

DRIVEN TO ABSTRACTION: A DESIGN CASE

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This design case documents the development of a new online training program to teach circuit court interns in Wise County, Virginia, how to create *smart land records*, or land record abstracts stored on a blockchain. The authors first describe the instructional context behind land record abstraction and the clients' original specifications for the curriculum. The authors then detail their empathic design approach, design decisions based on clients' feedback, and reflections-in-action at key points in the course's development. Major design decisions included the composition of a frame narrative to link the course modules, the reordering of the curriculum to mitigate the significant cognitive load in the training's content, and the use of both vertical and horizontal development to maintain aesthetic consistency. This paper concludes with the rationale for the evaluation plan and the establishment of a "multigenerational" partnership between the clients and new graduate students in the Instructional Design & Technology program at Old Dominion University.

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INTRODUCTION

Land records administration in the United States is a patchwork of antiquated record-keeping systems alongside efforts at digitization and modernization. Whenever a property is sold or transferred to a new owner, the chain of property ownership must be established through a land record abstract, a summary of all financial transactions and legal decisions pertaining to the property. The Circuit Court Clerk's Office in Wise County, Virginia, plans to store its digitized land records on a distributed ledger system, commonly known as blockchain technology. These "smart land records" will help professional land abstractors streamline their research and facilitate transfers, potentially reducing closing costs for new homebuyers.

Theoretically, smart land records could be automated through blockchain validation whenever a property transaction is conducted. However, to begin automating the process, an initial database of smart land records must be built from existing deeds. Wise County and Bloqable, the software company developing the smart land record creator, commissioned a training course to teach undergraduate interns how to perform land abstractions and enter accurate property information into the smart land record wizard (SLR Wizard).

This design case documents the development of the training course from Wise County and Bloqable's original course specifications through the final deliverable implemented with the first cohort of interns. We detail our efforts to make the abstraction process more concrete and mitigate the significant cognitive load imposed by the difficult content. We then conclude with our evaluation plan and the continuing

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partnership between Wise County and Old Dominion University (ODU) for periodic revisions.

Precedents from design cases serve as proactive models of problem framing and solving, from which readers will draw their own conclusions and insights (Boling, 2010). Although this case describes a highly specific context of use (Baaki & Tracy, 2019), readers may find broader utility in our eclectic design approach. We composed a frame narrative to link the training modules together and invest the interns in the recognizable human stories behind these land records. To deliver the product on time, we used a vertical and horizontal design method, which we also found highly effective for ensuring that the course would be both instructionally and aesthetically consistent. Cases that expose tensions between elements prove especially valuable in helping readers derive precedent (Howard et al., 2012). Determining the most effective way to model the abstraction process was complicated by the clients' request to include instruction in the fundamentals of blockchain technology, which was not directly related to the training's desired performance task. Readers may be interested in our iterative strategies to balance the extraneous cognitive load the additional training would impose on the interns.

INSTRUCTIONAL CONTEXT

Wise County's Land Records Office plans to employ four grant-funded cohorts of five interns each over the duration of the smart land records project (VCEDA, 2021). Our direct contact representing the clients was the founder of Bloqable, who had first broached the records modernization project with Wise County, secured the funding, contracted ODU to design the training, and acted primarily as our subject matter expert (SME). The SME communicated all expectations and feedback from Wise County's stakeholders and conveyed our questions to them.

The instructional intervention required designing a training curriculum for college undergraduates to research publicly available land records and create smart land records using a new data entry wizard. The SME's course specification outlined four modules with an expected training duration of 10 hours: 1) *Purpose of Land Records Administration*, 2) *Foundations of Land Record Abstraction*, 3) *Foundations of Blockchain Technology*, and 4) *Creating Smart Land Records*. However, we were given license to modify course content and sequencing as necessary.

A Note on the Authors

The design team consisted of four graduate students taking an advanced instructional design course at Old Dominion University. Jim was designated the project liaison and coordinated all communication with the SME, but the workload and responsibilities for the course's design were split evenly among all members.

Our makeup reflected diverse perspectives in education and training. Three members of our team have over 39 combined years' experience teaching students in the target interns' age group (18-22 years). Jim and Kristin are both former secondary educators and current instructional technologists with the technical expertise to create an asynchronous course offering via a learning management system (LMS). Lisa is an instructional designer and a former professor of American Sign Language who helped the team prioritize course accessibility. Jacqueline provided insights outside of education, having conducted sociological research to design training and communication packages for the Clinical Research Unit of Nanoro in Burkina Faso.

Notably, however, no member had prior experience in land abstraction.

Task Analysis

We conducted two task analyses with the SME, one on navigating the two software platforms the interns would use and the other on land abstraction procedures. These demonstrations revealed the enormity of the design task and the range of skills required. Abstraction is complex and meticulous, requiring knowledge of property laws and the ability to scan dense legal documents for specific information. Abstractors must be expert researchers and problem-solvers, able to synthesize multiple sources of information into a cohesive record. If required information is missing from their property searches, they must employ workarounds to find it through other means. Abstractors must therefore also rely on precedent to solve ill-defined problems with incomplete information.

Given a property's unique parcel number, the intern would first search for all available records in mxCourt, Wise County's land records database. The intern would need to identify deeds transferring the property from the previous owners (*grantors*) to the new owners (*grantees*) and then account for 60 years of ownership. This process of researching the chain of ownership is called *backwardation*.

The intern must then investigate any outstanding financial encumbrances against the grantors and grantees for the full period of 60 years as well as any court judgments impacting the property for a period of 20 years. An encumbrance is fulfilled if there is a corresponding Certificate of Satisfaction (CS) indicating that the loan has been repaid. Similarly, a judgment is fulfilled if there is a corresponding court release. Failing to identify relevant encumbrances and judgments can interfere with the legal transfer of properties and result in expensive delays.

Once the intern has completed the full chain of property ownership complete with any unresolved encumbrances and judgments, they would need to enter the information

into the SLR Wizard as prompted. These procedures are what our new training curriculum needed to address.

The training serves the dual purpose of matching suitable candidates to the limited number of paid internships and preparing them to perform land record abstractions using the SLR Wizard. Interns selected for the positions would only be required to perform routine abstractions for established land records; abstractions with the potential for litigation or those requiring more technical research would be reserved for professional abstractors.

Design Constraints

The primary constraint was time. We were commissioned in late January 2021 and the clients expected to pilot the training in May. We had three months in which to learn the abstraction process for ourselves, develop strategies to make it accessible for young interns with little experience in property transactions, and deliver a functional course for the clients requiring minimal administration.

Blogable had subcontracted another software development team to design the SLR Wizard, which continued receiving updates as we designed the course. We used a beta environment similar to the production version, but any instructional materials we created using the SLR Wizard would need to accommodate changes the developers made in visual design and functionality. Waiting on the software team hampered our ability to develop the assessments requiring the SLR Wizard until late in the design process.

The final deliverable would need to be packaged for immediate use. Wise County does not have an internal training LMS, so we would need to choose one that was free to use and intuitive for both the interns and the course facilitators. Course facilitators would include our SME and members of the Wise County Land Records Office. Facilitators would need to be able to add interns directly to the course and provide them with secure login credentials. The course as designed in the LMS would also need to be portable in the event Wise County wanted to export it to another LMS or transfer the training responsibility to another institution. Packaging the course through SCORM or a Common Cartridge file would provide the greatest interoperability across platforms.

Delivery System

Based on what we understood about the clients' limited availability to facilitate the training in person or through synchronous web conferencing, we decided on an asynchronous online delivery mode in consultation with the SME. We were uncertain whether COVID-19 restrictions would be lifted by the training's intended start date in May 2021, so an asynchronous online course also seemed to be the safest option in terms of both practicality and public health.

We considered our clients' needs in the choice of delivery method and the time needed to facilitate the course.

