within records and academic services organizations.

Next, participants reported their years of experience in higher education. Experience was captured using five ranges (0-1, 2-5, 6-10, 11-15, 16+) which provided a comparative lens for examining professional engagement behaviors. Participants then identified their institution type, selecting from *2-year institutions*, *4-year public institutions*, *4-year private institutions*, *graduate/professional institutions*, or *other*

classifications. This measure provided insight into whether institutional mission, structure, or scale influenced platform interaction patterns.

Finally, participants were invited to identify their state or province as an optional geographic variable. The drop-down included U.S. states and territories, as well as Canadian provinces and territories, with an *Other* option for international or unlisted locations. Responses were included in descriptive analyses if participants completed the demographic survey. For inferential or statistical comparisons, only participants who completed both scenario sets were included. This ensured that descriptive summaries reflected the full range of engagement while maintaining analytic rigor for comparative testing.

Descriptive Results

Participant Overview

A total of 134 records were collected during the platform's deployment. Of these, 33 were identified as pre-launch test records and were removed prior to analysis. The remaining 101 consented participants comprised the study's usable sample. Among them, 64 individuals (63.37%) completed the level and reached the end-stage component. Self-directed completion narrowed across stages of the platform, resulting in 38 participants who completed both additional Scenario Set 1 (Q1-Q3) and Scenario Set 2 (Q4-Q6), forming the analytic sample for all inferential analyses. This represented 37.62% of all consented participants. One participant consented but did not complete the demographic survey or enter the platform and was therefore not included in any analyses.

Demographic characteristics for the full and analytic samples are presented in Table 4.

Table 4*Demographic Summary Table*

Baseline characteristic	Full Sample (N=101)		Analytic Sample (N=38)	
	N	%	N	%
Functional Area				
Registrar/Records	75	74.3	31	81.6
Admissions/ Enrollment Services	15	14.9	3	7.9
Advising/ Student Success	3	3.0	1	2.6
IT/Data/Inst. Research	3	3.0	2	5.3
Other	4	4.0	1	2.6
Years of Experience				
2-5 Years	16	15.8	6	15.8
6-10 Years	16	15.8	5	13.2
11-15 Years	15	14.9	7	18.4
16+ Years	53	52.5	20	52.6
Institution Type				
2-year	12	11.9	2	5.3
4-year Public	45	44.6	19	50.0
4-year Private	31	30.7	11	28.9
Graduate/Professional	11	10.9	5	13.2
Other	1	1.0	1	2.6
State/Province*				
Alaska	1	1.0	1	2.6
Arizona	7	6.9	2	5.3
California	33	32.7	14	36.8
Hawaii	5	5.0	1	2.6
Idaho	2	2.0	-	-
Oregon	16	15.8	6	15.8
Utah	4	4.0	2	5.3
Washington	24	23.8	9	23.7
British Columbia	5	5.0	1	2.6

Note. Percentages reflect valid responses. One consented participant did not provide demographic data and is therefore not included in the full sample column.

*State/province selection was optional; Only states or provinces with at least one respondent are listed.

Following the summary presented in Table 4, I describe the demographic characteristics of both the full and analytic sample in greater detail. These descriptive profiles provided contextual insight into the professional backgrounds, institutional settings, and geographic representation of participants, supporting interpretation of this study's outcomes.

Professional Role

Participants represented a broad range of professional roles within PACRAO, reflecting the diverse functional areas that shape records, enrollment management, and student services across the region. Five primary categories were included in the demographic measure including *Registrar/Records*, *Admissions/Enrollment Services*, *Advising/Student Success*, *IT/Data/Institutional Research*, and *Other* categories. Frequencies and percentages for both the full participant pool and the analytic sample are in Table 4.

Within the full sample ($N=101$), the largest group identified as working in *Registrar/Records* roles (75, 74.3%), followed by *Admissions/Enrollment Services* (15, 14.9%). Smaller proportions represented *Advising/Student Success* (3, 3.0%), *IT/Data/Institutional Research* (3, 3.0%), and *Other* (4, 4.0%). This distribution reflected the professional composition of PACRAO membership, which is traditionally centered in records and enrollment services.

Role representation within the analytic sample ($N = 38$) closely paralleled the broader participant pool. *Registrar/Records* professionals comprised the majority of the analytic sample (31, 81.6%), with additional representation from *Admissions/Enrollment Services* (3, 7.9%), *IT/Data/Institutional Research* (2, 5.3%), *Advising/Student Success* (1, 2.6%), and *Other* (1, 2.6%). This alignment suggested that progression through the full scenario sequence was not isolated to a single functional group; rather, participants from multiple professional roles were represented within the analytic sample.

Years of Experience

Participants represented a wide range of professional experience levels within higher education. Experience was measured using five categorical ranges (0-1 years, 2-5 years, 6-10 years, 11-15 years, and 16+ years). Table 4 summarizes the frequencies and percentages for each range across both the full participant group and the analytic sample.

Within the full sample ($N = 101$), the largest proportion of participants reported 16 or more years of professional experience (53, 52.5%). Additional groups included those with 2-5 years (16, 15.8%), 6-10 years (16, 15.8%), and 11-15 years of experience (15, 14.9%). No participants reported 0-1 years of experience. This distribution indicated that the participant pool included a substantial number of senior practitioners, alongside representation from early and mid-career professionals.

Experience-level representation within the analytic sample ($N = 38$) generally mirrored the broader pattern. Participants with 16 or more years of experience comprised the largest group (20, 52.6%), followed by those with 11-15 years (7, 18.4%), 2-5 years (6, 15.8%), and 6-10 years (5, 13.2%). These similarities indicate that the experience-level distribution of the analytic sample was broadly comparable to that of the full

participant pool. Individuals across a range of higher-education career stages were represented among those who progressed through the platform's full learning pathway.

Institution Type

Participants represented a variety of institutional contexts across the PACRAO region. Institution type was categorized into five groups, including 2-year institutions, 4-year public institutions, 4-year private institutions, graduate/professional institutions, and Other categories. Table 4 presents the frequencies and percentages for each institution type for both the full participant group and the analytic sample.

Within the full sample ($N = 101$), the largest proportion of participants were employed at *4-year public* institutions (45, 44.6%), followed by those working at *4-year private* institutions (31, 30.7%). Smaller proportions reported employment at *2-year colleges* (12, 11.9%), *graduate/professional* institutions (11, 10.9%), and *other* institutional types (1, 1.0%). This distribution reflected the broader institutional composition of PACRAO membership, which is historically anchored in 4-year public and private institutions.

Institution-type representation within the analytic sample ($N = 38$) similarly reflected this pattern. Half of the analytic sample reported working at *4-year public* institutions (19, 50.0%), followed by those from *4-year private* institutions (11, 28.9%), *graduate/professional* institutions (5, 13.2%), and *2-year institutions* (2, 5.3%). One participant (2.6%) represented an institution classified as *Other*. These similarities indicated that progression through the full scenario sequence was not disproportionately associated with a specific institutional sector. Participants from a range of institutional

types engaged with the platform and were comparably likely to complete the learning pathway.

State/Province

State or province was included as an optional demographic question to capture the geographic distribution of participants across the PACRAO region. Frequencies and percentages for each location are presented in Table 4 for both the full sample and analytic sample.

Within the full sample ($N = 101$), participants represented institutions across eight U.S. states and one Canadian province. *California* (33, 32.7%) and *Washington* (24, 23.8%) accounted for the largest proportions of respondents, reflecting two major hubs of PACRAO membership. Additional representation included *Oregon* (16, 15.8%), *Arizona* (7, 6.9%), *Hawaii* (5, 5.0%), *British Columbia* (5, 5.0%), *Utah* (4, 4.0%), *Idaho* (2, 2.0%), and *Alaska* (1, 1.0%). This distribution demonstrates broad regional participation across the West Coast and Pacific regions.

Geographic representation within the analytic sample ($N = 38$) followed a similar pattern. *California* (14, 36.8%) and *Washington* (9, 23.7%) again comprised the largest groups, with additional participants from *Oregon* (6, 15.8%), *Arizona* (2, 5.3%), *Utah* (2, 5.3%), *Alaska* (1, 2.6%), *Hawaii* (1, 2.6%), and *British Columbia* (1, 2.6%). No analytic-sample participants were located in *Idaho*. These similarities indicated that completion of the full scenario pathway did not vary meaningfully by geographic location. Participants from a diverse set of states and provinces engaged with the platform and were proportionally represented in the analytic sample.

Summary

The demographic profile of participants reflected the diverse professional and institutional landscape of the PACRAO community. Participants represented a diverse mix of institutional types, professional roles, and experience levels, with the majority drawing from records and enrollment services. Representation across *2-year*, *4-year public*, *4-year private*, and *graduate/professional* institutions provided an appropriate cross-section for interpreting how professional context may shape engagement with gamified professional development. Years of experience ranged broadly, offering insight into both early-career and seasoned professionals' responses to the platform. This diversity supported the ecological validity of the study by situating findings within authentic professional contexts.

Skill Development

This section addresses RQ1: To what extent does the gamified platform foster skill development in professional scenarios?

I evaluated skill development through participants' performance across three domains including *Academic Policy*, *Recordkeeping*, and *Operational Management*. These scenarios provided parallel decision-making contexts that allowed examination of changes in decision quality across the platform. Findings below summarize whether, and to what extent, participants' decision quality improved following engagement with the platform.

Measures

Decision-quality scores were rated on a 1-4 internal scale aligned with AACRAO professional competency standards (AACRAO, 2025), where higher

values indicated stronger evidence of applied professional skill. Each of the platform's three domain-specific scenario sets, *Academic Policy*, *Recordkeeping*, and *Operational Management* produced two scores derived from participant selections. These scores were automatically calculated by the platform's scoring engine based on expert-coded decision pathways. These scores represented the participant's observed skill development within each professional domain.

Findings summarize changes in decision-making quality across the three professional domains evaluated in the platform's paired scenarios. Descriptive statistics (M, SD, N) and paired-samples *t*-tests (Frankfort-Nachmias et al., 2021) with Cohen's *d* (Cohen, 1988) and 95% confidence intervals (Cumming, 2012) were computed for each domain comparison. Assumptions of normality (Shapiro-Wilk) were evaluated for each domain-specific difference score. Decision-quality scoring was supported through the use of expert-coded decision pathways and consistent rubric application across parallel scenarios (Keppel & Wickens, 2004).

Analysis

Statistical significance was evaluated at $\alpha=.05$, with effect sizes (Cohen's *d*) and 95% confidence intervals (Cumming, 2012) reported for each comparison. In addition to statistical significance, a mean increase of approximately 0.50 or greater on the 4-point decision-quality scale was considered an educationally meaningful threshold, consistent with benchmarks for moderate but practical learning gains (Cohen, 1988; Cumming, 2012; Ferguson, 2009; Kirk, 1996).

A series of three paired-samples *t*-tests were conducted to evaluate changes in decision-quality scores across the three professional domains, *Academic Policy*

(Q1, Q4), *Recordkeeping Compliance* (Q2, Q5), and *Operational Management* (Q3, Q6). Each test compared participants' performance on a first scenario item (Q1–Q3) with the corresponding later scenario item (Q4–Q6) to determine whether engagement with the platform was associated with measurable skill gains.

Descriptive Statistics

Descriptive statistics were calculated for decision-quality scores across the three professional domains assessed in the platform: *Academic Policy*, *Recordkeeping Compliance* and *Operational Management*. Means and standard deviations for Scenario 1 and Scenario 2 are presented in Table 5. Across all three domains, participants demonstrated stable and relatively high decision-quality scores in Scenario 1, with little to no increase observed in Scenario 2. *Academic Policy* and *Recordkeeping Compliance* showed the largest mean improvements, whereas *Operational Management* scores remained unchanged across scenarios.

Assumptions Testing

Assumptions associated with the paired-samples *t*-tests used to evaluate skill development were evaluated prior to conducting inferential analyses. Consistent with the analytic plan outlined in Chapter 3, diagnostics focused on (a) the normality of the difference scores, (b) the identification of outliers, and (c) verification that the structure of the data supported the use of parametric tests.

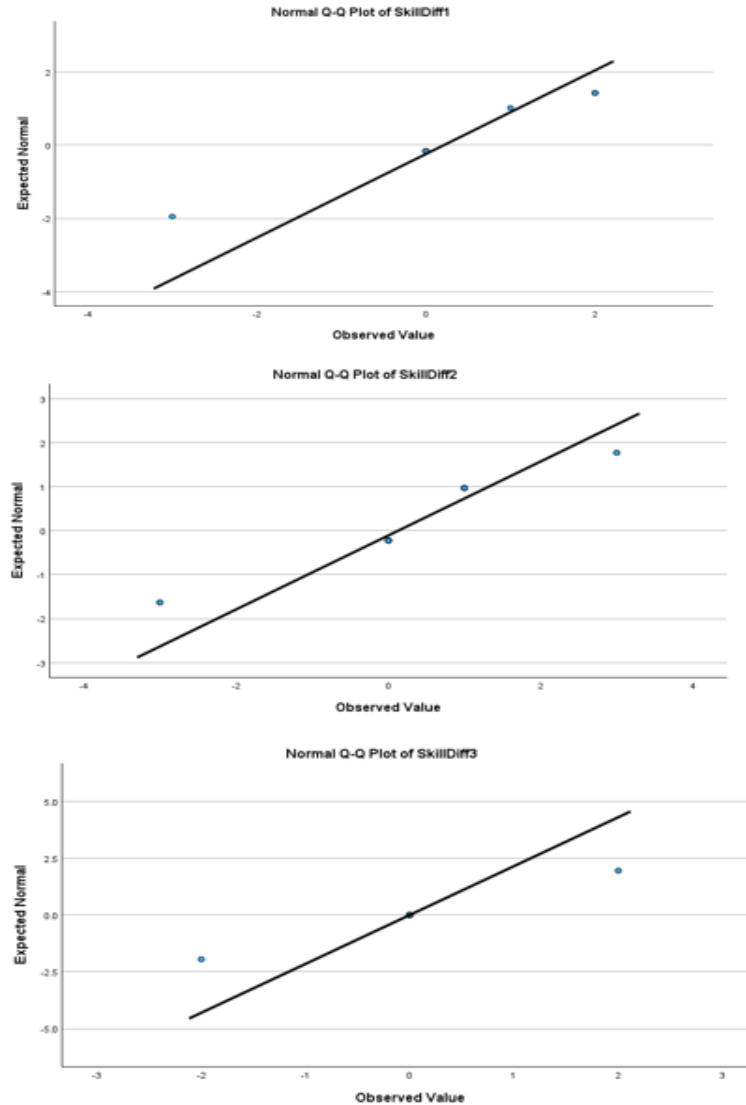
Because the paired-samples *t*-test evaluates the distribution of the difference between Scenario 1 and Scenario 2 scores, normality was assessed for each domain-specific difference variable (SkillDiff1-SkillDiff3) using Shapiro-Wilk tests and visual inspection of histograms and Q-Q plots. Shapiro-Wilk tests were statistically significant

for all three domains ($p < .001$), indicating statistical evidence of non-normality.

