Human-Centered Learning Ecosystems: Reimagining Water Education for Real Estate Professionals

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In Arizona, a gap exists between state-sponsored education and professional real estate practice, particularly in how licensed agents and brokers navigate water-related complexities such as rights, supply, and regional regulation. This paper presents the REAL Water Arizona project, a learning engineering initiative developed by the Arizona Water Innovation Initiative (AWII) at Arizona State University in partnership with the Arizona Department of Real Estate (ADRE). This work frames REAL Water Arizona as a learning engineering initiative that applies iterative, data-informed design cycles to transform compliance-driven continuing education into a scalable, human-centered learning system. Grounded in community engagement, user research, and applied instructional and interface design, the project seeks to enhance water literacy among Arizona's 83,000+ real estate professionals. Through evidence-based curriculum development and an interactive digital learning platform, researchers and designers advance the integration of

learning science, human factors, and public-sector collaboration to improve continuing education and professional decision-making in the context of Arizona real estate.

Introduction

The REAL Water Arizona project addresses a critical educational gap in the state's real estate sector. Many licensed real estate professionals, often the first point of contact for home buyers and sellers, lack confidence in discussing Arizona's complex water policies and regional supply realities. The Arizona Department of Real Estate (ADRE), which regulates real estate licensing and education, has recognized this gap by mandating a one-hour water course for all licensees effective January 1, 2025. In collaboration with ADRE, the AWII team seeks to improve statewide water literacy among Arizona's 83,000+ licensed agents and brokers through evidence-based curriculum design and digital learning innovation.

Arizona's water governance is regionally specific, with laws and management frameworks varying across boundaries like Active Management Areas (AMAs), Irrigation Non-Expansion Areas (INAs), and water unregulated zones. Given the complexity of Arizona's water systems, it is pedagogically and administratively unreasonable to expect individual CE instructors—many of whom are practicing agents to stay current on evolving hydrologic, legal, and policy developments. Applying a learning engineering approach (Goodell & Kolodner, 2022), the project converts this challenge into an opportunity to create a self-paced, expert-maintained learning system. Rather than treating curriculum development as a linear content-authoring task, REAL Water Arizona adopts a learning engineering mindset in which research, design, implementation, and evaluation are continuously aligned. We will deliver a curriculum co-developed by subject matter experts (SME) that integrates real-world relevance, quality user experience for licensees, learning science, and learning engineering principles to make water education both accessible and engaging.
Guided by the tenets of learning engineering interdisciplinary collaboration, technology as a tool to scale learning, design informed by learning science, and data instrumentation as a feedback loop (Goodell & Kolodner, 2022), the study investigates how water literacy can be improved through adaptive, research-informed instructional design driven by three questions:

1. What are the current water-related knowledge gaps among real estate professionals?
2. How can human-centered design improve engagement and comprehension of topics?
3. What data-driven methods optimize learning effectiveness for educators and learners?
4. Responding to higher education's call to bridge the "historic chasm between learning research and teaching practice (Thille, 2006), the ASU team serves as a learning engineering partner to ADRE. Through a tiered quality assessment and iterative design process, REAL Water Arizona brings together instructional designers, UX researchers, developers, hydrologists, policy experts, and ADRE staff to build a data-informed, contextually relevant learning platform for water literacy in real estate practice.
5.

Triangulation of Methods; Course observations, Surveys, Workshops, and Interviews

Our team used a mixed-methods approach to establish a holistic view of the landscape of water education for real estate professionals in both rural and urban areas of Arizona. A combination of four different research methods was designed to

ensure statewide reach, as well as qualitative and quantitative data encapsulating the lived experiences of real estate practitioners. Data was collected from professionals with active licenses who represent clients in real property transactions. Four team members observed 18 CE courses on water. Based on (Reinhart & Banister, 2018), a set of criteria was used to evaluate each class for its content coverage, materials/presentation quality, learner engagement, and depth of understanding. We conducted 14 semi-structured interviews to gauge the baseline knowledge, teaching practices, client concerns, past experiences, and recommendations for CE improvement. Interviewees were real estate professionals from agents from residential and commercial background, educators, and brokers who transact in a variety of different regulatory water locations.