The course is mostly self-paced with periodic checks for understanding that are scored automatically, although each module concludes with a performance assessment requiring manual feedback. The SME assumed primary responsibility for facilitating the course and stated that our goal was to "get [the interns] 60-80% of the way there" in understanding how to perform land abstractions. The SME and other facilitators would provide more detailed instruction using synchronous web conferencing if necessary. However, this course was intended to be a primer in land abstraction rather than a comprehensive guide.

We explored options for web-based LMS. After reviewing the prospective interns' prior educational experiences and instructional needs, we decided to use Canvas as our LMS for several reasons.

One, the interns may have already had experience using Canvas through their local high schools, community colleges, or four-year institutions. Although we planned to include an orientation module with instructions for navigating the course, it was reasonable to assume some familiarity with the platform. We ruled out other LMS used in K-12 such as Google Classroom and Schoology to demonstrate a clear break from high school expectations for the interns, most of whom will be 18-22 years old.

Two, the Canvas Free-for-Teacher account possessed all the necessary features we envisioned using for the training, including the abilities to add interns to the course with secure logins, embed interactive multimedia tutorials, and create practice opportunities and assignments.

Three, Canvas allowed for linear, streamlined sequencing of content (Figure 1). Course navigation was limited to only the essential sections: *Home* (Modules), *Wise County Land Records*, *Smart Land Records*, and a separate *Blockchain Tutorial*. Interns click NEXT to progress through the items in each module. We set module requirements and prerequisites so that interns must meet certain criteria before progressing further. Interns receive visual feedback from the Canvas interface indicating their progress in the course, including check marks for completed items. Fisher et al. (2014) suggested that undergraduate students respond positively and report being more engaged with LMS materials attached to release conditions. Because this training will address technical procedures likely unfamiliar to the interns, we wanted to ensure the content was appropriately scaffolded and presented to them in a logical order.

DESIGN PROCESS

Throughout the design process, we remained in frequent contact with our clients, clearing our major instructional decisions through the SME. Over three months, we conducted

five status meetings to present our prototypes, share concerns, and find appropriate solutions. A member of the Land Records Office reviewed our course outline for factual or procedural errors, which we corrected for the first draft. We sent the SME drafts of the course at two checkpoints for review and detailed feedback, implementing those revisions for the next iteration.

Once the course received a final round of revisions, Jim conducted a hand-off meeting with the SME and demonstrated how to navigate the course, monitor the interns' progress, provide feedback to the interns through Canvas, and troubleshoot basic technological issues that may occur within the LMS.

Figure 2 presents an advance organizer of the sections to follow in our design process, separated into the analysis, design, and development phases. Our reconstructed design process here appears more orderly than the recursive and often chaotic undertaking it was, characterized at first by our struggles to understand the nuances of abstraction and then later to reduce extraneous cognitive load. We begin with our empathic design approach to learner and contextual analysis. We then explain the design of the course's sequencing and materials using the Four-Component Instructional Design (4C/ID) model to combine whole learning tasks, supportive information, procedural information, and part-task practice (van Merriënboer & Kirschner, 2018). We selected this model in response to the insights gained from our task and learner analyses to manage cognitive load. Finally, we describe our vertical and horizontal approach to course development and revision, which helped maximize everyone's time on task and utilized our team members' unique strengths.

Empathic Design Approach

For the learner and contextual analyses, we drew from Kouprie and Visser's (2009) empathic design framework, Fraquelli's (2015) systems-view of deep empathic design, and Baaki and Tracy's (2019) definition of localized context of use. Empathic design involves stepping in and out of a learner's experience to learn, reflect, and then act (Kouprie & Visser, 2009). Inspired by Fraquelli's (2015) idea of *creative empathies* and how design solutions might emerge from systemic interactions, our eclectic approach demonstrated empathy not only for our learners, the interns, but also for the residents of



FIGURE 1. Course home page. Used with permission from Canvas by Instructure.

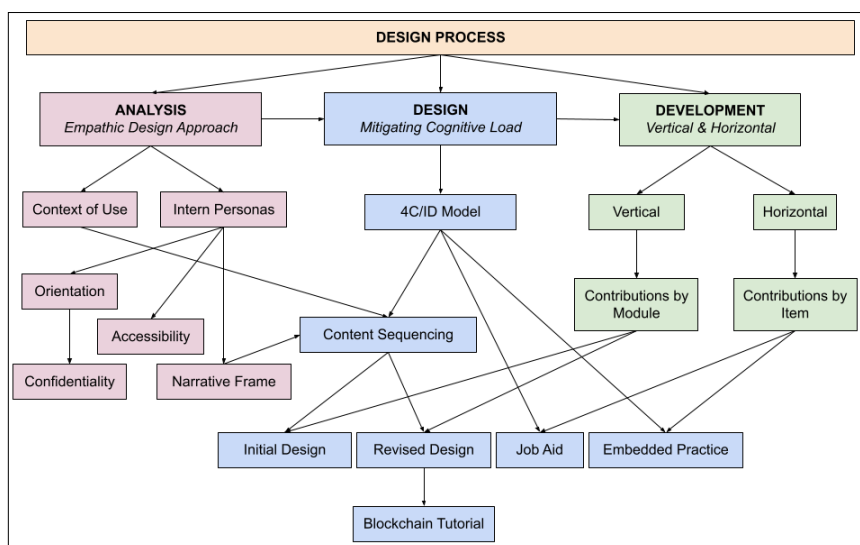


FIGURE 2. Advance organizer for design process with subtopics for our analysis, design, and development.

Wise County, whose personal property information would be exposed for the purposes of the training.

We did not bring existing subject matter knowledge into our design, which prompted us to recognize the need for empathy for ourselves as well, honoring Fraquelli's (2015) advice not to isolate the designer's perspective from the process. The immediacy of learning the content as we developed the course allowed us to step in and out of the learner's experience quickly and anticipate potential struggles the interns would likely encounter. The task analyses, which illustrated the consequential nature of land abstraction, led us to prioritize the interns' localized context of use, or those "specific moments of use where context is scaled back to what is needed" (Baaki & Tracey, 2019, p. 2). Baaki and Tracey (2019) further elaborated that seeking to understand a learner's context of use is empathic design in action and enables the designer to visualize multiple possibilities.

Later in the design process, our clients started recruiting interns for the land records project, although we did not have direct contact with anyone selected for the positions. We therefore needed to rely partly on our experiences as educators as well as our own developing understanding of land abstraction. Although these insights proved useful, our

perspectives were limited by the lack of qualitative information about the interns themselves (Kouprie & Visser, 2009). We used learner personas to transform the hypothetical interns into three-dimensional young adults who would be interested in the opportunity our training would enable.

Persona Composition

Our learner analysis was influenced by Kouprie and Visser's (2009) empathic design framework: *Discover, Immerse, Connect, and Detach*. We first endeavored to discover our interns and immerse ourselves in their worlds through the composition of learner personas, which became the springboard for subsequent decisions impacting the course's direction. Personas can help designers develop empathy for the intended audience in a way that mere demographic information cannot (Baaki et al., 2017) and avoid stereotypes or surface-level analysis (Baaki & Maddrell, 2020). To that end, two personas were created to capture the prototypical intern candidates: Lexie, a senior at Wise County Central High; and Darren, a student at Mountain Empire Community College. Providing context for why these individuals would choose this internship opportunity via an exploration of their daily activities and deeper hopes and dreams allowed for our design team to empathize with our intended audience.

Three members of our team have experience teaching individuals in the interns' age range. Kouprie and Visser (2009) advised designers in the connection phase to recall and utilize their own memories and experiences. Despite these general connections, we needed to uncover what it meant to be a young intern in Wise County, VA, as opposed to flattening differences of Generation Z learners and falling back on students we had known. We researched local high school and college websites for information about part-time job experiences, programs of study, and classroom access to digital technologies. At one point, we consulted Google Maps and Street View to determine what routes interns might take to the Land Records Office in the event of a face-to-face interview or training.