However, visual diagnostics suggested that deviations were moderate and primarily attributable to a small number of extreme values rather than systematic skew. Figure 9 presents representative Q-Q plots of the domain-specific difference scores used to evaluate normality.

Figure 9

Normal Q-Q Plots for Difference Scores Used in Paired-Samples t -Tests



Note. Plots display observed versus expected quantiles for difference scores in *Academic Policy*, *Recordkeeping Compliance*, and *Operational Management*. Visual inspection indicated moderate deviations from normality attributable primarily to a small number of extreme values. Comparable distributional patterns were observed for remaining research questions.

Given the paired design, sample size ($N = 38$), and the documented robustness of paired-samples t -tests to moderate violations of normality when difference scores are approximately symmetric, inferential analyses proceeded as planned (Field, 2018; Keppel & Wickens, 2004; Norman, 2010). Examination of boxplots and standardized difference scores did not indicate the presence of influential outliers that warranted exclusion. All observations were retained to preserve the integrity of the within-subjects comparisons and reflect authentic variation in participant decision-making. Although normality tests were statistically significant, the combined diagnostics and robustness supported the use of paired-samples t -tests for evaluating changes in decision-quality scores across scenarios (Cumming, 2012).

Inferential Statistics

Paired-samples t -tests were conducted to evaluate changes in decision-quality scores across the three professional domains: *Academic Policy*, *Recordkeeping Compliance*, and *Operational Management*. Descriptive statistics and inferential results for each domain are provided in Table 5.

Table 5*Paired-Samples t-Tests for Skill Development Across Professional Domains (N = 38)*

Professional Domain	Scenario 1 (Q1 - Q3)		Scenario 2 (Q4 - Q6)		t(37)	p	Cohen's d	95% CI
	M	SD	M	SD				
Academic Policy (Q1, Q4)	3.71	.694	3.92	.487	-1.483	.146	-.241	[-.562, .084]
Recordkeeping Compliance (Q2, Q5)	3.55	.860	3.68	.933	-.682	.500	-.111	[-.429, .209]
Operational Management (Q3, Q6)	3.95	.324	3.95	.324	.000	1.0	.000	[-.318, .318]

Note. Effect sizes calculated using the standard deviation of the paired differences.

Academic Policy

Participants' scores did not differ significantly between Scenario 1 (Q1; $M = 3.71$, $SD = .694$) and Scenario 2 (Q4; $M = 3.92$, $SD = .487$), $t(37) = -1.483$, $p = .146$, $d = -.241$, 95% $CI [-.562, .084]$.

Recordkeeping Compliance

Scores did not significantly differ between Scenario 1 (Q2; $M = 3.55$, $SD = .860$) and Scenario 2 (Q5; $M = 3.68$, $SD = .933$), $t(37) = -.682$, $p = .500$, $d = -.111$, 95% $CI [-.429, .209]$.

Operational Management

Participants showed no significant change between Scenario 1 (Q3; $M = 3.95$, $SD = .324$) and Scenario 2 (Q6; $M = 3.95$, $SD = .324$), $t(37) = .000$, $p = 1.000$, $d = 0.000$, 95% $CI [-.311, .311]$.

Across the three professional domains, decision-quality scores showed small and nonsignificant changes from Scenario 1 to Scenario 2. Mean scores for *Academic Policy* and *Recordkeeping Compliance* were slightly higher in Scenario 2, while *Operational Management* scores remained unchanged. None of the paired comparisons met the threshold for statistical significance. In the following section, I evaluate these outcomes in terms of practical significance, examining whether observed changes reached benchmarks commonly used to indicate educationally meaningful improvement.

Practical Significance

When comparing mean differences against the 0.50 benchmark for educationally meaningful gains, none of the three professional domains reached the threshold for educationally meaningful change. *Academic Policy* and *Recordkeeping Compliance* demonstrated the largest observed mean increases; however, these gains fell below the benchmark established for moderate practical significance. *Operational Management* showed no change across scenarios.

Although the observed changes did not meet the criterion for practical significance, the direction of the differences suggested modest improvement in domains emphasizing policy interpretation and compliance-based decision-making. These patterns indicated that the gamified platform could support incremental skill development in

selected professional domains, though the magnitude of change observed in this study was limited.

Hypothesis Evaluation

The null hypothesis for Research Question 1 stated that engagement with the gamified platform would not result in statistically significant changes in decision-quality scores across paired professional scenarios. Across the three domain comparisons, *Academic Policy*, *Recordkeeping Compliance*, and *Operational Management*, no statistically significant differences were observed between Scenario 1 and Scenario 2 scores. Accordingly, the null hypothesis for RQ1 was not rejected.

Although mean differences across domains tended in a positive direction for *Academic Policy* and *Recordkeeping Compliance*, these changes did not meet thresholds for statistical or practical significance. As such, the results did not provide inferential evidence that engagement with the platform produced measurable improvements in decision-quality scores within the timeframe of this study. In Chapter 5, I consider these findings in terms of practical significance and adult professional learning.

Summary

This section examined RQ1, which asked whether engagement with the gamified platform was associated with measurable skill development across professional scenarios. Skill development was assessed using paired scenario comparisons within three professional domains: *Academic Policy*, *Recordkeeping Compliance*, and *Operational Management*.

Across domains, participants entered the platform with relatively high baseline decision-quality scores in Scenario 1. Paired-samples *t*-tests indicated that

none of the observed mean differences between Scenario 1 and Scenario 2 reached statistical significance. *Academic Policy* and *Recordkeeping Compliance* demonstrated small positive mean increases, while *Operational Management* scores remained unchanged across scenarios.

Evaluation of practical significance further indicated that none of the observed mean differences met the predefined benchmark of 0.50-point increase on the four-point decision-quality scale. Although *Academic Policy* and *Recordkeeping Compliance* showed the largest observed gains, these changes fell below thresholds commonly used to indicate moderate or educationally meaningful improvement.

Taken together, the results for RQ1 suggest that, within the timeframe of this study, engagement with the gamified platform was not associated with statistically significant or practically meaningful improvements in decision-quality scores across paired professional scenarios. Implications of these findings for adult professional learning and platform design are addressed in Chapter 5.

Knowledge Application

This section addresses RQ2: To what extent does the gamified platform foster knowledge application in professional scenarios?

Knowledge application represented participants' ability to transfer what they had learned (including feedback and reinforcement from earlier decisions) into a later, parallel scenario that required applying the same underlying concept under slightly different conditions. In the platform, the construct was operationalized by comparing participants' performance across two equivalent scenario sets utilizing composite scores.

Differences between the initial and later scenarios were interpreted as evidence of applied understanding and adaptive decision-making, key indicators of knowledge transfer in professional learning environments (Kapp, 2012).

Measures

Decision-quality scores were rated on the same 1-4 internal scale aligned to AACRAO professional competency standards (AACRAO, 2025), where higher values indicated stronger evidence of applied professional knowledge. Each of the platform's three domain-specific scenario sets, *Academic Policy*, *Recordkeeping*, and *Operational Management*, included two parallel decision sequences designed to apply prior learning to a subsequent, conceptually aligned scenario.

For each participant, scores from the first scenario sequence (Q1-Q3) were averaged to create the Scenario 1 composite, representing baseline decision performance. Scores from the corresponding parallel sequence (Q4-Q6) formed the Scenario 2 composite, representing performance after exposure to feedback and reinforcement from earlier decisions. These composite scores allowed comparison of participants' decision quality performance across equivalent professional problems, providing an operational measure of knowledge application through transfer of learning to a new but structurally similar context. Decision-quality scoring was generated through expert-coded decision pathways and applied consistently across matched scenarios. The within-subject analyses compared each participant's composite scores across scenario pairs to evaluate changes in applied knowledge.

Analysis

Statistical significance was evaluated at $\alpha=.05$, with effect sizes (Cohen's d) and 95% confidence intervals (Cumming, 2012) reported for each comparison of Scenario 1 and Scenario 2 composite scores. In addition to statistical significance, a mean increase of approximately 0.50 or greater on the 4-point decision-quality scale was interpreted as an educationally meaningful threshold, consistent with benchmarks for moderate but practical learning gains (Cohen 1988; Cumming, 2012; Ferguson, 2009; Kirk, 1996).

Descriptive Statistics

Descriptive statistics (M , SD , N) were calculated for Scenario 1 and Scenario 2 composite scores to summarize participants' decision quality performance across equivalent professional scenarios. These composites represented participants' baseline decision performance and subsequent application of knowledge following exposure to feedback. Means and standard deviations for each composite, and the composite difference score, are presented in Table 6.

Participants' mean decision-quality scores increased from Scenario 1 ($M = 3.737$, $SD = .418$) to Scenario 2 ($M = 3.851$, $SD = .353$). The positive mean composite difference ($M = .114$, $SD = .571$) indicated a modest overall increase in decision quality across the paired scenario sets. Variability in the composite difference scores suggested individual differences in the extent to which participants applied prior learning when responding to the later scenario. These descriptive results provide an initial summary of performance patterns and informed subsequent assumption testing prior to inferential analysis.

Assumptions Testing

Assumptions associated with the paired-samples *t*-tests used to evaluate knowledge application were evaluated prior to conducting inferential analyses. Consistent with the analytic plan outlined in Chapter 3, diagnostics focused on (a) the normality of the paired difference scores, (b) the presence of influential outliers, and (c) verification that the data structure supported parametric within-subject comparisons.

Because knowledge application was operationalized using composite scores, normality was assessed for the difference between Scenario 1 and Scenario 2 composite scores using Shapiro-Wilk tests and visual inspection of histograms, Q-Q plots, and boxplots. The Shapiro-Wilk test was statistically significant, indicating deviation from a normal distribution, $W = .868, p < .001$. Visual inspection of the Q-Q plots and histograms revealed distributional patterns comparable to those observed in RQ1 (see Figure 9), supporting the continued use of parametric tests.

Given the paired-samples design, sample size ($N = 38$), and the documented robustness of paired-samples *t*-tests to moderate violations of normality when difference scores are approximately symmetric, parametric analyses were retained (Field, 2018; Keppel & Wickens, 2004; Norman, 2010). All observations were retained to preserve the integrity of the within-subjects comparisons and reflect authentic variation in participant performance.

Inferential Statistics

A paired-samples *t*-test was conducted to evaluate whether the observed increase in composite scores reflected a statistically significant gain in knowledge application. This analysis compared participants' composite decision-quality scores across matched scenario sets to determine whether engagement with the platform was associated with measurable transfer of learning. The inferential results are listed in Table 6.

Table 6

Paired-Samples t-Tests for Knowledge Application Across Scenario Sets (N = 38)

Scenario Composite	Scenario 1		Scenario 2		<i>t</i> (37)	<i>p</i>	Cohen's <i>d</i>	95% CI
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Scenario 2 Composite - Scenario 1 Composite	3.737	.418	3.851	.353	1.231	.226	.200	[-.074, .302]

Note. Positive mean differences indicate higher scores on the second scenario.

As shown in Table 6, participants' composite scores increased slightly from Scenario 1 ($M = 3.737$, $SD = .418$) to Scenario 2 ($M = 3.851$, $SD = .353$); however, this difference was not statistically significant, $t(37) = 1.231$, $p = .226$. The associated effect size was small ($d = -0.200$), and the 95% *CI* for the mean difference was [-.074, .302]. Although the mean difference was positive, the observed effect was small and did not provide inferential evidence of knowledge transfer across scenarios within the timeframe of the study.

Practical Significance

To evaluate practical significance, the mean difference between Scenario 1 and Scenario 2 composite scores was compared against the benchmark of $\Delta M \geq 0.50$ increase on the four-point decision-quality scale for educationally meaningful gains (Cohen, 1988, Cumming, 2012). The observed mean increase in composite scores ($\Delta M = .114$) did not meet this threshold. Although participants demonstrated a slight improvement in performance following exposure to feedback, the magnitude of the change was small and fell below the level typically associated with practically meaningful knowledge transfer in professional learning contexts. These findings suggest that, within the timeframe of this study, the gamified platform supported limited application of knowledge across parallel scenarios. While modest gains were observed ($d = 0.200$), the degree of improvement did not reach a level likely to reflect substantive transfer of learning to new professional decision contexts.

Hypothesis Evaluation

The Null hypothesis for Research Question 2 stated that participation in the gamified platform would not result in measurable differences in participants' composite decision-quality scores between Scenario 1 and Scenario 2. Paired-samples comparisons of the Scenario 1 and Scenario 2 composites indicated that participants demonstrated nonsignificant but positive improvements in applied decision-making across the parallel scenarios; however, this difference did not reach statistical significance.