To assess the effectiveness and perceived usefulness of current water courses among real estate professionals, we conducted nine 2-hour workshops across the state for CE credit. Workshops included interactive learning through small-group, scenario-based activities in which attendees developed client disclosure checklists related to water and real property. As evidenced by learning science studies, this deeper level of reasoning enhances learning gains (Craig et al., 2006). Drawing on Richter and Richter's (2024) assessment of professional development programs for teachers, workshop designs integrate cognitive activation, engaging prior knowledge through thought-provoking questions/reflections, and practical relevance, connecting course content directly to agent/broker workflow. We used a pre-workshop survey to collect participant demographics, areas of practice, perceived importance of water knowledge, confidence levels related to advising on water, client concerns about water, and water knowledge. This survey complements qualitative findings with quantitative ones.

Analysis Approach

Qualitative data, including the interviews and workshops, were thematically coded for patterns in common concerns, challenges, misconceptions, engagement strategies, and learner needs. Survey data were analyzed descriptively to quantify baseline knowledge and confidence levels. Notes from the course observation rubrics were transferred to an analysis framework examining the following areas: Instructor/Learner & Source Material Relations (how instructor and learner perceptions interface with water education content), Practical Relevance of Water to Real Estate Practice (how water education and real estate workflow are jointly represented), and Considerations for Student Needs (pedagogical approaches and supplemental resources). Insights were triangulated across methods to derive system-level themes, inform a taxonomy for the current state of educator approaches, highlight future content curation, and prioritize prototype features for the digital instruction platform.

Results

Data were collected from 83 licensed real estate professionals across Arizona. Rather than serving solely as descriptive outcomes, these findings function as design signals within a nested learning engineering cycle. The team:

1. Analyzed 18 ADRE-accredited CE courses to evaluate content accuracy, timeliness, and instructional design quality
2. Conducted 14 semi-structured interviews with educators and both residential and commercial practitioners to capture instructional challenges, misconceptions, and opportunities for improvement
3. Facilitated nine regional workshops across urban and rural regions of the state. Within these, 68 attendees participated in a structured survey helping to assess baseline knowledge, confidence, and perceived training needs

Findings revealed substantial knowledge gaps among both agents and educators in various locations, in topics including groundwater law, water supply designations and certificates, water rights, and water governance. Preliminary results are organized around key themes:

Regional Relevance and Contextual Learning

One of the most important findings was a strong regional variation in content needs. Workshops held in different parts of the state showed that water-related education must be localized based on regional governance, hydrology, and even the lived realities of each area (i.e. wells running dry). Different sessions had participants who spoke about certain topics and sparked more conversations specific to that area.

For instance, in urban/AMA regions, agents discussed rental subdivisions without 100-year supply requirements and Tribal water leasing/partnerships. In rural/INA regions, agents highlighted hauled water, seasonal wells, and a lack of client awareness. In southern Arizona, participants requested deeper coverage of stream adjudications, aquifer recharge, and groundwater management. Learners require localized content aligned with their areas. This finding directly informs both the instructional design framework and the organization of the web portal, ensuring that water education materials are differentiated by basin, water authority, and regional policy context.

Curriculum Consistency

Across 18 observed courses, the average total rubric score was 54.17 out of 75, indicating that most courses “met expectations” but showed a limited connection to practical workflow.

Table 1.
Average Rubric Scores for Observed Water Continuing Education Courses

Criteria	Average Scores	Highest Possible
ADRE Curriculum Topic Count	5.5	7.5
Course Content Coverage	12.39	20
Instructor’s Ability to Answer Questions	11.61	20
Source Credibility and Timeliness	14.39	20
Quality of Presentation Materials	12.61	20

The average inclusion rate was 73% across all ADRE-recommended topics. Foundational topics such as Groundwater and Identifying the 7 AMAs showed up in 100% of courses, while advanced or policy-related topics like Arizona Water Priority System (50%) and Proposed Commingling for Water Certificates (11%) were covered less frequently. Observation notes from workshops and courses showed that traditional lecture-heavy CE classes maintained low engagement, limited support, and topic inconsistencies. In contrast, our workshop design emphasized scenario-based learning, myth-or-fact games, and visual scaffolding (e.g., maps and infographics), producing higher participation during the sessions.