Following Parrish's (2014) recommendations for writing design stories, we composed the personas quickly for a sense of immediacy and considered the interns' motivations, desires, and ambitions. Two key themes elicited through the personas were the interns' financial incentives for pursuing this new opportunity and the importance of both personal and community connections. These themes led to a deeper contextual analysis of Wise County and the opportunities this internship could afford its younger citizens.

According to 2020 census data, Wise County has a population of 36,130 (down 9.8% since 2010) and a median household income of \$38,888, as compared to Virginia's median household income of \$74,222 (U.S. Census Bureau, 2021). However, Wise has begun to benefit from economic revitalization thanks to its relative proximity to Midwestern and

East Coast urban centers. Wise forms part of the Southwest Virginia e-Region (*electronic information technology, energy, and education*), which seeks to attract high-tech jobs to an area that has historically depended on natural resources and manufacturing. Access to high-speed broadband internet has lagged behind the rest of the state, but strategic partnerships with SpaceX and local foundations and institutions of higher learning promise to transform the area's information infrastructure (Lake, 2020). The land records project is funded through a grant from one of these local benefactors, the Virginia Coalfield Economic Development Authority (VCEDA, 2021).

Based on our contextual analysis of Wise County and local school district websites, we reasoned that our intern cohort may have some experience with web-based instruction but that navigating multiple web platforms simultaneously might present a challenge. Additionally, Wise's rapid economic development and expanding information infrastructure led us to consider how technological innovations might transform the community and the need to find not only an instructional solution, but also a socially desirable one (Moore, 2014). These insights prompted the addition of an orientation module to acclimate the interns to online learning as well as their ethical obligations to their community when accessing land records. Detaching from our personas allowed us to resume our roles as instructional designers and provide our clients with these necessary resources they had not considered.

Orientation Module

The orientation module opens by thanking the interns for their interest with an informal tone used throughout the course in accordance with the personalization principle (Clark & Mayer, 2016). Interns are introduced to their dual roles as Property Detective and Storyteller. These are the first indications of the recurring narrative elements that we gradually built into the training. These roles also influenced the language of the training objectives presented to the interns (*clues, investigate, create*; Figure 3). Interns are then given explicit instructions for navigating the course, technology requirements, and direct links to support resources.

The orientation module concludes with a confidentiality policy statement approved by the clients that the interns would be required to read and acknowledge by submitting their names. Land records are publicly available documents but can often contain private and sensitive information. When creating a smart land record, interns will need to identify any encumbrances or judgments on a land title, which may include child support payments, liens, large amounts of debt borrowed against the value of the property, and court rulings against the owners. In Wise's smaller communities, interns may even recognize people they know in these records.

Think of yourself as a property detective and storyteller. This course will prepare you to do the following:

- Research the history of a property's ownership and transfers using clues found in legal documents.
- Investigate anything that may impact the value of a property or its ability to be transferred/sold.
- Create a smart land record to be validated and added to a blockchain.

FIGURE 3. Course objectives.

After discussing the project parameters with the clients and learning what information land records could potentially contain, we realized that we also needed to be empathetic to Wise County's residents and that it would be necessary to incorporate training in the ethical and responsible handling of land records. Considering the age of the interns and their familiarity with social media, we distinguished appropriate and inappropriate uses of the information they may access in the official course of their duties. Our prior experiences teaching students in the interns' age range underscored the need for an explicit policy prohibiting the inappropriate access and posting of information discovered through land record searches. The interns will need to acknowledge the following statement before progressing any further in the course: "Information you learn through the course of performing your work should not be disclosed to anyone else or posted outside of the Wise County Land Records creation software."

Accessibility

We considered inclusive design as a corollary of empathic design and made all materials and learning experiences accessible to avoid excluding any interns in the future (Holmes, 2018). There are many screenshots in the course, all of which have descriptive alt-text or contextual explanations in an adjoining paragraph. Our original tutorial videos are closed captioned, and we selected only captioned videos from YouTube and other sources. All hyperlinks to external resources are descriptive and embedded in the text wherever possible.

One major accessibility problem we encountered is that the PDF land records we needed to use for deed analyses and quiz questions were scanned image files rather than searchable documents. We used Adobe Acrobat's Optical Character Recognition (OCR) to convert these scans to searchable documents that are accessible for screen readers.

We also considered a broader definition of *access* beyond the technocentric, compliance-oriented view of captions and alt-text (Moore, 2014) to include cognitive and motivational access, the ability to understand information as presented and the desire to do so (Rieber & Estes, 2017). Our aim was that the interns would not only be able to interact physically with our materials, but also understand and want

to interact with them meaningfully. Considering the interns' motivation led to the development of the frame narrative.

Every Land Record Tells a Story

We designed from the principle that every land record tells a story. Imposing the more familiar discipline of narrative structure onto the unfamiliar content (Schön, 1983) revealed further opportunities to connect with the interns and translate the learning experience through storytelling. Narrative can be a powerful way to empathize with and motivate learners (Parrish, 2014). Sometimes the interns would play detectives as they investigated encumbrances and judgments, and other times they would be storytellers, tracing the history of a property back through its previous owners with their own stories to tell.

Early in the course's development, we decided to use a single property as a case study for the interns to learn land record abstraction. This property would need to be simple enough to serve as an introduction to abstraction, but complicated enough to illustrate its nuances, including how to investigate encumbrances and judgments. The SME provided us with sample properties that had already been abstracted, including 123 Apple, 123 Cherry, and 123 Orange. (The real addresses were used in the training but have been anonymized here.) Using previously abstracted properties would also make it easier for the facilitators to assess the interns' work.

Choosing a suitable property for the case study was perhaps the design decision that caused the most internal debate. The most difficult abstraction of the three was 123 Orange, which would prove useful to illustrate aspects of encumbrances and property transfers but was not what interns should begin with or be expected to perform independently. The simplest land record was 123 Cherry, which we chose as our case study for interns to examine. Having settled on 123 Cherry as the exemplar, we then encountered the problem of how to assess the interns' ability to abstract an unfamiliar property. It would not have made much sense to use the same property that we had already described in detail through worked examples.

We selected 123 Apple as the land record the interns would investigate independently because it was a more complete learning experience. Although it fell between 123 Cherry and

Total Documents: 12

Efile ID	I-ID	Book	Page	Name	I-Group	I-Type	Parcel No.	Descr.	I-File	Status
1858831	201501701				LR	CS	014267	CS INS 200902957	LR20150170100100.pdf View	04/15/2015 13:33:03.410 Recorded-V
1657326	201500945				LR	RFDI	014267	RFDI INS 200902957	LR20150094500100.pdf View	03/02/2015 16:24:21.983 Recorded-V
1657325	201500944				LR	DG	014267	LOT 4 BL 1 GAY DAWN ACRES SUB	LR20150094400100.pdf View	03/02/2015 16:22:57.530 Recorded-V
1150680	201101402				LR	DPD	014267	LOT 4 BL 1 GAY DAWN ACRES SUB	LR20110140200100.pdf View	05/27/2011 14:23:00.000 Recorded-V
1152955	200903068				LR	CS	014267	CS INS 200900718	LR20090306800100.pdf View	09/18/2009 10:20:00.000 Recorded-V
1152843	200902957				LR	RFDI	014267	RFDI INS 200900718	LR20090295700100.pdf View	09/10/2009 14:09:00.000 Recorded-V
1150663	200900791				LR	CS	017030 014738 012840 014267 013125	CS INS 200205892	LR20090079100100.pdf View	03/09/2009 11:37:00.000 Recorded-V
1150580	200900718				LR	DOT	014267	LOT 4 BL 1 GAY DAWN ACRES	LR20090071800100.pdf View	03/04/2009 10:18:00.000 Recorded-V
1150579	200900717				LR	DIB	014267	LOT 4 BL 1 GAY DAWN ACRES	LR20090071700100.pdf View	03/04/2009 10:16:00.000 Recorded-V

gifts the property
to herself under her maiden
name 4 years later


and
divorce, and the property is
transferred to her

They've taken out a few loans
against the property

Property is sold to

FIGURE 4. The “story” of 123 Apple as presented in the mxCourt interface. Used with permission from mxCourt.