Although the direction of the mean difference suggested modest improvement in applied decision-making across parallel scenarios, the magnitude of the effect was small and the associated confidence interval indicated substantial variability in participant

outcomes. Based on these findings, the null hypothesis for RQ2 was not rejected. The results did not provide evidence that engagement with the platform produced measurable knowledge application within the professional domains assessed, within the timeframe of this study.

Summary

Taken together, the results indicated that the participants demonstrated modest positive gains in knowledge application across parallel scenario sets within the gamified platform. Participants' Scenario 2 composite scores were slightly higher than Scenario 1 composite scores, suggesting incremental improvement in applied decision-making following exposure to feedback and reinforcement. However, these differences did not reach statistical significance and did not meet thresholds for educationally meaningful change.

Although the observed pattern of results is consistent with emerging knowledge application, the magnitude of the effect was small and characterized by substantial variability across participants. As such, the findings did not provide inferential evidence that engagement with the platform produced measurable knowledge transfer across structurally similar professional scenarios within the timeframe of this study.

This analysis addressed RQ2 by examining whether participants exhibited measurable gains in decision-quality performance across equivalent scenario sets designed to assess knowledge application. While the comparisons served as theoretically grounded indicators of transfer, the results suggest that additional exposure, extended practice, or enhanced instructional scaffolding may be

necessary to support detectable knowledge application outcomes in professional learning environments. In Chapter 5, I discuss the implications for platform design and adult professional learning.

Engagement as an Outcome

This section addresses RQ3: To what extent does the gamified platform foster engagement among PACRAO members?

Engagement represented participants' behavioral investment and sustained interaction with the gamified platform. This construct was operationalized through time-based metrics that captured how participants interacted with scenario content, feedback, and navigation features over time. Engagement was measured through the use of embedded JavaScript timing functions, which recorded the duration of interaction for each decision and feedback event.

These measures provided a direct, system-generated indicator of participant persistence and depth of interaction. Collectively, they captured sustained attentional focus during gameplay. Findings reported in this section summarized the extent to which the gamified platform fostered measurable behavioral engagement, reflecting participants' sustained attention and active participation.

Measures

Engagement was operationalized as an outcome through *time-on-task* metrics representing participant depth and persistence of interaction with the gamified platform. Timestamp data were automatically recorded for each scenario question and feedback interaction within both special scenario question sets. This provided a behavioral indicator of participant engagement.

Two composite variables were created to represent overall engagement within each scenario sequence. The Scenario 1 composite (Q1-Q3) reflected engagement during initial gameplay, with the Scenario 2 composite (Q4-Q6) representing engagement during the later phase of gameplay. Each composite captured the cumulative duration of time spent on both decision and feedback screens across the three scenario items. For each participant, total *time-on-task* was calculated as the sum of interaction times for the question and feedback components within each special scenario sequence. This approach produced a standardized engagement measure for each scenario, allowing direct comparison of mean engagement levels across gameplay phases.

Analysis

Statistical significance was evaluated at $\alpha = .05$, with effect sizes (Cohen's d for paired samples) and 95% confidence intervals (Cumming, 2012) reported for each comparison. In addition to statistical significance, a moderate within-subject effect size ($d \geq 0.50$) was interpreted as a practically meaningful indicator of sustained engagement, consistent with benchmarks for modest but practically relevant behavioral change in learning contexts (Cohen, 1988; Cumming, 2012; Ferguson, 2009; Kirk, 1996).

Descriptive Statistics

Descriptive statistics (M , SD , N) were calculated for both composites to summarize overall engagement patterns of *time-on-task* across scenario sets. The Scenario 1 engagement composite reflected participants' cumulative interaction time with the initial scenario set, while the Scenario 2 composite reflected engagement during the later scenario set of the platform learning pathway.

Table 7 presents descriptive statistics for the engagement composite scores across the two special scenario sets ($N = 38$). Engagement was operationalized as the cumulative *time-on-task*, measured in milliseconds, aggregated across decision and feedback screens within each scenario, and reported in seconds. Engagement *time-on-task* varied widely across participants, with Scenario 1 engagement ranging from 42.86 to 2,320.71 seconds and Scenario 2 engagement ranging from 44.51 to 403.37 seconds. Mean engagement was higher during Scenario 1 ($M = 170.813s$, $SD = 359.560$) compared to Scenario 2 ($M = 97.016s$, $SD = 60.601$). The larger standard deviation observed in Scenario 1 indicated greater variability in participant engagement during the initial scenario, whereas engagement during Scenario 2 was more tightly clustered. Overall, these descriptive results suggest a reduction in *time-on-task* as participants progressed through the platform and scenarios.

Assumptions Testing

Prior to conducting the paired-samples *t*-test for engagement, assumptions of the analysis were evaluated. Engagement composite scores were measured on a continuous scale, and paired observations were obtained from the same participants across both scenario sets. Independence of observations was assumed, as each participant's engagement data were not influenced by other participants.

Normality of the difference scores between Scenario 1 and Scenario 2 engagement composites was assessed using visual inspection of histograms and Q-Q plots, as well as the Shapiro-Wilk test. Results indicated a deviation from normality, driven by a small number of extreme values comparable to those observed in RQ1 (see

Figure 9). Given the within-subject design, sample size, and the documented robustness of the paired-samples *t*-test to moderate violations of normality, the analysis was retained.

Inferential Statistics

A paired-samples *t*-test was conducted to compare mean engagement times between Scenario 1 and Scenario 2, evaluating whether engagement differed across scenario sets as participants progressed through the platform. Effect sizes were reported with Cohen's *d* (Cohen, 1988), and 95% confidence intervals were reported for each comparison (Cumming, 2012). Inferential results are in Table 7.

Table 7

Paired-Samples t-Test for Engagement Across Scenario Sets (N = 38)

Scenario	Scenario 1		Scenario 2		t(37)	<i>p</i>	Cohen's <i>d</i>	95% CI
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Composite								
Total ToT Composite	170.813	359.560	97.016	60.601	1.259	.216	.204	[-.118, .524]

Note. Engagement values represent cumulative *time-on-task* per scenario set and are reported in seconds. Raw *time-on-task* data were collected in milliseconds and converted for presentation. Cohen's *d* reflects standardized mean differences based on the standard deviation of the paired differences.

A paired-samples *t*-test was conducted to examine differences in engagement between the initial (Scenario 1) and later (Scenario 2) special scenarios. As shown in

Table 10, mean engagement was higher during Scenario 1 ($M = 170.813s$, $SD = 359.560$) than during Scenario 2 ($M = 97.016s$, $SD = 60.601$); however this difference was not statistically significant, $t(37) = 1.259$, $p = .216$ (two-tailed). The 95% confidence interval for the mean difference included zero $[-.118, .524]$, and the associated effect size was small (Cohen's $d = .204$). These results indicated that, although engagement tended to decrease across scenarios, changes in *time-on-task* varied substantially across participants.

Practical Significance

Practical significance was evaluated using a benchmark of Cohen's $d \geq 0.50$, representing moderate and educationally meaningful behavioral change (Cohen, 1988; Cumming, 2012; Ferguson, 2009). The observed effect size for engagement across scenario sets was small ($d = 0.20$) and did not meet this threshold. Accordingly, changes in engagement across scenarios were not considered practically meaningful at the aggregate level. However, substantial variability in *time-on-task* was observed across participants, suggesting that engagement trajectories differed meaningfully among individuals, even in the absence of a moderate or large overall effect.

Hypothesis Evaluation

The null hypothesis for Research Question 3 stated that there would be no measurable difference in participant engagement, as measured by *time-on-task*, between the first and second scenario sets. Results from the paired-samples t -test indicated no statistically significant difference in engagement between Scenario 1 and Scenario 2 at the $\alpha = .05$, $t(37) = 1.26$, $p = .216$. Accordingly, the null hypothesis was not rejected.

Summary

Research Question 3 examined the extent to which the gamified platform fostered behavioral engagement among PACRAO members, with engagement operationalized as cumulative *time-on-task* across two scenario sets representing early and later phases of the platform. Descriptive results indicated higher mean engagement during the initial scenario set, accompanied by substantial variability across participants. Inferential analysis revealed no statistically significant difference in engagement between the initial and later scenarios, and the associated effect size was small, indicating limited practical significance at the aggregate level.

Although mean time-on-task decreased from Scenario 1 to Scenario 2, this pattern may reflect procedural adaptation rather than diminished engagement. Participants encountered structurally similar navigation elements and feedback systems across both scenarios, and the absence of a statistically significant decline, coupled with individual variability, suggests increasing fluency with platform mechanics than disengagement or superficial participation. Because time-on-task alone cannot distinguish between efficiency gains and reduced cognitive effort, this interpretation remains inferential; however, the observed pattern aligns more closely with adaptation to the platform's structure than evidence of disengagement.

Collectively, these findings suggest that while the platform supported measurable behavioral engagement, engagement patterns were not uniform across participants and did not demonstrate a consistent increase across scenarios. Instead, results point to meaningful individual differences in how participants interacted with the platform across scenarios. This observed heterogeneity underscores the importance of examining

engagement not solely as a group-level outcome, but as a learner-dependent process that may function differently across individuals. These findings provide important context for subsequent analyses in RQ4, which examines how engagement relates to learning outcomes within the platform.

Engagement as a Predictor

This section addresses RQ4: What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

Engagement was examined as a predictor variable to determine whether participants' behavioral investment was associated with learning outcomes. In this context, engagement reflected the extent of participants' time-based interaction with decision and feedback components. This served as an indicator of persistence and attentional investment during platform use. By examining engagement as a predictor, this analysis examined whether behavioral patterns observed during gameplay were statistically associated with differences in skill development and knowledge application.

This section builds upon the previous analyses by shifting from outcome evaluation to relational analysis, linking behavioral metrics to learning performance. Engagement time was aggregated across all six scenario questions to form a composite measure representing overall participant investment in the platform. This engagement composite was then compared with skill development subcomponents to assess whether higher levels of sustained engagement were associated with improved learning outcomes.

Measures

Engagement was operationalized as a behavioral predictor representing participants' time-based investment during gameplay. The engagement composite reflected the total *time-on-task* aggregated across all six scenario questions (Q1-Q6), combining the duration of interaction on both decision items and feedback review screens. This system-generated variable provided a continuous measure of participant persistence and engagement across the platform.

Learning outcomes were examined through domain-specific skill development measures. *Skill development* was operationalized as change scores representing differences in decision-quality performance between the first and second scenario sequences (Q1-Q3 vs. Q4-Q6). Change scores were calculated separately for each of the three domain-specific sets (Academic Policy, Recordkeeping Compliance, and Operational Management), resulting in three skill development variables (SkillDiff1, SkillDiff2, SkillDiff3). These variables captured domain-specific changes in professional decision-making performance across the platform.

Internal consistency was examined for each scenario sequence used to construct the *Knowledge Application Composite*. Cronbach's alpha coefficients were low for both Scenario 1 ($\alpha = .237$) and Scenario 2 ($\alpha = -.126$). These values reflect the intentional design of the platform, in which each item assessed a distinct competency domain (*Academic Policy*, *Recordkeeping Compliance*, and *Operational Management*) instead of serving as multiple indicators of a single latent construct. Because the scenario composites represent aggregated performance across heterogeneous domains, they should be interpreted as performance indices rather than internally consistent scales. Since the

Knowledge Application Composite was derived from the same scenario scores used to compute the domain specific skill development variables, it was not included in the correlation matrix; however, it was examined separately in regression analyses.

Analysis

Pearson product-moment correlations (r) were computed to assess the strength and direction of associations between engagement time and each learning outcome (SkillDiff1, SkillDiff2, SkillDiff3). Simple linear regression analyses were then conducted to examine whether engagement significantly predicted each learning outcome at the participant level (Keppel & Wickens, 2004).

Statistical significance was evaluated at $\alpha = .05$. Effect sizes were reported using the coefficient of determination (r^2) to indicate the proportion of variance in learning outcomes explained by engagement. Ninety-five percent confidence intervals were reported for standardized regression coefficients to support interpretation of effect magnitude and precision (Cumming, 2012).

Descriptive Statistics

Descriptive statistics were calculated for engagement and each learning outcome variable to summarize overall distributions prior to inferential analyses. Engagement, operationalized as total *time-on-task* across all six scenario questions, demonstrated substantial variability across participants, reflecting differences in behavioral investment with the platform. Table 8 presents descriptive statistics for engagement and learning outcome variables used in Research Question 4 ($N = 38$). Engagement demonstrated substantial variability across participants ($M = 267.83$, $SD = 367.96$), indicating wide differences in behavioral investment with the platform.

Learning outcomes were examined at the domain-specific level. Skill Development change scores varied across domains, with mean differences of 0.21 (SD = 0.87) for SkillDiff1 (Academic Policy), 0.13 (SD = 1.19) for SkillDiff2 (Recordkeeping Compliance), and 0.00 (SD = 0.46) for SkillDiff3 (Operational Management). These values indicate modest average changes across domains with notable individual variation.

Assumptions Testing

Assumptions for correlation and regression analysis were evaluated prior to model estimation. Distributions of engagement, SkillDiff1, SkillDiff2, and SkillDiff3 variables were examined using descriptive statistics, histograms, boxplots, and normal Q-Q plots. Shapiro-Wilk tests indicated statistically significant departures from normality for all three variables ($p < .001$). Given the sample size and the known sensitivity of normality tests to minor deviations, particularly for time-based and difference-score measures, visual inspection was emphasized in determining the suitability of parametric analyses (Field, 2018; Ghasemi & Zahediasl, 2012).

Visual inspection of histograms and Q-Q plots suggested that departures from normality were primarily attributable to positive skewness and kurtosis in the engagement variable and the bounded, zero-centered nature of the skill difference scores. The skill development variables demonstrated clustered distributions consistent with change-score metrics, while the knowledge application composites demonstrated approximately symmetric distributions with minor tail deviations, consistent with difference-score outcomes (Tabachnick & Fidell, 2019).