Baseline Knowledge and Misconceptions

Survey data and workshop discussions show measurable knowledge gaps and misconceptions about Arizona’s water systems. Among the 68 survey respondents, 81% were full-time real estate professionals, primarily agents and brokers, and 19% were educators. While most participants rated water knowledge as “highly important” to their practice, only 9% reported discussing water with clients daily, and 56% said they do so monthly.

The survey findings show that Arizona's real estate professionals recognize water as an important issue influencing property value, client decisions, and long-term development, but have low confidence in communicating some topics, including groundwater management outside AMAs/INAs, water rights, and legal frameworks. To understand their baseline knowledge about certain topics, we asked them a few questions related to AMA/INA identification, water rights, and wells:

1. 38% (26) incorrectly identified Yuma and Kingman as AMAs, showing confusion about where AMA designations apply
2. 78% (36) incorrectly believed property water rights always transfer with land sales
3. 32% (15) incorrectly thought INA landowners can't drill any new wells

Discussion

The REAL Water Arizona project illustrates how learning engineering can transform compliance-oriented continuing education into a dynamic, evidence-based learning ecosystem. By grounding design decisions in user research and iterative feedback, the project advances the learning engineering cycle of continuous data-informed improvement (Koedinger et al., 2021). Each workshop served as a small-scale design experiment, producing data on how real estate professionals learn complex, region-based water concepts.

Adaptive and Localized Learning

Water education in Arizona cannot succeed under a "one-size-fits-all" model. Regional variation in hydrology, governance, and lived experience requires modular and adaptive learning design, responsive to rapid changes at state water agencies, and also translated into the language of real estate. The platform's regional modules, interactive maps, and a water themed chatbot for real-time inquiries address this challenge by aligning instruction with local realities and adapting content to user needs with generative AI (Huynh, Linh, & McNamara, 2025). Such contextualization supports situated learning, in which understanding emerges through authentic, practice-based contexts (Lave & Wenger, 1991).

Training the Trainers

Because ADRE-approved instructors act as the primary intermediaries between water experts and learners, "training the trainers" represents a crucial multiplier for learning outcomes. This approach aligns with human-centered learning engineering practices that position instructors as key stakeholders within the learning ecosystem rather than passive content deliverers (Thai et al., 2023). By equipping educators with modular lesson plans, video demonstrations, and ready-to-use digital materials, the project shifts the burden of technical expertise away from individual instructors and toward a sustainable, expert-maintained ecosystem. This design mirrors cognitive activation strategies that engage prior knowledge and promote reflection (Richter & Richter, 2024), while supporting conceptual change among learners (Posner et al., 1982).

Learning Engineering Implications and Future Work

REAL Water Arizona demonstrates how interdisciplinary collaboration can address complex, real-world learning challenges. The project's methodology operationalizes human-centered research, instructional design, and data science to improve learning at scale (Goodell & Kolodner, 2022). Translating qualitative insights into an adaptive digital experience requires embedding feedback loops at every phase of development. At the beginning of this project, we established a feedback loop through mixed methods research to build a taxonomy of current educator practices. Extending this educator engagement into the design cycle and platform testing creates the opportunity to observe ways in which this taxonomy changes after a learning intervention. Thus aligning with a top priority of Learning Engineering, studying which practices in professional learning are effective and scalable (Baker, Boser, Snow, 2022). To ensure that the curriculum remains technically current while pedagogically relevant, our team will engage with subject matter experts and current CE educators to co-author learning

modules. In alignment with the Society for Learning Analytics Research framework (Giannakos et al, 2022), data instrumentation will be theoretically grounded, measuring constructs that matter to learning, not merely tracking platform activity.

Conclusion

The REAL Water Arizona project demonstrates how learning engineering can strengthen professional education by aligning curriculum design with real user needs. Mixed methods research identified knowledge gaps, current pedagogical practices and inconsistencies, and ways to increase content relevance through region-specific curricula. Future work will focus on piloting the online learning platform, consisting of interactive videos, micro learning modules, and shareable client resources. By integrating regional context, data-driven design, and interdisciplinary collaboration, the project introduces an innovative approach to continuing education that aligns Arizona's water literacy goals with the realities of professional practice. This learning engineering process lays the groundwork for a future model of continuing education that connects regulatory requirements with human-centered, evidence-based learning.

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