Module 2 Overview



INTRODUCTION

Let's check back in with the Wise family. At the beginning of each month, they plan out their monthly income and expenses. At the end of the month, they compare their expenses against their income to determine if what they spent is cancelled out by what they earned.

Properties are also subject to the same income to debt ratio. Think of **encumbrances** as a balance sheet or bank statement with the owners' debts in one column and their payments in the other. As long as the payments cancel out the debts, there are no outstanding encumbrances impacting the property. However, if there are any outstanding encumbrances, those will need to be added to the smart land record.

We need to make sure that the Wises are paying a fair price for [redacted] and that no one else has a claim to the property, such as a bank, building contractor, or another organization. We need to identify **encumbrances** that exist on the property, including any loans the owners may have taken against its value, any **judgments** against the owners and the previous grantors, and any contractor's or mechanic's **liens**.

In addition, the property may have **easements**, or legal rights of access to the property for individuals and businesses other than the property owner.

FIGURE 5. The Wise Family narrative from Module 2. Used with permission from Canvas by Instructure.

123 Orange in difficulty, 123 Apple was the easiest property to “read” based solely on the types of deeds that appeared in the search (Figure 4). Learning to read the story of 123 Apple was a significant development in our own understanding of the content, and we wanted the interns to experience a similar epiphany after viewing various other land records. It would not be an easy abstraction, but it would be a relatable and understandable one.

To invest the interns emotionally in rather dry content, we developed a short frame narrative around the “Wise Family” buying 123 Cherry as their first home. After years of saving, they can now afford their dream home for their expanding

family. Each module's overview page introduces the next phase in the Wises' home-buying journey and connects their experiences metaphorically and thematically with the content to be presented. For example, in Module 2, we visit the Wises as they balance their monthly budget to cancel out expenditures with income, just as loan repayments cancel encumbrances (Figure 5).

In contrast to the specific personas, we created to understand our interns better, we did not give the Wises any distinguishing characteristics beyond this basic frame narrative. We wanted the interns to be able to see themselves and their families in this story. The Module 3 Overview page

Module 3 Overview



INTRODUCTION

The Wises' dream home sits on a parcel of land that has been gifted to family members and sold to others for more than 60 years. Remember that every property has a story to tell of its history and of the various people that have lived on the land. This is the work of a land record abstractor. In Module 2 you were a property detective investigating encumbrances and judgments. Now, you become a storyteller who must write the story backwards.

In this module, we'll learn to perform the roles and responsibilities of a land record abstractor. We will also review the basic principles and processes of land record abstraction. We'll then focus on the research and investigation of property ownership.

As you recall from Module 1, **land record abstraction** is the process of 1) investigating land record documents that summarize the ownership of a piece of land/property and 2) collecting property information to create a chain of property ownership for the purpose of risk analysis.

The **chain of property ownership** is the history or record of real estate property's ownership. When a real estate property is sold or resold, the property's title is transferred to the new owner, known as a **property transfer**. These property transfers form the chain of ownership, and the chain begins with the most recent property owner and ends with the owner of the property over a course of sixty (60) years or more.

FIGURE 6. Module 3's overview and the visual chain of ownership. Used with permission from Canvas by Instructure.

features a graphic banner depicting proud new homeowners throughout the last century, visually linking them in a chain of ownership (Figure 6). Just as the intern plays a property detective and storyteller, the role they play in the frame narrative is the land abstractor whose work creating smart land records will help families such as the Wises when purchasing a new home. In this way we connected their imagined roles with their actual role, the abstract with the concrete. It was important for us to convey to the interns that although their work may involve data entry, it requires specialized skills and will have direct, positive impacts on their community. It was also our hope that through the Wises' narrative, the interns might aspire to their own personal visions of success just as these new homeowners have.

Mitigating Cognitive Load

The curriculum presented a significant challenge in managing cognitive load because of the intrinsic load of the unfamiliar subject matter, the increased need for germane load to help the interns understand it, and the potential for extraneous load based on the historical and contextual information requested by the clients (Sweller, 2020). To complement the intrinsic load with beneficial germane load, we used tutorial videos, worked examples, numerous screenshots with highlights and callouts, and relevant metaphors for the abstraction process.

Our design process and deliverables were loosely inspired by the Four-Component Instructional Design (4C/ID) model, which we selected after our learner and task analyses to manage the cognitive load demands (Figure 7). The 4C/ID

model combines whole learning tasks, supportive information, procedural information, and part-task practice (van Merriënboer & Kirschner, 2018). Our design centered on the whole learning task to be performed by the interns, a full abstraction and smart land record created from a single property. This consistent focus prevented the course from becoming too fragmented by the constituent processes in land abstraction (Frerejean et al., 2019). The learning task was illustrated through procedural (routine) information, including how to navigate mxCourt and cancel out encumbrances. The learning task was complemented by supportive (non-routine) information, including workarounds to find information missing from a deed. Interns would receive additional part-task practice through embedded activities and module quizzes.

Initial Design

The ordering of course content underwent two major structural changes, which we presented to the SME with our rationale and received approval to implement. At the outset of the project, we were presented with a training curriculum outline proposing four main content areas: 1) *Purpose of Land Records Administration*, 2) *Foundations of Land Record Abstraction*, 3) *Foundations of Blockchain Technology*, and 4) *Creating Smart Land Records*. The proposed sequencing reflected a general to highly specific orientation, with the expectation that interns complete a full smart land record by the end of the course. However, this sequencing front-loaded a large amount of extraneous historical and conceptual information in Modules 1-3 and reserved the actual work of