Scatterplots were used to assess linearity between engagement and each learning outcome, and no evidence of non-linear relationships was observed. Examination of

boxplots and standardized scores did not identify influential cases exceeding conventional thresholds. Given the robustness of Pearson correlation and linear regression to moderate violations of normality, particularly when residual assumptions are met (Field, 2018; Schmidt & Finan, 2018), parametric analyses were deemed appropriate for addressing RQ4.

Inferential Statistics

Bivariate correlations were conducted to examine the strength and direction of relationships between engagement and each learning outcome variable. Engagement was operationalized as cumulative *time-on-task* across all six scenario questions, while learning outcomes were represented by three domain-specific skill development change scores (SkillDiff1, SkillDiff2, SkillDiff3). Correlation coefficients were evaluated to determine whether greater behavioral engagement was statistically associated with differences in learning performance at the participant level. Correlation results are presented in Table 8.

Table 8*Descriptive Statistics and Correlations for Engagement and Skill Development (N = 38)*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1. SkillDiff1	0.21	0.87	1			
2. SkillDiff2	0.13	1.19	0.10	1		
3. SkillDiff3	0.00	0.46	0.00	0.29	1	
4. Engagement	267.83	367.96	-0.06	0.14	-0.01	1

Note. Engagement was collected as milliseconds and converted to seconds for reporting and represents cumulative time-on-task across all six scenarios.

As shown in Table 8, engagement was not significantly correlated with any learning outcome variable. Associations between engagement and skill development were small and non-significant for SkillDiff1 ($r = -0.06$, $p = .724$), SkillDiff2 ($r = 0.14$, $p = .411$), and SkillDiff3 ($r = -0.01$, $p = .978$), indicating that greater time-on-task was not statistically associated with differences in learning performance within this sample.

Results from the regression analyses indicated that engagement did not significantly predict any learning outcome at the participant level. Separate models were estimated for each domain -specific skill development variable and for knowledge application. Across models, engagement demonstrated small, non-significant

standardized effects. Table 9 presents the results of the simple linear regressions examining engagement as a predictor of learning outcome.

Table 9

Simple Linear Regression Predicting Learning Outcomes from Engagement (N =38)

Outcome	β	t	p	R ²
SkillDiff1	-0.06	-0.36	.724	.00
SkillDiff2	0.14	0.83	.411	.02
SkillDiff3	-0.01	-0.03	.978	.00
Knowledge Application	0.06	0.38	.703	.00

Note. SE = standard error; β = standardized coefficient. Engagement represents total *time-on-task* aggregated across all six scenarios.

Separate simple linear regression analyses were conducted to examine whether engagement predicted each learning outcome. Engagement did not significantly predict SkillDiff1, $R = .059$, $R^2 = .004$, $F(1, 36) = 0.127$, $p = .724$, $\beta = -0.06$, $t(36) = -0.36$. Similarly, engagement did not significantly predict SkillDiff2, $R = .137$, $R^2 = .02$, $F(1, 36) = 0.639$, $p = .411$, $\beta = .137$, $t(36) = 0.83$. For SkillDiff3, engagement again failed to demonstrate a significant predictive relationship, $R = .005$, $R^2 = .00$, $F(1, 36) = 0.001$, $p = .978$, $\beta = -.005$, $t(36) = -0.03$. Finally, engagement did not significantly predict

Knowledge Application, $R = .064$, $R^2 = .004$, $F(1, 36) = 0.148$, $p = .703$, $\beta = .064$, $t(36) = 0.38$.

Practical Significance

Practical significance was evaluated using conventional benchmarks for meaningful effect sizes in educational research, with correlations of $r \geq 0.30$ and standardized regression coefficients of $\beta \geq .30$ interpreted as indicating moderate, educationally meaningful effects (Cumming, 2012; Ferguson, 2009; Kirk, 1996).

Engagement did not demonstrate practical significance as a predictor of any learning outcomes. Standardized regression coefficients were small across models ($\beta = -0.06$ for SkillDiff1; $\beta = .137$ for SkillDiff2; $\beta = -.005$ for SkillDiff3; $\beta = .064$ for Knowledge Application), all falling below thresholds for meaningful educational impact. Corresponding coefficients of determination indicated that engagement explained between 0% and 1.9% of variance in learning outcomes.

Although engagement varied substantially across participants, increased time-on-task was not associated with practically meaningful improvements in decision quality or knowledge application. This has important implications for professional development design, indicating that learning quality, instructional structure, and decision scaffolding may play a more critical role than duration of interaction alone.

Hypothesis Evaluation

The null hypothesis for RQ4 stated that engagement would not significantly predict participants' learning outcomes. Results from both bivariate correlation and simple linear regression analyses indicated that engagement was not significantly associated with learning outcomes. The regression model was not statistically significant,

and engagement explained a negligible proportion of the variance in outcomes. Based on these findings, the null hypothesis for Research Question 4 was not rejected. Engagement did not function as a statistically significant predictor of learning outcomes in this sample.

Summary

This section addressed RQ4 by examining whether behavioral engagement within the gamified platform, operationalized as total *time-on-task*, was associated with learning outcomes in the form of domain-specific skill development change scores and knowledge application. Across descriptive, correlational, and regression analyses, engagement did not emerge as a statistically or practically significant predictor of learning outcomes at the participant level. Although participants demonstrated substantial variability in engagement duration, increased time spent interacting with platform scenarios was not associated with higher gains in decision quality or learning transfer.

Together, these findings suggest that while learning gains occurred within the platform, they were not directly attributable to engagement duration alone. Instead, learning outcomes appear to reflect integrated decision-making processes that extend beyond simple time-based behavioral engagement.

Limitations of Findings

Several methodological and contextual limitations should be considered when interpreting the findings of this study. Participation in this study was voluntary, which may have introduced self-selection bias among individuals already inclined toward innovation, technology adoption, or professional development. This potential over-

representation of early adopters may limit the generalizability of the results to the broader PACRAO membership or to other professional populations.

Engagement in this study was operationalized using system-generated behavioral indicators, including *time-on-task*, scenario access, and completion states. While these measures provided objective insight into participant interaction patterns, they did not directly capture cognitive processes such as depth of reflection, metacognitive engagement, or learning strategy selection. As a result, higher engagement as measured behaviorally may not necessarily correspond to greater conceptual processing, and lower engagement may reflect intentional boundary-setting rather than disengagement. These constraints are particularly relevant given the platform's intentionally self-directed, non-mandatory design.

Differences in technology access and digital literacy also represented a possible source of variance in engagement patterns. Participants' familiarity with browser-based interfaces or comfort navigating gamified environments could have influenced both the duration and the quality of interaction recorded in the system logs. While the platform was designed to minimize technological barriers, variations in device performance, connection speed, or user experience could not be entirely ruled out.

The study captured engagement and learning outcomes within a single platform session, limiting conclusions about longer-term retention, sustained engagement, or transfer of skills beyond the immediate study context. Additionally, some subgroup analyses, particularly those disaggregated by institution type and experience level, were based on small cell sizes and should be interpreted as exploratory and descriptive, rather than confirmatory.

In addition to participation constraints, several outcome measures relied on bounded rating scales, which introduced the potential for ceiling effects (Norman, 2010). A substantial portion of participants entered the platform with relatively high baseline decision-quality scores, which limited the amount of measurable upward change detectable through aggregate analyses. Although overall mean differences were small, individual response patterns indicated variability in outcomes, with some participants demonstrating notable improvement across paired scenarios. These patterns suggest that the results reflect heterogeneity in baseline scores and individual response trajectories rather than a lack of learning across participants, and that scale sensitivity may have constrained detectable change for higher-scoring participants (Cumming, 2012).

Finally, the findings are contextually bound to the *PACRAO University* environment. The professional-association setting provided a meaningful but specific sample, and results may not generalize directly to campus-based professional development programs or other regional associations without adaptation. Despite these limitations, this study's design and analytic rigor support cautious interpretation of the results as suggestive of the platform's potential value for fostering learning engagement and professional growth.

Summary

This chapter presented the quantitative results of this study, examining participant performance and engagement within *PACRAO University*, a gamified professional-development platform designed to simulate authentic workplace decision-making. Analyses were organized around four research questions addressing skill development, knowledge application, engagement patterns, and the relationship between engagement

and learning outcomes. Primary inferential analyses were conducted using a complete-case analytic sample of participants who completed both scenario sets ($N = 38$), enabling paired comparisons across parallel professional scenarios.

Across research questions one and two, participants demonstrated relatively high baseline decision-quality scores in Scenario Set 1, with only small changes observed in Scenario Set 2. Paired-samples *t*-tests indicated no statistically significant differences across the three professional domains (Academic Policy, Recordkeeping Compliance, and Operational Management), and composite comparisons likewise showed only a modest nonsignificant increase in Scenario Set 2 performance. None of the observed changes met the predefined threshold for educationally meaningful practical significance. These results indicated that within the timeframe and structure of this platform session, measurable improvements in decision quality and knowledge application were limited, despite slight positive movement in select domains.

Research questions three and four examined engagement as both an outcome and as a predictor. Time-on-task metrics indicated higher average engagement and greater variability in Scenario Set 1, followed by lower and more tightly clustered engagement in Scenario Set 2; however, the difference was not statistically significant and did not reach practical significance thresholds. Correlational and regression analyses further indicated that cumulative engagement time did not predict learning outcomes in this sample. Supplementary system-level analyses provided contextual grounding for these findings by illustrating stable platform performance and behaviorally coherent participation pathways shaped primarily by participant choice rather than system-enforced exits.

Chapter 5 extends this analysis by interpreting these results within the study's guiding frameworks of humanism, andragogy, and gamification. Building on the descriptive and inferential findings reported in Chapter 4, the discussion shifts from outcome evaluation to theoretical meaning-making and design implications. It also explores implications for PACRAO practice, theoretical alignment and future research directions.

Chapter 5: Discussion, Interpretation, and Implications

In this chapter, I interpreted the findings presented in Chapter 4 through the lens of the study's theoretical framework and professional-development context. The purpose of this study was to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members. In this chapter, I explored the ways in which adult learners interacted with structured, game-based, professional learning opportunities, and how those interactions supported professional growth, applied learning, and sustained engagement within a professional-association context. To guide this inquiry, four research questions framed both the design and analyses:

RQ1. To what extent does the gamified platform foster skill development in professional scenarios?

RQ2. To what extent does the gamified platform foster knowledge application in professional scenarios?

RQ3. To what extent does the gamified platform foster engagement among PACRAO members?

RQ4. What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

These questions drew on three complementary frameworks: humanism (Rogers, 1969), which emphasizes self-directed and meaning-centered learning; andragogy (Knowles,

1990), which highlights learner autonomy, relevance, and experiential application; and gamification (Kapp, 2012), which examines how motivational design elements influence adult engagement and learning. Together, these perspectives provided an interpretive foundation for exploring how professional learning occurs within a gamified professional-development platform.

Discussion and Interpretation of Findings

This discussion focused on what the observed patterns suggest about professional learning, engagement, and system design within PACRAO. Taken together, the findings offered insight into how adult learners interacted with a self-directed, gamified professional-development environment and how such environments functioned within professional associations.

Beyond functioning as a gamified professional development platform, *PACRAO university* can also be understood as an applied curriculum grounded in standards-based instructional design. The platform operationalized AACRAO core competencies in sequenced based decision-making tasks, with each scenario functioning as an instructional unit aligned to professional standards, feedback mechanisms served as a formative assessment tools, supporting iterative refinements of reasoning rather than simple completion tracking. In this sense, the system represented a digitally mediated curriculum structured around competency alignment, scaffolded progression, and reflective application within an adult professional development context.

Research Question 1: Skill Development

Research Question 1 examined whether participation in the gamified professional-development platform was associated with measurable changes in skill development. As

reported in Chapter 4, analyses did not reveal statistically significant differences in skill development domain scores. Interpreting these findings benefits from contextualization within both the study design and the professional characteristics of the participant population (Cumming, 2012).

Participants entered the platform with relatively high baseline skill levels, limiting the potential magnitude of measurable change over a short engagement window (Eraut, 2004). This ceiling effect was consistent with the professional expertise of PACRAO members, many of whom routinely engage in complex decision-making related to policy interpretation, workflow analysis, and academic records management. In this context, the absence of statistically significant gains did not necessarily indicate a lack of learning (Cumming, 2012). Rather, these results suggested that the platform functioned as a reinforcement and calibration space rather than as a traditional educational space focused on skill acquisition (Eraut, 2004; Hattie, 2009; Cumming, 2012; Rogers, 1969).

From a humanistic perspective (Rogers, 1969), learning does not always manifest through immediate performance gains, particularly among experienced professionals. Instead, learning may occur through reflection, affirmation of existing competence, or refinement of judgment. The observed stability in skill-related performance may therefore indicate that participants were engaging in confirmatory learning by testing their existing knowledge against simulated scenarios, instead of acquiring entirely new competencies.

These findings suggest that gamified professional-development platforms could be especially well suited for supporting reflective practice and skill maintenance among experienced practitioners, even when short-term performance gains are modest.

Research Question 2: Knowledge Application

Research Question 2 focused on participants' ability to apply professional knowledge within simulated scenarios. Similar to skill development, knowledge application did not demonstrate statistically significant changes. However, patterns observed across measures and behavioral indicators provided important interpretive insight. Interpretation of these findings should also consider participants' relatively high baseline decision-quality scores and the bounded nature of the composite measures, which may have constrained detectable change in knowledge application despite engagement with the scenarios.

Skill development and knowledge application scores aligned closely across participants, indicating that these constructs moved together rather than independently (Eraut, 2004; Knowles, 1990). This coupling suggested that participants approached scenario-based decision-making holistically, integrating procedural knowledge, contextual judgment, and professional norms simultaneously (Eraut, 2004). Rather than isolating discrete knowledge elements, participants engaged in applied reasoning reflective of authentic workplace practice (Eraut, 2004; Knowles, 1990).

From an andragogical standpoint (Knowles, 1990), this pattern was expected. Adult learners tend to apply knowledge in problem-centered ways, drawing on experience and contextual understanding, rather than abstract recall. The platform's scenario structure mirrored real professional dilemmas, encouraging participants to rely on judgment shaped by prior experience. As a result, participants may have applied knowledge at a level of sophistication not easily captured through traditional gain-score comparisons (Cumming, 2012; Eraut, 2004; Ferguson, 2009).

These findings reinforced the interpretation that *PACRAO University* functioned less as a content-delivery mechanism and more as a structured environment for applied professional reasoning, in which learning manifested through engagement with realistic decision contexts rather than measurable content acquisition or application.

Research Question 3: Engagement

Research Question 3 examined engagement as an outcome of participation in the gamified platform. Engagement outcomes remained notably coherent and stable across the platform, reflecting sustained behavioral investment through the learning experience.

Participant flow analysis demonstrated that most users progressed through the platform as designed, with minimal evidence of system-induced attrition. The system overwhelmingly categorized sessions as *Completed_Natural*, indicating successful progression through the full programmed level rather than premature disengagement due to frustration, confusion, or technical issues. Importantly, scenario engagement was optional, and participants could complete the platform without engaging with the special scenarios. This pattern suggested that participants exercised agency in determining the extent of their participation, consistent with humanistic conceptions of learner autonomy (Rogers, 1969) and andragogical principles of self-directed learning that emphasize learner-controlled pacing and intentional boundary setting (Knowles, 1990).

Time-on-task analysis further supported this interpretation. Violin plot distributions revealed higher central tendency and greater variability during Scenario Set 1, followed by tighter distributions and slightly reduced mean time during Scenario Set 2. This pattern suggested an initial orientation and familiarization phase followed by increased procedural fluency as participants became more comfortable navigating the

platform and its scenario structure. Importantly, reduced *time-on-task* in later scenarios did not coincide with lower completion rates or disengagement. Instead, this pattern reflected efficiency gains rather than withdrawal, reinforcing the interpretation of sustained cognitive engagement rather than declining motivation.

Research Question 4: Engagement as a Predictor

Research Question 4 explored whether engagement functioned as a predictor of learning outcomes. Contrary to expectations derived from gamification literature (e.g., Hamari et al., 2016), the engagement composite did not significantly predict changes in knowledge application or domain-specific skill development in Academic Policy, Recordkeeping Compliance, or Operational management within this study. This finding should be considered in light of participants' relatively high baseline decision-quality scores and the bounded nature of the outcome measures, which introduce the potential for ceiling effects and restricted variance in change scores, limiting the magnitude of detectable associations between engagement and learning outcomes.

Notably, although engagement did not predict learning outcomes, strong associations were observed between domain-specific skill development and knowledge application, suggesting that learning gains reflected integrated decision-making processes rather than variation in time-based engagement alone. These findings suggested that, within a highly experienced professional population, engagement may operate differently than it does in novice or student-based samples (Eraut, 2004; Hamari et al., 2016). High engagement did not necessarily translate into measurable learning gains because participants may already possess stable competencies (Eraut, 2004; Knowles, 1990). In this context, engagement functioned more as a mechanism for validation, reflection, and

professional alignment rather than skill acquisition (Eraut, 2004; Knowles, 1990; Rogers, 1969).

From a theoretical perspective, this result challenged generalized assumptions in the gamification literature that increased engagement reliably predicts learning gains across contexts (Hamari et al., 2016). Instead, it supported a more nuanced interpretation in which engagement serves as a necessary but not sufficient condition for learning, particularly among adult professionals with established expertise. These findings contributed to gamification theory by suggesting that engagement metrics should be interpreted contextually, accounting for learner experience, baseline competence, and the purpose of the learning environment.

Integrated Interpretation

Taken together, the findings across all four research questions suggested that *PACRAO University* functioned as a stable, coherent, and learner-controlled professional-development environment. While short-term learning gains were modest, engagement patterns reflected intentional participation, procedural fluency, and sustained involvement. These patterns aligned strongly with humanistic (Rogers, 1969) and andragogical (Knowles, 1990) principles, indicating that the platform supported autonomy, relevance, and reflective practice rather than externally driven performance outcomes. Collectively, these interpretations positioned the platform not as a performance accelerator but as a viable professional-learning environment capable of supporting self-directed engagement, applied reasoning, and reflective professional practice within a regional association context.

Comparison to Existing Literature

This section situated the findings of this study within the existing literature on adult learning, gamification, engagement, and professional development. By comparing observed outcomes from *PACRAO University* with prior research, this analysis highlighted areas of alignment with established findings as well as points where this study extends or complicates prevailing assumptions. Taken together, these comparisons reinforced the theoretical grounding of the platform while clarifying its contributions to professional development research in higher education contexts.

Alignment to Prior Findings

As outlined in Chapter 2, prior research on gamification, adult learning, and professional development emphasizes engagement as a design-mediated construct shaped by autonomy, relevance, and contextual authenticity. The engagement patterns observed in this study aligned closely with prior research demonstrating that gamified learning environments can support sustained behavioral engagement among adult learners when engagement is intentionally designed rather than assumed (Kapp, 2012; Kapp et al., 2020; Zainuddin et al., 2023; Zainuddin et al., 2024).

This alignment was further supported by adult learning and professional development literature emphasizing autonomy, relevance, and reflective engagement as central drivers of persistence among experienced practitioners (Barath & Ross, 2024; Cain & Piascik, 2015; Eraut, 2004; Cumming, 2012; Ferguson, 2009; Green & Huntington, 2017; Hope et al., 2023; Knowles, 1990; McCray, 2016; Rogers, 1969; Tessier et al., 2021).

The *PACRAO University* platform demonstrated voluntary persistence, repeated interaction with learning materials, and intentional progression through challenges, consistent with prior findings (Cain & Piascik, 2015; Hope et al., 2023; Kapp et al., 2020). Importantly, engagement in this study was operationalized as an outcome, which reinforced prior work that positions engagement as an observable construct shaped by design choices (Hamari et al., 2016; Kapp, 2012).

The stability of engagement across the platform also reflected findings from studies emphasizing the importance of autonomy, relevance, and feedback in adult learning environments (Knowles, 1990; Rogers, 1969; Zainuddin et al., 2023). Participants exercised control over pacing and stopping points, and session terminations overwhelmingly reflected intentional completion rather than disengagement. This mirrored prior research showing that learners were more likely to persist when learning experiences respected self-direction and professional judgment (Barath & Ross, 2024; Green and Huntington, 2017).

In terms of learning outcomes, the absence of statistically significant short-term gains in skill development and knowledge application aligned with literature emphasizing that professional learning among experienced practitioners often manifests as refinement, validation, or calibration rather than discrete performance increases (Eraut, 2004; Cumming, 2012; Ferguson, 2009). Similar to findings reported by Tessier et al. (2021) and McCray (2016), learning in this study appeared to occur through reflective engagement with authentic scenarios rather than through measurable acquisition of new competencies over a brief exposure window.

The close alignment between skill development and knowledge application scores further supported prior research suggesting that adult professionals engage holistically with complex decision-making tasks, integrating procedural knowledge, contextual reasoning, and professional norms simultaneously (Knowles, 1990; Eraut, 2004). This pattern reflected the problem-centered orientation of adult learning described in the andragogical literature and reinforced the value of scenario-based designs for professional development.

Extensions and New Contributions

While many findings aligned with existing literature, this study also extended prior research in meaningful ways. Unlike much of the gamification literature that focuses on student or novice populations, this study examined an experienced professional cohort operating within a voluntary, non-incentivized environment. The finding that engagement did not significantly predict learning gains qualified interpretations of gamification research that often assume a direct causal relationship between engagement intensity and measurable learning outcomes (Hamari et al., 2016). Instead, the results suggested that among experienced professionals, engagement may serve different learning functions, including validation, professional alignment, and reflective confirmation of expertise. These findings did not contradict prior gamification research, but rather refined its application by highlighting how engagement operates differently across learner populations and professional contexts.

This finding extended gamification theory by reinforcing calls for contextualized interpretations of engagement metrics within adult learning contexts (Eraut, 2004; Hamari et al., 2016; Knowles, 1990; Kapp, 2012). In *PACRAO University*, engagement

functioned less as a driver of skill development and more as an indicator of perceived relevance, autonomy, and professional resonance. This distinction added nuance to the literature by suggesting that engagement functioned as a necessary, but not sufficient, condition for learning. In an adult professional-development setting characterized by high baseline competence, engagement appeared to support relevance, validation, and professional alignment rather than directly producing measurable learning gains.

This study also contributed to the literature by operationalizing humanism (Rogers, 1969) and andragogy (Knowles, 1990) simultaneously within a gamified system and empirically examining how these frameworks interact in practice. While prior research had examined gamification and andragogy conceptually (Zainuddin et al., 2024), fewer studies had demonstrated how humanistic principles of autonomy, self-directed boundary-setting, and related dimensions of psychological safety manifest through behavior system data. The predominance of *Completed_Natural* session endings provided empirical support for Rogers' (1969) assertion that meaningful learning environments empower learners to determine the scope and timing of their engagement.

Finally, this study extended professional development literature by demonstrating how gamified platforms could function as structurally stable, low-friction learning ecosystems within professional associations. Unlike traditional PD models that rely on episodic, conference-based delivery, *PACRAO University* illustrated how gamified design could support sustained engagement, applied reasoning, and reflective practice across time and geography. Although not designed in response to a specific industry report, this contribution is consistent with gaps identified in the professional-development literature regarding scalable, theory-aligned professional development models capable of

addressing access, equity, and engagement challenges in higher education (Hope et al., 2023; Kilgore, 2025).

Implications

This section outlined the potential implications of the study's findings for professional practice, theoretical development, and the design of future professional-development systems. While the specific outcomes were interpreted in light of the results presented in Chapter 4, several important implications emerged from the observed engagement patterns, system-level behaviors, and performance trends captured through the study's embedded analytics.

The gamified professional-development platform, developed in association with PACRAO, was designed not only to test how learning occurred in a digital environment, but also to explore how established learning theories could be operationalized within real-world professional communities. The implications of this work therefore extended beyond the immediate findings of participant engagement or skill acquisition. They reached into the broader conversation about how adult-learning theory, motivational design, and organizational vision and practice could converge to strengthen the professional learning ecosystem within professional associations.

In this sense, the implications of this study were multidimensional. At the practical level, the study informed how professional associations such as PACRAO could design sustainable and inclusive development opportunities that align with members' authentic work. At a theoretical level, it extended foundational frameworks by demonstrating how they interact within a single applied context. At the design level, the study illustrated new ways of structuring learning ecosystems that were reflective, data-

driven, and intrinsically motivating. Taken together, these dimensions highlighted how the intersection of theory, technology, and community could create a dynamic space for professional growth. The following sections explore these potential implications in greater detail.

Practical Implications

At a practical level, the findings of this study indicated that *PACRAO University* could meaningfully extend the association's professional development ecosystem through a flexible, gamified learning model. Although several results did not reach statistical significance, the direction and consistency of the observed patterns suggested that the platform held practical value for supporting learning, engagement, and professional connection across PACRAO's membership. The implications below interpret these findings through the study's theoretical frameworks and highlight how the platform could support ongoing professional development within regional associations.

Participants demonstrated coherent behavioral engagement throughout the platform by consistently completing scenario sequences, interacting with the feedback, and showing highly professionally aligned decisions across multiple domains. Even without statistically significant changes in all areas, these patterns reflected sustained involvement and voluntary cognitive investment. This was an important indicator of perceived relevance within a humanistic learning framework (Rogers, 1969). The fact that participants chose to persist through a non-required, non-incentivized platform suggested that the platform resonated with their professional experiences and motivated active engagement. This pattern directly addressed the engagement gap identified in

Chapter 1 by demonstrating one way PACRAO could support sustained member involvement between conferences and across the year.

Engagement metrics also showed stable or adaptive *time-on-task* across scenario sets. Violin plot analyses indicated greater variability and higher central tendency during Scenario Set 1, followed by tighter distributions and slightly reduced engagement time in Scenario Set 2. This pattern suggested an initial orientation and familiarization phase, followed by increased procedural fluency and efficiency rather than disengagement. Such adaptation is aligned with andragogical assumptions (Knowles, 1990) that adult learners become more efficient as task relevance and confidence increase through experience.

The platform's "special scenario project" structure offered participants opportunities to apply policy interpretation, workflow reasoning, and data-stewardship skills in realistic, low-stakes scenarios. Even modest gains in performance suggested that the platform supported early-stage learning and reflective practice among participants. Functionally, the platform extended beyond content delivery by structuring opportunities that encouraged discovery and interpretation, reflecting characteristics consistent with facilitative learning approaches. This dual role supported PACRAO's identity as a community of practice and positioned the platform as a potential learning laboratory where knowledge is co-created rather than delivered hierarchically. This directly spoke to the skill-development and knowledge application gaps highlighted in Chapter 1, especially the lack of structured, practice-based opportunities for professionals to develop shared judgment and applied decision-making skills.

The findings also suggested that gamified professional development could broaden access to learning. The asynchronous, cost-free format allowed members,

particularly those from small or geographically remote institutions, to engage without the travel and financial constraints associated with conference attendance. This accessibility aligned with PACRAO's stated values of inclusion and equity, and it reflected andragogical (Knowles, 1990) principles of autonomy and self-direction. In a broader sense, the model appeared to address gaps in access and reduce professional isolation for practitioners who otherwise have limited opportunities for structured professional development.

This pattern addressed the access and equity gap described in Chapter 1, where opportunities for development were unevenly distributed across institutional types and resource levels. Beyond improving access, the platform also appeared to reduce the "conference-to-conference" engagement gap by offering a self-directed, problem-centered structure that encouraged PACRAO members to connect with meaningful learning opportunities throughout the year, meeting participants when and where *they* are.