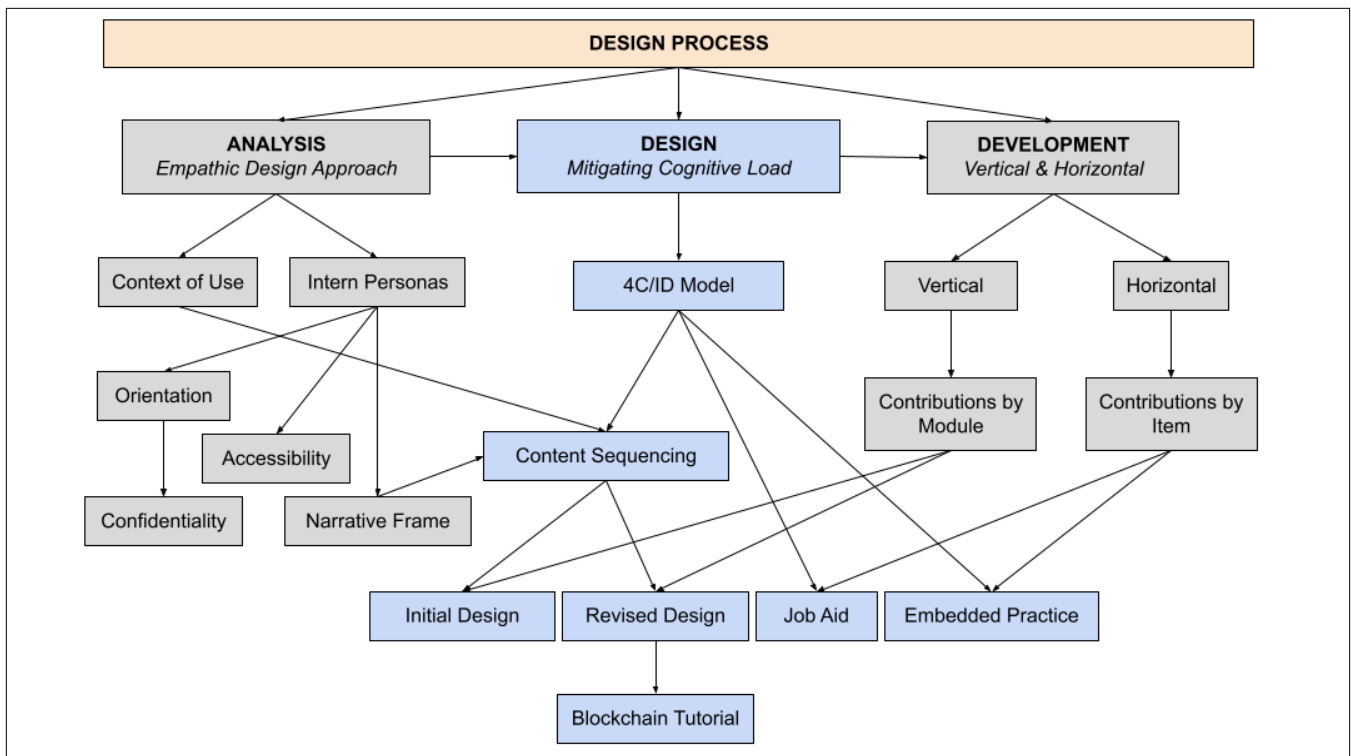


FIGURE 7. Design phase detail from advance organizer.

smart land record creation for the final module. We deemed Modules 2 and 4 as specified *need-to-know* and Modules 1 and 3 *nice-to-know*. Finding the right balance between the abstract conceptual content and the concrete procedural support that the interns needed proved to be the most difficult part of the course's development and the greatest challenge to reducing extraneous load.

Concerned that Module 4 would introduce too much essential new content too late in the training, we proposed instead spreading Module 4's content over Modules 1-3 and restructuring the entire curriculum around creating a smart land record based on the land abstraction process. Some of the foundational content about land records administration and information about blockchain could be interwoven into the procedures as needed, but neither topic required detailed explanation for the interns to perform the learning task successfully.

We organized the course into five modules, one orientation ("Module 0") and four with the newly sequenced content: 1) *Property Details*, 2) *Property Transfers*, 3) *Property Encumbrances*, and 4) *Smart Land Records*. Each module introduced one procedural chunk of land record abstraction and concluded with the interns submitting that section for the facilitators' review and feedback. By Module 4, the intern would have all requisite information to complete a full smart land record independently. Each module was divided into two sections: the presentation of content using 123 Cherry

FIGURE 8. A single property entry for the SLR Wizard. The positions of "Property Transfer" and "Property Details" switched during the course's development. Used with permission from Bloqable, LLC.

and the application of content to the independent abstraction for 123 Apple.

Our sequencing reflected a general to specific orientation within each module and a simple to complex orientation over the entire course, from scanning for basic property details to investigating encumbrances and judgments impacting the property to establishing a full chain of ownership. This sequencing would also respect the interns' time by exposing them to the specific tasks they would need to perform and the level of rigor earlier in the training rather than waiting until Module 4.

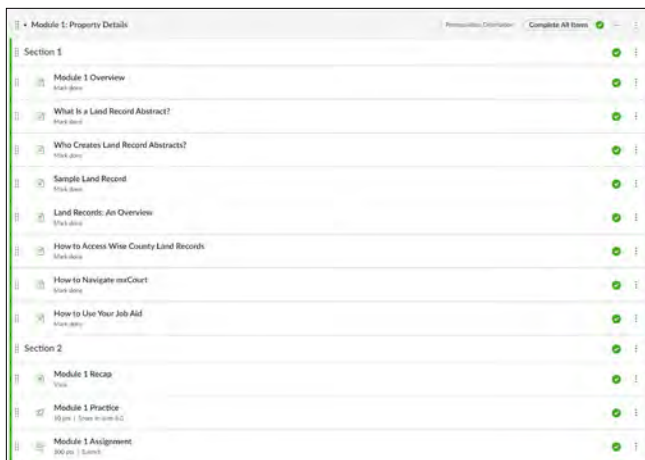


FIGURE 9. Module 1 (*Property Details*) with 11 items. Used with permission from Canvas by Instructure.

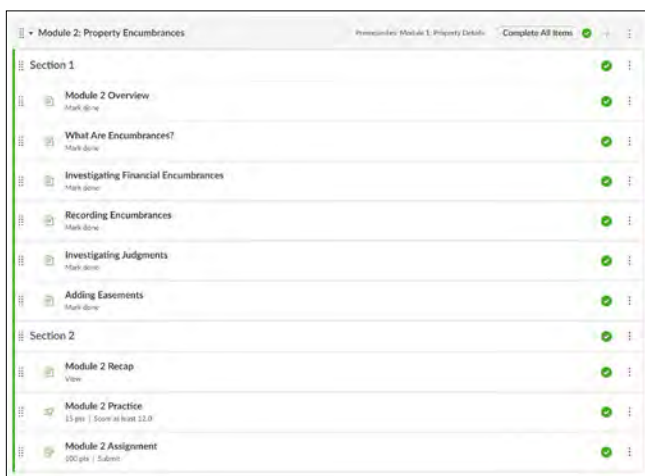


FIGURE 10. Module 2 (*Encumbrances*) with nine items. Used with permission from Canvas by Instructure.

Revised Design

The second major structural change occurred after we received feedback from the SME and Wise County's stakeholders and reviewed our initial draft of the entire course. The sequencing problem that quickly became apparent was that the abstraction process as demonstrated in our task analysis did not match the structure of the SLR Wizard. The SME's abstraction method would require the interns to record all property transfers *first* and then revisit each to investigate any encumbrances; the SLR Wizard required users to complete one full property transfer *with* encumbrances before adding any previous property transfers (Figure 8). The accurate recording of any unfulfilled encumbrances and judgments is arguably the most important part of abstraction. Requiring the interns to revisit each property entry in the SLR Wizard to update encumbrances would have introduced too many opportunities for errors, necessitating a change in the sequence.

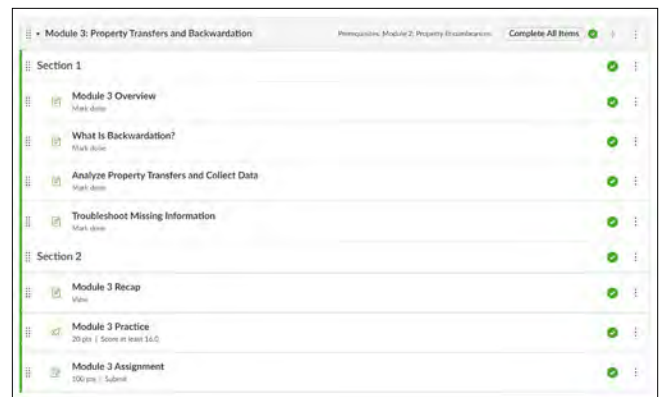


FIGURE 11. Module 3 (*Property Transfers*) with seven items. Used with permission from Canvas by Instructure.

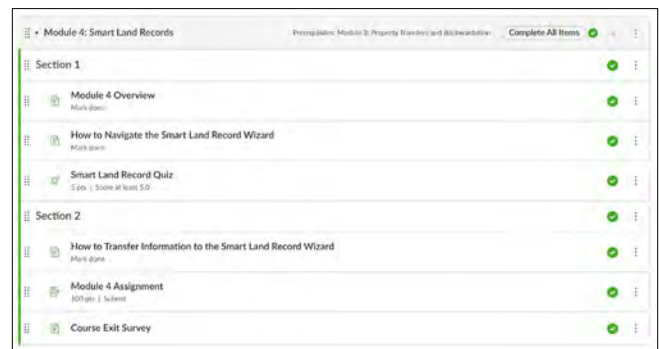


FIGURE 12. Module 4 (*Smart Land Records*) with six items. Used with permission from Canvas by Instructure.