Participation from both the United States and Canada further underscored this accessibility. Because the platform functioned effectively across national contexts and was interpretable by professionals working within different higher-education systems, the findings suggested that its underlying competencies, scenario structure, and learning design could have relevance beyond U.S. institutional settings. This cross-border usability strengthened the platform's potential for broader adoption across AACRAO's diverse regional landscape.

In addition to the behavioral engagement data captured by the platform, informal reactions during the PACRAO conference launch provided useful context for interpreting the findings. Several attendees expressed surprise and enthusiasm when the platform was

introduced, noting that the game-like structure “sounded fun” and “felt different from other things.” Although anecdotal, these reactions provided ecological validity for the platform’s cultural fit within the association and suggested that a gamified model could be well positioned for deeper integration into PACRAO’s professional development ecosystem. These reactions further affirmed the need identified in Chapter 1 for professional-development options that feel relevant, contemporary, and aligned with emerging professional identities.

Beyond immediate engagement, *PACRAO University* could also contribute to long-term knowledge stewardship. Over time and with intentional governance, member reflections, scenario responses, and collaborative insights could be aggregated into a living repository of institutional knowledge. Such an archive would support Rogers’ (1969) emphasis on learning as a cumulative, community-driven process and could offer an innovative mechanism for supporting leadership continuity and preserving professional memory within the association. This function mapped directly onto the knowledge-stewardship gap from Chapter 1, where the field’s institutional memory has been vulnerable to turnover, burnout, and structural shifts.

These implications also aligned with broader trends in the profession. Recent AACRAO research (Kilgore, 2025) emphasized pipeline gaps, uneven professional preparation pathways, and the ongoing need for scalable, learner-centered development models across enrollment management. Although findings from the present study focused specifically on Records and Academic Services Professionals within PACRAO, the observed engagement patterns demonstrate conceptual alignment with AACRAO’s national findings. The *PACRAO University* platform did not extend beyond the study’s

defined population, but it did offer a potential framework that could be adapted across regional associations seeking to modernize and sustain their professional-development offerings. This connection reinforces the broader pipeline and preparation gaps and situates *PACRAO University* as a response aligned with professional-level needs.

Finally, the platform's structural stability, directionally positive learning patterns, and favorable qualitative impressions suggested that *PACRAO University* could serve as a prototype for broader implementation within AACRAO's regional network. Gamified design principles (Kapp, 2012) are inherently adaptable, allowing similar platforms to be customized across varied subfields while maintaining consistent motivational and reflective elements. As such, the findings of this study indicated that the *PACRAO University* platform could offer a promising, research-informed approach to strengthening professional learning, enhancing member engagement, and supporting a more connected and inclusive regional association community.

Theoretical Implications

At the theoretical level, this study contributed to the evolving conversation about adult learning in professional communities by integrating three frameworks that are seldom examined together in academic and enrollment services contexts. The intersection of Humanism (Rogers, 1969), Andragogy (Knowles, 1990), and Gamification (Kapp, 2012) provided a unique opportunity to observe how adult learning operates within a structured, yet exploratory environment. Each of these frameworks contributed a distinct dimension of understanding, ranging from personal motivation to contextual relevance and systems design, which collectively informed the meaning and impact of professional learning within *PACRAO University*. Rather than testing these frameworks in isolation,

this study examined how they function collectively through design and participant behavior, offering insight into how theory could be operationalized within real-world professional communities.

Drawing on Rogers (1969), the gamified platform developed for this study illustrated how learner autonomy, self-direction, and personal meaning manifested in digital professional-development spaces. Participants exercised agency in pacing, progression, and stopping decisions, reflecting humanistic principles of intrinsic motivation and self-regulation. In this sense, *PACRAO University* functioned as a humanistic learning environment in which structure supported exploration without enforcing compliance. The behavioral patterns observed in Chapter 4 suggested that autonomy and self-directed choice remained powerful drivers of engagement even in institutional contexts.

Consistent with Knowles' (1990) principles of andragogy, *PACRAO University's* design encouraged relevance and problem-centered learning by situating professional scenarios within authentic workplace tasks. Participants engaged with issues that mirrored real professional challenges faced by practitioners, supporting immediate applicability and contextual relevance. Although the study did not demonstrate statistically significant learning gains, the observed engagement patterns and coherent progression through scenarios provided descriptive evidence that andragogical assumptions remained salient within gamified, asynchronous professional learning environments.

Building upon Kapp (2012), this study extended gamification literature by examining its application within a voluntary, professional-association context. Unlike

traditional corporate or classroom methods that rely on external rewards or performance incentives, *PACRAO University* leveraged game mechanics to structure professional curiosity, reflection, feedback, and progression without imposing extrinsic motivators. The findings suggested that gamification could function as a design scaffold that supported meaningful participation and sustained interaction, rather than as a direct driver of learning outcomes.

By positioning gamification as the mediating “bridge” between self-directed growth (humanism) and problem-centered learning (andragogy), this study demonstrated how theory could be operationalized through purposeful design. Within this integrated framework, Humanism (Rogers, 1969) provided the foundation by emphasizing autonomy, intrinsic motivation, and personal meaning in the learning process. Andragogy (Knowles, 1990) extended that foundation by focusing on relevance, application, and the learner’s ability to shape their own professional growth. Gamification (Kapp, 2012) connected these theories by translating them into interactive structures that sustained engagement, reflection, and feedback. Supported by the behavioral and system-level findings in Chapter 4, this synthesis contributed to theoretical understanding by framing gamification not as a motivational overlay but as an integrative mechanism that could make adult learning theory tangible within digital professional development environments.

Reflection on the platform’s design and participant interaction patterns also suggests that Eisner’s (1994) conception of cognition as dynamic interaction between individuals and their environments provides an additional theoretical lens for understanding *PACRAO University*. Eisner emphasized that meaning-making emerges

through perception, interpretation, and response within structured environments. The scenario-based architecture of the platform required participants to interpret contextual cues, weigh competing considerations, and enact decisions within simulated professional settings. In this sense, the learning process was not solely internal or motivational, but shaped by how the environment was intentionally structured to support reflection and professional judgement. Although Eisner's framework was not an explicit component of the original theoretical framing, future iterations of the platform may more intentionally incorporate this perspective to deepen understanding of how digital professional environments shape adult learning behavior.

Design Implications for Professional Development

Beyond PACRAO itself, this study could inform the broader design of professional-development systems across higher education and other practitioner communities. The findings could help organizations rethink how learning design, motivation, and reflection intersect in environments where professional development often competes with time constraints, resource limitations, and varied engagement levels. The following implications highlight how gamified structures could influence the next generation of professional development frameworks.

The platform's use of non-contingent points and visual progress indicators demonstrated how visual progress cues could operate alongside intrinsic reflection without displacing learners' self-directed meaning-making. Unlike gamified designs that tie scenario completion to bonus points or performance-based rewards, progress within this platform was intentionally decoupled from participant decisions. This design allowed learners to progress through scenarios without external pressure or coercion, preserving

autonomy and supporting self-directed engagement. Such an approach aligns with humanistic theory by honoring learners' intrinsic desire for meaning while avoiding the regulation of engagement through reward structures.

The study underscored the value of modular, low-time-commitment learning opportunities that align with professional schedules of busy staff members. By offering brief, contextually relevant challenges, gamified platforms could model scalable professional development that maintains both accessibility and depth. This design approach parallels andragogical principles (Knowles, 1990) by respecting adult learners' need for relevance and efficiency while still supporting reflection and mastery. In professional practice, this could lead to development models that scale across institutions without sacrificing contextual authenticity or learner ownership.

By tracking engagement patterns and task completion, gamified platforms could generate evidence-based insights into what members actually value in professional learning. These data could help organizations evaluate engagement patterns, refine program design, and allocate resources more strategically. Within an institutional or organizational context, this approach supports a shift from anecdotal to analytical PD design, where continuous feedback loops inform ongoing improvement. This outcome also aligned with gamification (Kapp, 2012), which emphasizes feedback as a driver of sustained learning, demonstrating how data could serve as both an evaluative and pedagogical tool.

Gamified platforms could serve as evolving repositories of institutional wisdom, retaining expertise that might otherwise be lost during leadership turnover and providing future professionals with structured yet adaptive access to knowledge. This function

extends humanistic theory (Rogers, 1969) by framing professional development not as isolated training but as a living archive of shared growth. In professional-association contexts, this may strengthen continuity, transparency, and collective ownership of knowledge, ensuring that development efforts contribute to a sustained culture of learning rather than episodic events.

Limitations

This study's design and scope involved certain constraints that may have influenced the interpretation and generalizability of the findings. I acknowledge the following limitations and delimitations to provide transparency about the boundaries of this work and to guide appropriate interpretation of its findings.

Because participation in *PACRAO University* was voluntary and self-directed, the study reflected engagement patterns among individuals who chose to interact with the platform rather than a randomly assigned or uniformly required population. This self-selection may limit the generalizability of findings to PACRAO members who are less inclined toward optional professional-development activities or digital learning environments. At the same time, this design choice aligned intentionally with andragogical principles of autonomy and self-direction (Knowles, 1990), prioritizing ecological validity over experimental control.

The timing and context of the study also shaped participation. The platform was launched in conjunction with the PACRAO annual conference and remained open for participation over a 30-day winter holiday period. While this approach supported visibility and naturalistic engagement, it may have influenced participation volume due to competing professional responsibilities, travel, or seasonal availability. Additionally, the

analytic sample was drawn exclusively from PACRAO members, which ensured contextual relevance but limited direct generalization to other professional associations, institutional types, or regional contexts. The study was designed to explore engagement and learning patterns within this specific professional community rather than to produce universally generalizable results.

A methodological limitation also concerns the restricted range of the decision-quality rubric used to assess learning outcomes. The four-point scale, while aligned with AACRAO best practices and designed to reflect meaningful distinctions in professional judgement, may have constrained variability among experienced participants whose baseline performance was already high. Descriptive statistics indicated clustering near the upper end of the scale, suggesting potential ceiling effects. This compression may have reduced sensitivity to detect learning gains across scenarios. Nonsignificant findings related to learning growth should be interpreted in light of the measurement range and its implications for detecting subtle developmental change.

A second methodological limitation concerns the reliability of the Knowledge Application Composite measure used in this study. Internal-consistency estimates for the scenario clusters used to construct this composite were low, likely reflecting the platform's design in which individual scenario items assessed distinct competency domains instead of a single construct. Consequently, the composite score provides limited evidence of internal-consistency reliability and should be interpreted accordingly. Future iterations of the platform could strengthen measurement reliability by incorporating multiple scenario items within each competency area, extending the time

between observations, or increasing the number of observations used to estimate professional learning over time.

Finally, I operationalized engagement in this study through system-generated behavioral indicators, including *time-on-task*, progression patterns, and completion states. While these measures provided objective and granular insight into how participants interacted with the platform, they did not directly capture internal cognitive processes such as motivation, depth of reflection, or perceived learning value. The absence of qualitative data limited interpretive depth regarding participants' subjective experiences. This limitation reflected an intentional design decision favoring low participation burden, unobtrusive measurement, and authentic interaction within a self-directed learning environment. Accordingly, findings were interpreted as indicators of behavioral engagement through system interaction rather than comprehensive measures of learning experience or motivation.

Taken together, these limitations and delimitations reflected the intentional boundaries of the study's design. They defined the conditions under which the findings were interpreted and reinforced that the study's primary contributions are in applied insight, theoretical integration, and design innovation rather than universal generalization.

Recommendations for Future Research and Practice

Future research could extend this study by examining how gamified professional development functions across additional roles within enrollment management. Although the present study focused on Records and Academic Services professionals, similar studies could be conducted with admissions, advising, or other associated professionals to explore cross-role applicability. Such replication would also allow researchers to examine

whether engagement patterns, learning behaviors, or perceived value shift as participants progress through different stages of their careers or experience multiple cycles of platform use.

Although this study welcomed participants across career stages, no novice professionals participated in the study. Future research should intentionally recruit early-career practitioners to examine whether baseline knowledge variability influences engagement patterns and learning outcomes. Greater variation in professional experience may produce more differentiated performance trajectories and increased sensitivity to detecting learning gains across developmental stages. Including participants at earlier stages of professional identity formation may also clarify how gamified professional development supports onboarding, confidence-building, and the development of foundational decision-making skills. Purposeful recruitment within onboarding cohorts, graduate preparation programs, or institutional training pipelines may provide a more developmentally heterogeneous sample for examining how learning unfolds across career progression.

The decision-quality rubric used in this study was directly from AACRAO's core competency framework and organized around entry, intermediate, and expert performance indicators. While this structure ensured professional alignment, the broad developmental categories may have limited discrimination among experienced practitioners. Future iterations may benefit from expanding the rubric to include additional performance bands within each competency domain or disaggregating analytic dimensions such as procedural accuracy, contextual reasoning, and policy interpretation. Incorporating behaviorally anchored descriptors within these subdimensions may

enhance range sensitivity and improve detection of incremental growth, particularly in samples with high baseline expertise.

Given that the present study identified directionally positive but non-significant learning outcomes, further research may also investigate the long-term impact of gamified professional development through longitudinal designs, iterative participation, and larger analytic samples. Tracking the same participants across multiple semesters or years could illuminate how sustained involvement influences professional skill development, confidence, identity, and engagement within the association. Longitudinal research may also help determine how participants' trajectories evolve as the platform's features are refined over time. This would provide valuable insights into developmental patterns that short-term studies cannot capture.

Comparative modality research represents another important direction. Future studies could compare gamified PD with traditional approaches such as webinars, workshops, and conference sessions to examine differences in engagement, perceived relevance, and skill-related decision-making. Additional work could explore how embedding traditional PD content *within* a gamified structure affects professional learning, or how team-based or collaborative game mechanics influence outcomes compared to individual participation. This line of inquiry may deepen understanding of which design features most effectively promote adult learning and interaction among professionals.

Additional research could focus on scenario structure, user experience, and feedback mechanisms to refine gamified PD platforms. Studies could examine which types of scenarios or challenge designs most effectively support skill application,

workflow interpretation, or policy reasoning. Researchers could also investigate how different forms of automated feedback affect learning processes and participant satisfaction. Parallel work in usability, accessibility, and design-impact analysis could improve navigation and reduce friction for users, especially those new to digital or game-based learning environments.

Finally, future research could explore broader organizational and equity implications. Investigating whether gamified PD improves access for professionals at small institutions, in rural regions, or among historically underrepresented groups could help determine whether such systems reduce participation barriers associated with time, cost, or travel. Studies might also examine how participation in gamified PD influences early-career professionals' sense of identity, belonging, or confidence within their professional association.

As professional learning ecosystems continue to evolve, researchers could test this model across additional AACRAO regions to assess generalizability, as well as examine its potential applicability within other professional-development contexts in higher education, or where appropriate, in broader adult-learning or organizational training environments. Future work could also consider whether gamified systems can support onboarding or micro-credentialing initiatives within these broader developmental environments. Together, these lines of inquiry would further strengthen the evidence base for gamified professional development in higher education and help clarify how models like *PACRAO University* can meaningfully contribute to the evolving landscape of professional learning.

Concluding Statement

The problem of practice guiding this study centered on the limited availability of meaningful, accessible, and sustained professional-development opportunities for professionals within PACRAO. Traditional professional-development models in higher education tend to be episodic and conference-based, which, when combined with geographic and institutional challenges, could limit opportunities for sustained skill development, knowledge application, or engagement. The purpose of this study was to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members.

Findings from this study did not demonstrate statistically significant gains in skill development, knowledge application, or engagement within the timeframe of implementation. However, the results revealed a coherent and stable pattern of participant interaction with the platform. Participants demonstrated high baseline decision quality, voluntary persistence through self-directed learning pathways, and structured engagement behaviors aligned with the platform's design intent. System-level analyses further indicated reliable platform performance, participant-controlled pacing, and consistent completion patterns that reflected autonomy rather than attrition or system failure. Together, these findings suggest that while measurable learning gains were modest, the platform functioned as a viable and behaviorally coherent professional-learning environment.

Although not used as formal data, informal reactions shared by PACRAO members during the conference launch provided additional context for interpreting these findings. Expressions of curiosity, enthusiasm, and perceived relevance aligned with

observed engagement patterns and supported the cultural feasibility of gamified professional development within the association. These early impressions, combined with the empirical results, indicated that challenge-based, self-directed learning models could offer a meaningful complement to traditional association-based professional-development practices.

Ultimately, this work contributed to the profession by offering an evidence-informed model for reimagining how professional development associations can support continuous, practice-centered learning. At a time when higher education faces growing demands for adaptability, inclusiveness, and innovation in professional development, this study demonstrated a pathway for integrating practice-centered, scalable, and learner-responsive approaches into the fabric of association-based adult learning. In doing so, it highlights that sustainable growth in the profession requires equally sustainable systems of learning, and that such systems are both possible and within reach.

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Appendix A

Community Partner Agreement

Community Partner Agreement

This agreement outlines the terms of collaboration between a doctoral researcher and a professional association to support a research study on gamified professional development.

Between: Chad Saunders, EdD student in Curriculum and Instruction, The University of Denver
And: Pacific Association of Collegiate Registrars and Admissions Officers (PACRAO)

Purpose:

This Community Partner Agreement establishes a collaborative partnership between Chad Saunders and PACRAO in support of the researcher's Dissertation in Practice (DiP), which seeks to evaluate the effectiveness of a gamified platform designed to support professional development among higher education professionals. PACRAO, as the community partner, will facilitate access to its membership and support the implementation of the project.

Research Questions:

This study aims to explore the following research questions in the dissertation study:

- To what extent does the gamified platform foster skill development in professional scenarios?
- To what extent does the gamified platform foster knowledge application in professional scenarios?
- To what extent does the gamified platform foster engagement among PACRAO members?
- What is the relationship between participant engagement with the gamified platform and their skill development and knowledge application outcomes?

Community Partner Organization:

PACRAO is a professional association serving higher education institutions across the Pacific and Rocky Mountain region, with a mission to promote best practices and professional development in the academic and enrollment services industry.

Description of Partnership:

This partnership supports the development and assessment of a gamified tool to enhance engagement in professional learning. The tool will be made available to PACRAO members, and data will be gathered to measure its usefulness in skill development, knowledge application, and engagement.

Responsibilities of the Researcher:

- Secure Institutional Review Board (IRB) approval for the research.
- Provide PACRAO with all necessary documentation and updates throughout the project.
- Design, implement, and manage the gamified platform and research surveys.
- Ensure confidentiality, data security, and ethical standards in all aspects of research.
- Attend the 2025 PACRAO conference and introduce that platform to the membership.
- Share a summary of findings and recommendations with PACRAO at the conclusion of the study.

Responsibilities of PACRAO:

- Support the dissemination of research invitations and communications to members.
- Encourage voluntary participation among its members by email, newsletter, or website.
- Provide a session slot at the 2025 conference for researcher to present the platform to interested members and respond to questions.
- Provide feedback, insights, and guidance on the platform's relevance and fit for the profession.
- Allow public acknowledgment as a partner in the study and inclusion in the dissertation.

Boundaries of Engagement:

- PACRAO members will participate voluntarily and may withdraw at any time.
- No financial obligations are expected of either party.
- The researcher will retain all data in compliance with IRB requirements and will not share raw data with PACRAO, except in aggregate form.
- PACRAO may opt out of the agreement with written notice.

Timeline:

- Initial Internal Preparations: July, 2025
- Project Launch: November, 2025
- Platform Accessibility Period: November, 2025-December, 2025
- Final Report Shared with PACRAO: June, 2026

Oversight:

This research will be conducted under the supervision of Dr. Brette Garner, Associate Professor in the Department of teaching and learning at the Morgridge College of Education, University of Denver. If you have any questions, concerns, or would like additional information about the project or the researcher's role, you are encouraged to contact Dr. Garner at Brette.Garner@du.edu.

Signatures:

By signing below, both parties affirm their understanding of, and agreement to, the responsibilities and scope of this collaboration:

Researcher Name: Chad Saunders	PACRAO Representative Name:
Title: EdD Candidate and Researcher	Title: President
Institution: The University of Denver	Organization: PACRAO
Signature: <i>Chad Saunders</i>	Signature: <i>Tina Miller</i>
Date: 09/05/2025	Date: 09/08/2025

Appendix B

Exempt Research Information Sheet-Informed Consent



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Exempt Research Information Sheet

Study Title: Bridging Professional Development Gaps in PACRAO Through Gamification

IRBNet #: 2336124-1

Consent Version: 09/24/2025

Principal Investigator: Chad Saunders, Doctor of Education Candidate, University of Denver, Teaching and Learning Sciences

Faculty Sponsor: Dr. Brette Garner, Doctor of Philosophy, University of Denver, Teaching and Learning Sciences

You are invited to participate in a research study.

The purpose of this study is to explore the effectiveness of a gamified professional development platform in fostering skill development, knowledge application, and engagement among PACRAO members.

Procedures

If you decide to participate, you will complete a brief demographic questionnaire and an interactive, scenario-based activity within this website. The full session will take approximately 10-15 minutes. You will first be asked to provide basic demographic information (such as your role and years of professional experience). You will then complete the gameplay activity in which you respond to professional situations relevant to higher education.

Your participation in this research study is voluntary, and you do not have to take part. You are free to stop at any time by closing the webpage before submitting your responses. You may also be asked for your state or province; this question is optional and may be skipped without affecting your participation. All other questions within the activity must be completed in order to move forward.

Risks/Discomforts and Benefits

Your participation will contribute to a better understanding of professional development practices in higher education and may help inform future program design. While you will not receive direct personal benefits, your involvement supports improvements that can benefit the broader professional community. The risks associated with this study are minimal. The primary risk is the potential for minor discomfort or inconvenience from reflecting on your professional experiences. These risks are not expected to be any greater than those encountered in everyday life. Your decision whether to participate will not affect your future relationships with the University of Denver, PACRAO, or any other institution.

Confidentiality of Information

Data will be collected using the Internet. While no guarantees can be made regarding the interception of data sent via the Internet by a third party, steps will be taken to protect your confidentiality to the degree permitted by technology. In addition to your responses, the system



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records session duration and basic interaction events (e.g., time on feedback) tied to a randomly generated session ID.

Responses will be collected and stored in a secure, password-protected Firebase database. Only the researcher and the faculty advisor will have access to the data. No personally identifying information will be collected, and responses will be stored using coded identifiers only.

Data will be retained for five years in accordance with federal research regulations and then securely destroyed. Aggregated results may be used in publications or presentations, but no individual participant will ever be identified.

Future Research

Unidentifiable responses may be used in future research or shared with other investigators, but they will never contain information that could be linked back to you.

Data Sharing

Unidentifiable data from this study may be shared with the research community to advance knowledge and practice in higher education. Any shared data will not include information that could be used to identify you.

Questions

If you have additional questions, please contact:

Chad Saunders, Doctor of Education Candidate, University of Denver, Teaching and Learning Sciences

Chad.Saunders@du.edu

Dr. Brette Garner, Doctor of Philosophy, University of Denver, Teaching and Learning Sciences

Brette.Garner@du.edu

If you have any questions or concerns about your rights as a research participant, you may contact the University of Denver's Institutional Review Board (IRB) by emailing IRBAdmin@du.edu to speak to someone other than the researchers.

By checking the box below and clicking **Continue**, you acknowledge that you have read and understand this information and agree to take part. (A "Cancel" button is available if you do not wish to participate.) Its general purposes, the particulars of involvement, and possible risks and inconveniences have been explained to my satisfaction. I understand that I can discontinue participation at any time. My consent also indicates that I am at least 18 years of age. [Please feel free to print a copy of this consent form.]

Appendix C

Recruitment Materials

Subject line: Invitation to Participate in PACRAO-Supported Research Study

Body:

Dear PACRAO Members,

The PACRAO Board is pleased to share an opportunity to support an innovative doctoral research study designed to enhance professional development for registrar and enrollment management professionals.

Chad Saunders, a doctoral student at the University of Denver and Immediate Past President of RMACRAO, has developed a gamified, web-based professional development activity that explores how interactive tools can foster knowledge application, skill development, and engagement in our field. PACRAO has agreed to serve as a community partner in this project.

About the Study:

- Participation takes approximately 10-15 minutes.
- Activities are completed entirely online, at a time convenient for you.
- Your responses are **anonymous**; no names, emails, or identifiers are collected.
- Participation is completely **voluntary**.

If you are interested, please click the link below to review the consent information and begin the activity:

👉 [Insert Study Link Here]

This research is conducted by Chad Saunders under the supervision of Dr. Brette Garner, Associate Professor at the University of Denver. If you have questions, you may contact Dr. Garner at Brette.Garner@du.edu.

Thank you for considering this opportunity to contribute to PACRAO's ongoing commitment to professional growth and innovation.

Sincerely,
PACRAO Board of Directors

Closing Email (“Last Chance”)

Subject: Closing Soon: Final Opportunity to Participate in PACRAO Research Study


Body:

Dear PACRAO Members,

The window to participate in the PACRAO-supported research study is closing soon. If you are interested, now is the final opportunity to contribute.

- 10–15 minutes to complete.
- Entirely online and anonymous.
- Voluntary — no identifiers are collected.

Click here to review consent information and participate:

 [Insert Study Link Here]

Thank you to all who have already participated. Your engagement supports PACRAO’s ongoing commitment to professional development and contributes to important doctoral research.

Sincerely,
PACRAO Board of Directors

Appendix D

Sample Special Project Question

<p>Example Scenario: Your institution recently implemented a new academic calendar structure, shifting from quarters to semesters. This change affects course scheduling, credit hour policies, and student registration timelines. As registrar, you are responsible for coordinating policy revisions, ensuring compliance with FERPA and accreditation standards, and guiding your team through operational transitions.</p>		
Question Category	Question	Answers
Academic Policy	Your academic affairs office requests a policy recommendation regarding how quarter-hour credits will convert to semester-hours credits. What is the most appropriate response?	<ul style="list-style-type: none"> A) Propose a 1:1 conversion to simplify the transition and minimize confusion for students. (2-Entry Level) B) Recommend deferring to peer institutions' approaches and adopting a midpoint average conversion ratio. (3-Intermediate) C) Conduct a curriculum mapping analysis and work with faculty governance to recommend conversions aligned with learning outcomes and contact hours. (4-Expert) D) Recommend following whatever the SIS vendor suggests, since they handle the transcript conversion. (1-Non-aligned)
Recordkeeping Compliance	The change to semesters requires new student academic records formats. A staff member suggests migrating legacy data to the new format without student consent. How do you respond?	<ul style="list-style-type: none"> A) Approve the migration since it is a backend administrative change and doesn't impact students directly. (1-Non-aligned) B) Require signed FERPA waivers from all current students before proceeding. (2-Entry Level) C) Coordinate with your legal team and data governance board to ensure the plan complies with FERPA and institutional policy, documenting all decisions and updates in a log. (4-Expert)

		D) Allow the migration but send an all-campus email afterward informing students of the update. (3-Intermediate)
Operational Management	You are tasked with updating the registration system to reflect the new semester-based structure. What is the best initial step?	<p>A) Immediately change the term labels in the SIS and notify IT that the transition is complete. (1-Non-aligned)</p> <p>B) Survey students about their preferred registration timeline and base changes on their feedback. (2-Entry Level)</p> <p>C) Lead a cross-functional task force including IT, advising and academic affairs to map out key system dependencies, timeline changes and student impact. (4-Expert)</p> <p>D) Draft an updated process based on your experience with quarter systems and send it directly to IT for implementation without broader input. (3-Intermediate)</p>

Note. This table provides an example of a scenario-based special project set of questions that will be used in this study, along with the alignment to the AACRAO principles that will be used in the internal scoring.