We reordered the modules to present the abstraction process in the same order that the interns would need to complete a smart land record rather than having to double back to previous steps. This required swapping the positions of Modules 2 and 3 so that interns would cover encumbrances in Module 2 and then property transfers in Module 3. Encumbrances and property transfers were comparable in complexity, so the swap did not impact the simple to complex orientation as much as we initially feared when we realized the change was necessary. The reorganization allowed us to taper off the amount of supportive content in later modules as both the abstraction process and module assessments grew more intensive (Figures 9-12). Module 3's assessment represented a significant leap in length and difficulty from the previous two, requiring the interns to perform the same tasks they had for Modules 1 and 2 but with multiple property transfers for 123 Apple. Essential content on types of transfer deeds and navigating mxCourt that we had originally placed in the property transfers module worked better in Module 1 and reduced the number of items in Module 3, allowing the interns to devote more cognitive processing towards the assessment.

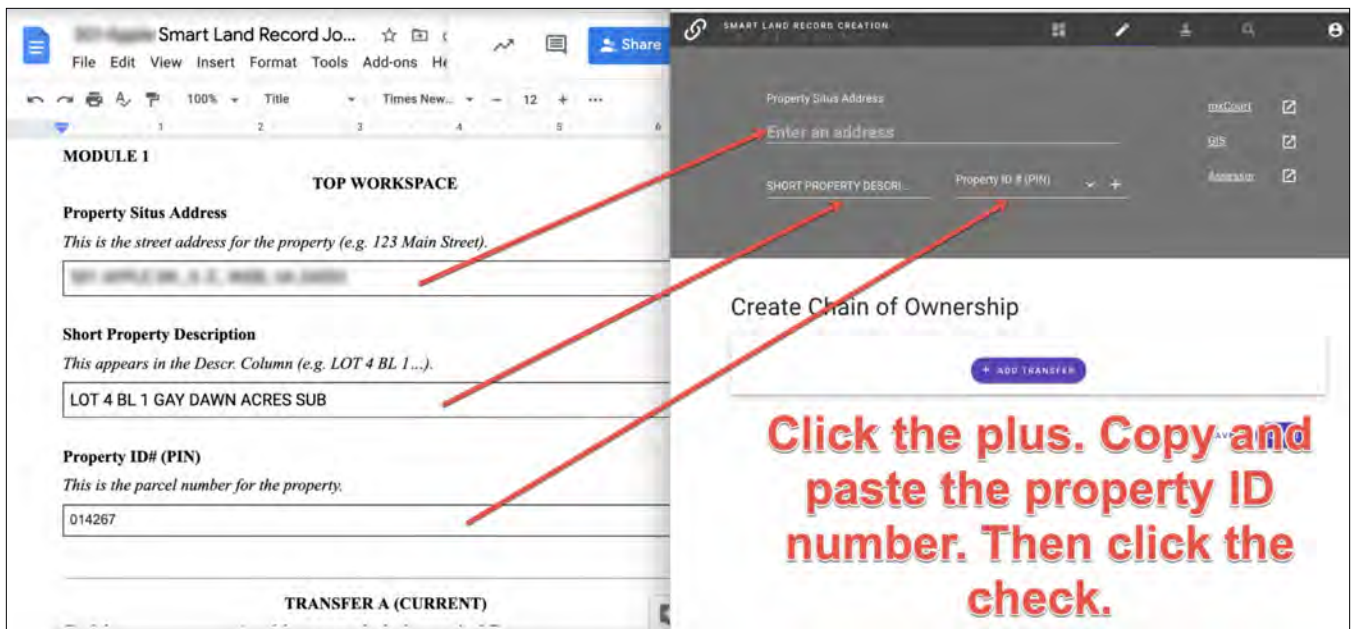


FIGURE 13. Horizontal snap screen of the job aid next to the SLR Wizard. Used with permission from Bloqable, LLC.

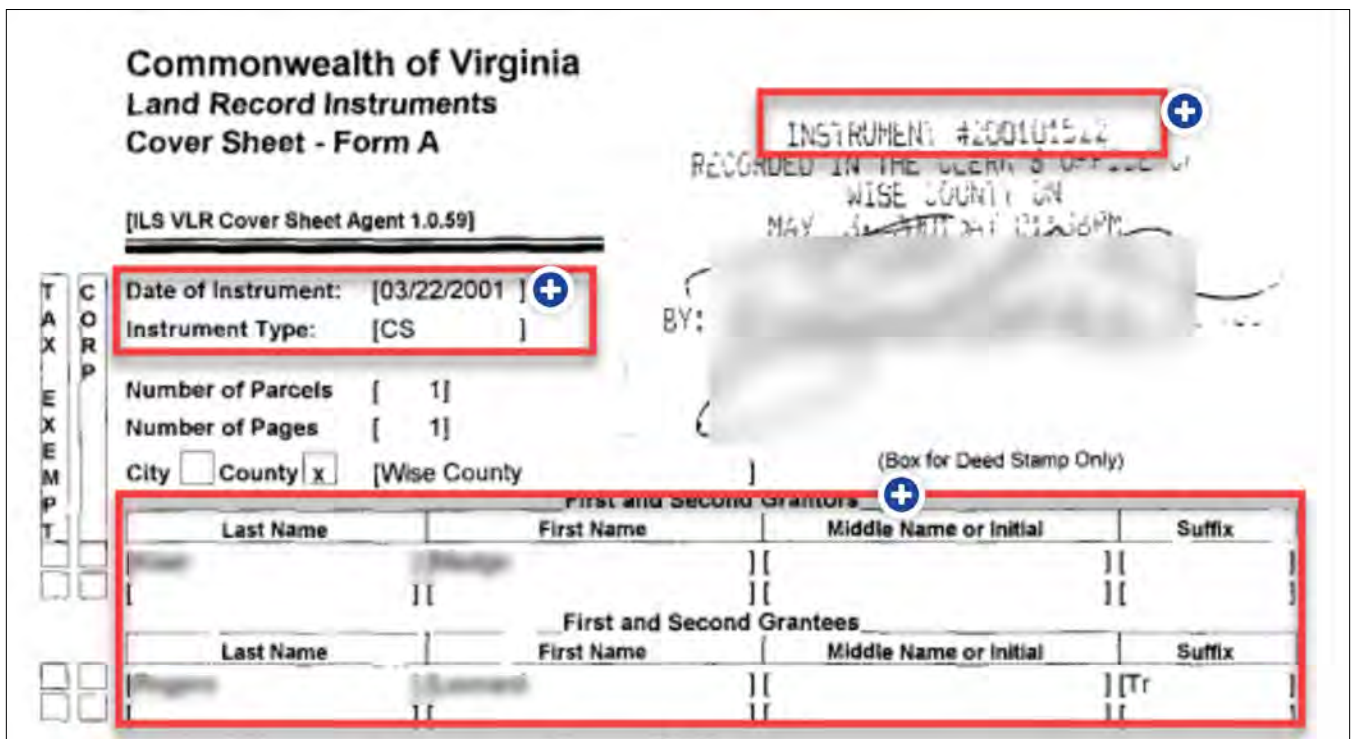


FIGURE 14. Hotspot activity. Please note that the text blurriness is due to the original document scan, indicating the range in the quality of documents that interns will need to consult. Used with permission from mxCourt.

Job Aid

The reorganization based on the SLR Wizard's interface prompted the development of the course job aid, which became the recurring assessment for Modules 1-3. The job aid we developed to assist interns in creating a full smart

land record was perhaps the most representative procedural artifact in accordance with the 4C/ID model.

Our SME demonstrated how to create smart land records by making notes on scratch paper and working between two browser tabs opened to mxCourt and the SLR Wizard. An

expert abstractor would know where to source information in mxCourt and the appropriate data field in which to enter it in the SLR Wizard, regardless of where or how scratch notes were recorded. We first tried to teach the interns to replicate the practice of using two open tabs through either the vertical snap (top-bottom) or horizontal snap (side-by-side) features in the web browser. However, we determined this method to be an expert's shortcut that would introduce too much extraneous load via the split-attention effect (Sweller, 2020). Instead, we needed a scaffolded intermediary to transition the interns from mxCourt to the SLR Wizard with prompts where to find the information in the first database and where to enter it in the second database. We decided a job aid would be easier and more effective for beginners.

We created a job aid using Google Docs, separated by module with fillable fields. Interns can either copy and paste information from mxCourt into the job aid or print it and keep written records (Figure 13). This method allows the interns to focus on one database at a time while learning the abstraction process. The job aid is structured the same as the SLR Wizard, with data fields appearing in the same order. Ideally, once the interns have completed the job aid with information from mxCourt, they can complete a smart

land record using simple data entry and copy-and-paste. We intend the interns to continue using the job aid for their first few abstractions post-training, but as they develop expertise, they can drop the intermediary step and use more direct methods through multiple browser tabs or dual monitors.

Embedded Practice Opportunities

In each content page we embedded opportunities for engagement and review coupled with instant feedback. We used H5P as an interactive learning approach for the interns to understand procedural information. H5P is an HTML5 plugin, an authoring tool that allows creators to produce rich interactive content efficiently and quickly on a website or LMS. These H5P widgets included document hotspots (Figure 14), drag-and-drop matching activities (Figure 15), and flashcards.

Each module featured a practice quiz created through Canvas's quiz engine. The quiz format was inspired by the 4C/ID model's part-task practice component. Although we supported our decision to use 123 Cherry as the case study, we also worried that using only one property would not provide the interns with enough breadth in land record analysis. The purpose of the module quiz was to expose the interns to

Drag each label to the correct section of the Land Record Cover Sheet.

301 Cherry Street

**Commonwealth of Virginia
Land Record Instruments
Cover Sheet - Form A**

[JLS VLR Cover Sheet Agent 1.0.66]

TAX EXEMPT

Date of Instrument: [3/15/01]
Instrument Type: [DBS]
Number of Parcels: [1]
Number of Pages: [2]
City: [] County: [2] [Wise County] (Box for Deed Stamp Only)

First and Second Grantors
Last Name First Name Middle Name or Initial Suffix
First and Second Grantees
Last Name First Name Middle Name or Initial Suffix

Grantee Address (Name) (Address 1) (Address 2) (City, State, Zip) [Coeburn] [VA] [24230]
Consideration [115,000.00] Existing Debt [0.00] Assumption Balance [0.00]

Prior Instr. Recorded at: City [] County [2] [Wise County] Percent. in this Juris. [100]
Book [834] Page [589] Instr. No. []
Parcel Identification No (PIN) [015746]
Tax Map Num. (if different than PIN) []
Short Property Description [1.962 acres, more or less in the Gay Dawn area of the Town of Wise, in the Gladeville Magisterial District of Wise County, VA]
Current Property Address (Address 1) (Address 2) (City, State, Zip) [Wise] [VA] [24230]

Instrument Prepared by
Recording Paid for by
Return Recording to (Name)

Check

Instrument ID

Date of Property Transfer

Grantor/Grantee Names

Property Details

FIGURE 15. Drag-and-drop activity with arrows indicating correct locations. Used with permission from mxCourt.

Judgments
1 pts

While investigating judgments against a property owner, you discovered the following request for lien and clicked View to view the document. What should be added to the smart land record?

Please select all that apply.

NOTE: If numbers appear too small, use the zoom feature in your browser.

CITY STATE ZIP CITY

DATE OF ENTRY: 10/14/2011 10:07:00 AM

This is to certify that a judgment was rendered in this court in favor of:

PLAINTIFF(S) against DEFENDANT(S)

DEFENDANT(S) against PLAINTIFF(S)

DATE OF JUDGMENT: 1/28/2011

\$ 13,042.48 AMOUNT OF JUDGMENT

\$ AMOUNT OF ADD

Doc#: 00000000000000000000000000000000

REQUEST FOR LIEN

1-File

01/28/2011 13:07:41 13/

Recorded-V

Correct Answer

☐ The plaintiff who filed the request

☐ Nothing. This judgment has been fulfilled by a release.

☐ Nothing. The court ruled in favor of the defendant.

Correct Answer

☐ The date of the judgment

Correct Answer

☐ The amount owed

Wrong answer comments

This is an active judgment against the property owner. All relevant information will need to be added to the smart land record, including the plaintiff who filed the lien, the date, and the amount.

[move/copy question to another bank](#)

FIGURE 16. Practical quiz question on identifying information from a judgment. The question stem reinforces the procedures interns will take when examining documents. Used with permission from mxCourt and Canvas by Instructure.

Recall that data blocks in a blockchain [match their hash numbers](#) to the previous block.

Genesis Block

Data: "Property Grantor"

Previous Hash: 0000000

Hash: ABC0123

Block 2

Data: "Property Grantee"

Previous Hash: ABC0123

Hash: DEF4567

Block 3

Data: "Transfer Price"

Previous Hash: DEF4567

Hash: GHI8910

Similarly, the *descriptions* of Certificates of Satisfaction (CS) and other fulfillments will match the *I-ID* of their corresponding encumbrance (such as a Deed of Trust Credit Line/DTCL, for example). Entering the property's parcel number in mxCourt will give you a list of records such as the following for . Note that the description for the Certificate of Satisfaction (CS) ending in "2337" matches the I-ID number for the Refinance Deed of Trust Credit Line (RFDT) also ending in "2337." This CS cancels out the RFDT encumbrance. Therefore, this encumbrance has been paid off and no longer exists on this property.

Parcel Number	Record ID	Record Type	Description	Document ID	Document Type	Recorded Date
1166573	201300847	LR	CS	014169	CS INS 200802337	03/21/2013 09:25:00.000 Recorded-V
1166221	201300496	LR	DTCL	014169	9.835 AC PCL	02/20/2013 10:07:00.000 Recorded-V
1166220	201300495	LR	DTCL	014169	9.835 AC PCL	02/20/2013 09:37:00.000 Recorded-V
1156050	201001879	LR	CS	014169	CS INS 580000840	06/14/2010 16:43:00.000 Recorded-V
1147218	200802567	LR	CS	014169	CS INS 200402348	07/02/2008 09:11:00.000 Recorded-V
1146988	200802337	LR	RFDT	014169	RFDT INS 200402348	06/17/2008 08:59:00.000 Recorded-V

FIGURE 17. The encumbrance as blockchain metaphor. Used with permission from mxCourt and Canvas by Instructure.

a wider variety of document types and task variability, which can be an effective method to foster germane load (Sentz et al., 2019). We intended the quizzes to help the interns automate necessary skills, including how to scan a deed for parties, easements, and information about the previous transfer.

For each quiz, we developed question banks of 10 multiple-choice and true/false questions derived from the module's content and 10 application questions requiring the interns to examine a property deed for specific information and then choose the correct response based on an authentic scenario (Figure 16). Five questions from each bank would be pulled randomly for each quiz attempt so that interns could retake the quiz and see different combinations of questions. Wrong answers were accompanied by feedback explaining how to solve a similar problem correctly. Interns must meet a 75% threshold on the practice quiz to progress to the module's final assessment.

Blockchain Tutorial

The development of the course coincided with increased media coverage of cryptocurrencies, the most well-known applications of blockchain technology. Although we did not find it necessary to know blockchain technology to be able to create smart land records, the clients requested that we include information about blockchain to demonstrate the project's cultural relevance for community stakeholders. We struggled with how best to meet the clients' needs and incorporate the additional training without introducing extraneous cognitive load. We tested three iterative solutions.

First, we created seven individual content items as one section of the module on encumbrances and judgments. Connecting the blockchain information to the encumbrances module revealed a useful instructional metaphor. The data "blocks" in a blockchain are connected by unique cryptographic hash numbers, which makes the system nearly tamper-proof. Similarly, property encumbrances are connected to their corresponding Certificates of Satisfaction (CS) by an instrument ID number. Encumbrances that have been fulfilled by their corresponding CS are no longer active and are not added to the smart land record (Figure 17). The arrows in Figure 17 demonstrate how data blocks point to the previous block's hash number and how CS point to their corresponding encumbrance.