Appendix E

AACRAO Core Competencies for Records and Academic Services

Competency Area	Academic Policy & Curriculum Delivery	Recordkeeping Compliance	Operations Management
Content Knowledge Requirements	Leading practices in catalog content, curriculum management, course scheduling, and academic policy documentation.	Federal and State laws, accreditation requirements, and institutional policies on student records and data maintenance.	Student enrollment cycle, academic calendar, workload management, business processes, and automation capabilities.
Skill Requirements	Strong communication and policy management; advisor to faculty and administration.	Understanding of legal requirements for handling student records; ability to train staff and develop best practices.	Evaluate staffing and processes; anticipate workloads; improve efficiency and service quality.
Ethical Requirements	Conduct aligned with AACRAO ethics; maintain professionalism in academic and enrollment services.	Enforce laws and policies governing student data privacy and proper record handling.	Follow AACRAO principles of ethics and ensure adherence to campus codes of conduct.
Entry Level	Basic understanding of institutional academic policies and catalog production.	Awareness of privacy laws and resources; basic understanding of student data policies.	Basic understanding of registration, scheduling, transcripts, and grading processes.
Intermediate Level	Contribute to policy development; participate in academic committees.	Understanding of legal provisions; support institutional training and compliance.	Manage unit operations; document and improve business processes.
Expert Level	Partner in academic	Thorough	Align staffing and

	policy; guide decisions; evaluate and improve academic delivery.	knowledge of laws; assess and respond to violations; implement changes and recommend actions.	technology; implement improvements; manage budget and resource allocation.
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Note. This table provides a summary of the AACRAO professional competencies for Records and Academic Services records positions.

Appendix F

Gameplay Screenshots



Note. Title screen of the *PACRAO University* gamified professional development platform.



Note. Gameplay area for the gamified professional development platform.

Special Project Quiz

The provost has noticed an increase in transcript requests and is concerned about how these trends may reflect retention risks. You have been tasked with analyzing these trends while ensuring FERPA compliance and providing meaningful insights.

How can you ensure FERPA compliance while providing meaningful insights?

- ☐ Provide the total number of transcript requests from the past semester, grouped by academic program.
- ☐ Analyze transcript request patterns alongside student demographics and reasons for requests to identify potential retention risks.
- ☐ Focus on students with high numbers of transcript requests, as they are most likely to transfer or leave the institution.

Submit

Note. This is a screenshot of a previous iteration from functionality testing. This does not represent the actual question, rather the functionality behind the mechanism.

Congratulations!

Great job! You navigated the complexities of student privacy and mastered the essentials of FERPA compliance in Level 1. Your understanding of these regulations is key to maintaining trust and safeguarding student information.

Reflect: How did following FERPA guidelines shape your decisions in Level 1, and how will this foundation help you address new challenges in Level 2?

Replay Level

Next Level



Student Project

Course Overrides unlocked!

Note. This is a screenshot of the end screen that triggered the Complete_Natural flag and the completion of the level.

Appendix G

Summary of Analysis and Assumptions

Test/Design	Key Assumptions	Tests if assumptions are violated
Paired samples <i>t</i> -test	Continuous data, observations are independent, normality, no significant outliers, related groups/matched pairs	Wilcoxon signed-rank test for non-normality; consider transformations or bootstrapping
Correlation	interval/ratio data, linear relationship, no significant outliers, normality	Spearman's rho may be considered for non-normal or ordinal data; remove or winsorize outliers
Regression	Linearity, independence of errors, homoscedasticity, normality of errors, absence of multicollinearity	Check residuals, use transformations, or nonparametric alternatives

Appendix H

IRB Exemption Letter



Research Integrity
& Education

DATE: September 30, 2025

TO: Chad Saunders, EdD
Brette Garner, Faculty Sponsor

FROM: University of Denver (DU) IRB

PROJECT TITLE: [2336124-1] Bridging Professional Development Gaps in PACRAO Through Gamification

SUBMISSION TYPE: New Project

ACTION: **EXEMPTION GRANTED**

DECISION DATE: September 30, 2025

NEXT REPORT DUE: *September 30, 2026*

RISK LEVEL: Minimal Risk

REVIEW CATEGORY: Exemption category # 2(i)

Exemption 2: Educational Tests, Surveys, Interviews, or Observations
Research in this category is allowed as long as the following criterion is met:

(i) Information obtained is not identifiable.

Thank you for your submission of Exemption Request materials for this project. The University of Denver IRB has determined this project is **EXEMPT FROM IRB REVIEW** according to federal regulations. This exemption was granted based on appropriate criteria for granting an exemption and a study design wherein the risks have been minimized.

Please note that maintaining exempt status requires that (a) risks of the study remain minimal; (b) that anonymity or confidentiality of participants, or protection of participants against any increased risk due to the internal knowledge or disclosure of identity by the researcher, is maintained as described in the application; (c) that no deception is introduced, such as reducing the accuracy or specificity of information about the research protocol that is given to prospective participants; (d) the research purpose, sponsor, and recruited study population remain as described; and (e) the principal investigator (PI) continues and is not replaced.

Implementation of Changes to the Previously Approved Research

If changes occur in any of the features of the study as described, this may affect one or more of the conditions of exemption and may warrant a reclassification of the research protocol from exempt and require additional IRB review. Prior to the implementation of any changes in the approved research, the investigator must submit any modifications to the IRB by completing an amendment form and awaiting approval before implementing the changes, unless the change is being made to ensure the safety and welfare of the subjects enrolled in the research. If such occurs, a Reportable New Information (RNI) Form should be submitted, via the IRBNet system, within five days of the occurrence indicating what safety measures were taken and provide an updated protocol and/or consent, if applicable.

Informed Consent Process

Informed consent is an important process when conducting human subject research beginning with providing potential subjects with a description of the project and assurance of a participants' understanding. If requested, each participant is entitled to receive a copy of the Consent document.

Unanticipated Problems Involving Risks to Subjects or Others (UPIRTSOs)

Any incident, experience, or outcome which has been associated with an unexpected event(s), related or possibly related to participation in the research, and suggests that the research places subjects or others at a greater risk of harm than was previously known or suspected must be reported to the IRB. The investigator is responsible for reporting UPIRTSOs to the IRB within 5 working days after becoming aware of the unexpected event. Use the Reportable New Information (RNI) form within the IRBNet system to report any UPIRTSOs. All NON-COMPLIANCE issues or COMPLAINTS regarding this project must also be reported.

Study Extension and Closure Requirements

This project has been assigned a **one-year review period**. Prior to that one-year review period ending you must either request that your study review period be extended for another year or close your study. If you need to **extend your review period**, please submit a Request to Extend the Next Report Due Date Form through IRBNet. If you need to **close your project**, please submit a Closure/Final Report for your project prior to the Next Report Due date through IRBNet by creating a New Package for your project.

If you have any questions, please contact the DU Institutional Review Board (IRB) at IRBAdmin@du.edu. Please include your project title and IRBNet number in all correspondence with the IRB.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Denver (DU) IRB's records.

Appendix I

Analytic Data Set

ID	Q1S	Q1T	Q1FT	Q2S	Q2T	Q2FT	Q3S	Q3T	Q3FT
1			6070			6107			
2	4	41113	6577	4	20973	2895	4	11543	2617
3	2	40049	10583	4	51521	6104	4	23728	3377
4	4	34695	16159	4	24592	6401	4	39320	7065
5	4	22960	8062	4	23550	5928	4	19693	3136
6	4	27566	8366	4	35048	7248	4	34450	6732
7	2	33520	3366	4	26543	4896	4	40175	2704
8	4	26763	12635	4	29692	3480	4	20961	2340
9	4	31143	13795	4	36622	8299	4	22792	9018
10	4	12526	5480	4	27505	5069	4	12815	4725
11	4	49859	9881	4	17724	1319	4	17611	1595
12	4	17958	8112	4	29362	7009	4	23903	4188
13	4	37865	11903	3	38494	14979	4	48010	9585
14	4	32517	8133	3	44747	16682	4	16094	6198
15	4	15316	8873	3	2260077	14240	4	19299	2904
16	4	17095	6353	4	15847	5855	4	23632	1224
17	4	95434	24254	4	87015	19638	4	29088	3833
18	4	38184	3782	4	23080	7547	4	19016	6632
19	4	41360	20877	4	53143	4159	4	17839	1303
20	4	43786	23166	4	47345	9959	4	25739	9447
21			7515			10020			

22	4	35601	15112	4	34799	4207	4	27175	6719
23	4	17368	43006	4	70071	6831	4	22267	6239
24	4	25313	3749	4	32197	5888	4	19078	2894
25	2	29953	3579	3	27120	10533	4	17496	4009
26	4	43873	5391	1	52370	7725	4	35601	2531
27	4	46397	15238	4	36471	9382	4	25371	10021
28	2	24967	14561	4	22442	3247	4	13159	2326
29	4	19248	13607	4	34506	7514	4	14741	2975
30	4	33209	8649	4	27293	3518	4	44257	2246
31	4	46171	14055	4	351445	6524	4	52337	5271
32	4	37032	15895	4	40672	4688	4	37256	13519
33	4	35239	9633	1	23836	9397	4	30272	4016
34	2	31552	16539	4	27235	4147	4	22000	2679
35	4	44385	14742	3	70389	19343	4	39582	12573
36	4	31606	3264	4	46021	9338	4	22485	2378
37	4	278211	5303	4	23633	1912	4	14868	3001
38	4	57017	18436	4	39432	6702	4	22792	3919
39	4	19157	4355	3	29055	9728	4	17271	4681
40	4	33296	17375	4	34334	10159	4	26800	6047
41	4	34268	5348	1	19759	3210	2	22108	2900
42			17284			10847			
43	4	59363	12098	3	27571	12839	4	18572	2305
44	2	60122	10776	3	46521	15325	4	31809	8022
45	4	18576	2305	4	29637	2182	4	17544	2169
46	4	19592	4535	4	20735	4055	4	17616	1975

47			11961						
48	4	26880	8309	4	30254	2685	4	32936	5447
49			1781			4774			
50			16286			14434			
51	4	16649	2951	4	7839	2199	4	17152	1469
52	4	33215	21928	4	38118	18454	4	25903	11559
53	3	37531	18276	3	39174	10951	4	17927	6428
54	4	13799	5848	4	93989	3321	4	14093	2222
55	4	16473	3136	4	19165	2829	4	13730	1395
56	4	39638	8166	3	55967	9344	4	18923	1912
57	2	26867	11910	4	56118	7317	4	19017	3675
58	2	21367	11224	4	25104	10280	4	20399	7440

Note. This appendix presents raw, participant-level data used in the analyses reported in Chapter 4. Participant identifiers are study-specific and anonymized and do not correspond to institutional records, platform user IDs, or identifiers used in the original data files. Raw time-on-task values were collected in milliseconds and converted to seconds for reporting consistency.

ID	Q4S	Q4T	Q4FT	Q5S	Q5T	Q5FT	Q6S	Q6T	Q6FT
1									
2									
3									
4	4	25958	16159	4	22767	6401	4	30298	7065
5	4	12680	4573	4	13119	1988	4	11550	2150
6	4	23784	5332	4	27601	2248	4	25099	2499
7	4	16848	3366	4	29639	4896	4	24327	2704
8	4	17903	7902	4	22215	2047	4	23024	2969
9									
10	4	15361	6082	4	8891	2009	4	10185	2474
11	4	11119	1603	4	14447	2379	2	29204	6309
12	4	18949	8112	4	21522	2078	4	13381	4188
13	4	33858	5586	4	26860	2635	4	47160	6417
14	4	28196	7143	4	14010	1810	4	15339	6198
15	4	64316	5387	4	20803	1654	4	14637	2904
16	4	10568	6353	4	20878	5855	4	11896	3183
17									
18	4	15683	3782	4	20100	4216	4	17183	3749
19	4	16896	6199	4	31487	4159	4	34543	1303
20	4	28224	13572	4	28422	6610	4	35062	6803
21									
22	4	130935	15112	4	27950	4207	4	24231	1703
23	4	27488	7062	4	29305	6831	4	28971	7216

24	4	326838	3749	4	29257	3645	4	36944	2933
25	4	21465	3579	4	19438	2279	4	16925	4009
26	4	48523	4540	4	33302	2641	4	37219	2531
27	1	21072	15238	4	27566	9382	4	29459	5622
28	4	18645	9508	4	20743	3247	4	21584	3645
29									
30									
31									
32	4	35785	12095	4	31304	4688	4	27023	6120
33	4	16342	3620	1	22339	3843	4	22296	2969
34	4	15189	5832	4	15150	3656	4	17534	2523
35									
36	4	24825	3264	1	36279	9338	4	29150	2543
37									
38	4	23552	7199	4	14398	2648	4	13336	3919
39	4	16104	4355	4	25486	6391	4	48285	4851
40	4	27488	14975	4	59766	6782	4	21375	7215
41	4	12600	4665	4	25172	3210	4	12996	2082
42									
43	4	24525	6719	4	28116	3580	4	15511	2305
44	4	25584	10776	4	52055	17192	4	31975	4383
45	4	13808	2305	1	13243	2636	4	17003	1128
46									
47									
48	4	31923	8309	4	27471	2685	4	26790	1679

49									
50									
51	4	17585	1758	4	17727	1967	4	17185	1469
52									
53	4	18436	7106	4	27819	4368	4	20910	2295
54	4	16057	5470	1	51239	7415	4	11080	2375
55	4	12678	2099	4	13834	1752	4	11862	2281
56									
57									
58									

Note. This appendix presents raw, participant-level data used in the analyses reported in Chapter 4. Participant identifiers are study-specific and anonymized and do not correspond to institutional records, platform user IDs, or identifiers used in the original data files. Raw time-on-task values were collected in milliseconds and converted to seconds for reporting consistency.

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