Second, we used the same seven items to create a separate blockchain module, which could be slotted anywhere in the course (Figure 18). This change required us to drop the *encumbrance as blockchain* metaphor that we found useful to understand both encumbrances and blockchain because they would no longer be temporally connected in the same module. However, a separate module would provide the course facilitators greater flexibility in determining where best to use this material. We were still able to use the

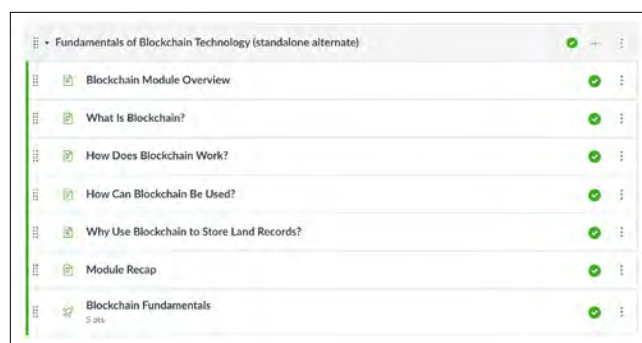


FIGURE 18. Separate blockchain module with seven items. Used with permission from Canvas by Instructure.

encumbrance as budget metaphor in the Wise Family narrative, but we lost some of the visual richness that we found in the association between encumbrances and cryptographic hash numbers.

Third, we abandoned the idea of incorporating blockchain training directly into the course. We had to acknowledge that the extra module did not fit into our training's sequencing and would impose too much extraneous load for the interns. To balance the clients' needs against our more streamlined vision of the course, we decided to create a standalone [blockchain tutorial website](#) that would be separate from the course but accessible via the navigation menu.

We used Google Sites to create the website because of the greater flexibility in layouts and aesthetic affordances than were available in Canvas. We first developed a content page template so that we could duplicate the structure quickly for the subpages (Figure 19). Each subpage used the same basic layout as the original Canvas blockchain pages - *Learn*, *Watch*, *Practice*, and *Explore* - but graphics were easier to place inline with their corresponding text to preserve the spatial contiguity principle (Schroeder & Cenkcı, 2018). Each page began with pretraining in the relevant vocabulary (Clark & Mayer, 2016), followed by a video tutorial, and then independent practice using embedded H5P widgets or blockchain simulations.

The clients had requested more blockchain information rather than less, so we also included videos and news items about other blockchain applications, such as automated supply chains and smart contracts. Therefore, the *Explore* section is by design full of these seductive details in direct violation of the coherence principle (Mayer & Fiorella, 2014). However, these tangential applications of blockchain were added to the bottom of each page to avoid distracting the interns as much as possible.

We developed a blockchain-themed interface metaphor in the site navigation so that the interns would see their "knowledge blocks" added to a chain as they progressed through each page (Lohr, 2007). The clickable blocks for each page were developed using the free graphic design site

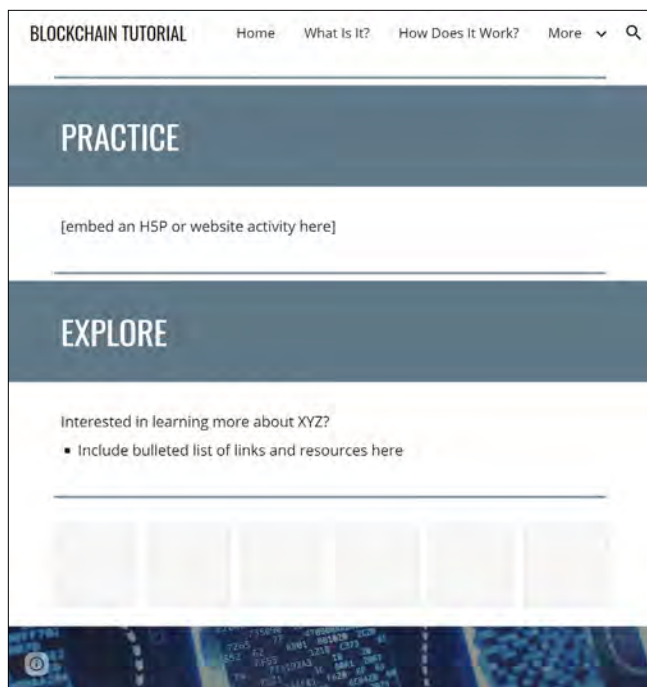


FIGURE 19. Detail of content page template for the blockchain website. The empty blocks at the bottom are placeholders for the website's navigational interface.

Canva. Each tile had two variations, gray (incomplete) and green (complete), to illustrate the interns' progress (Figures 20-21).

This standalone website is not intended to be part of the training but can rather be used as supplemental information for interns who are interested in the technology. It also helps the clients demonstrate to their community stakeholders that partnerships such as the one brokered with Bloqable are bringing real-world knowledge and skills to Wise County.

Vertical and Horizontal Development

Because of our time constraints, it would have been infeasible to designate one team member to develop all course modules for aesthetic consistency (Stefaniak et al., 2020). We instead each took ownership of a single module to add content and placeholders once we had decided on the restructuring of the course. After this vertical drafting of modules top to bottom, we met to share our drafts and provide formative feedback, learning more about each other's qualities as designers. We then harmonized the modules by integrating one another's specializations horizontally across every module in the revised version (Figure 22).

From Jacqueline's draft for Module 1, we developed a comprehensive style guide for page layout templates, headings, and module structure. It is unlikely we would have developed this style guide had we not first drafted our own modules vertically to determine which headings were necessary. Jacqueline provided the ideas for a *Summary* at



FIGURE 20. Instructional interface blockchain metaphor showing two pages completed.

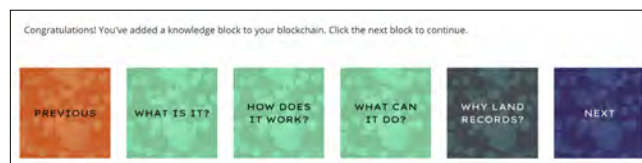


FIGURE 21. Progress is shown by filling in the navigational blocks.

the bottom of each content page and a *Recap* page for each module. The strength of this approach was that it urged us to look backward and ask the interns to reflect on what they had learned, even as we pressed ahead with increasingly difficult content and procedures.

From Lisa's module, we expanded the idea of a *Let's Focus* section, an in-depth look at abstraction challenges. Through our task analysis and investigations of land records, we realized that it would be beyond our scope to cover a wide range of abstraction scenarios. We instead focused on a few issues interns would surely encounter in their research, such as ways to find essential information missing from a deed. We illustrated these in-depth looks with embedded H5P widgets and hotspots in each module.

We then identified the incomplete areas of each other's modules where we could apply the skills we had gained from our vertical drafting. Lisa and Kristin filmed tutorial videos, Lisa for the general abstraction process and Kristin for the SLR Wizard. Kristin also added the directions and the 123 Apple job aid to each module's final assessment. Jim wrote the questions and feedback for the module quizzes using a variety of property deeds that he had examined when researching easements, encumbrances, and judgments.

This "vertical/horizontal" dichotomy appeared multiple times and in unexpected ways during our process, which may partly explain why we adapted it for our design. Our method was perhaps inspired by the two approaches to land abstraction we saw demonstrated by our SME and the SLR Wizard. The SLR Wizard required interns to use a vertical approach in that all relevant details of a single property transaction, from deed of transfer to encumbrances, are completed as part of one entry. The SME employed a more horizontal research method by first recording all property transfers going back 60 years and then revisiting each transfer to add encumbrances and judgments. Although we had to choose the SLR Wizard's structure for the course's sequencing, we found utility in both approaches.

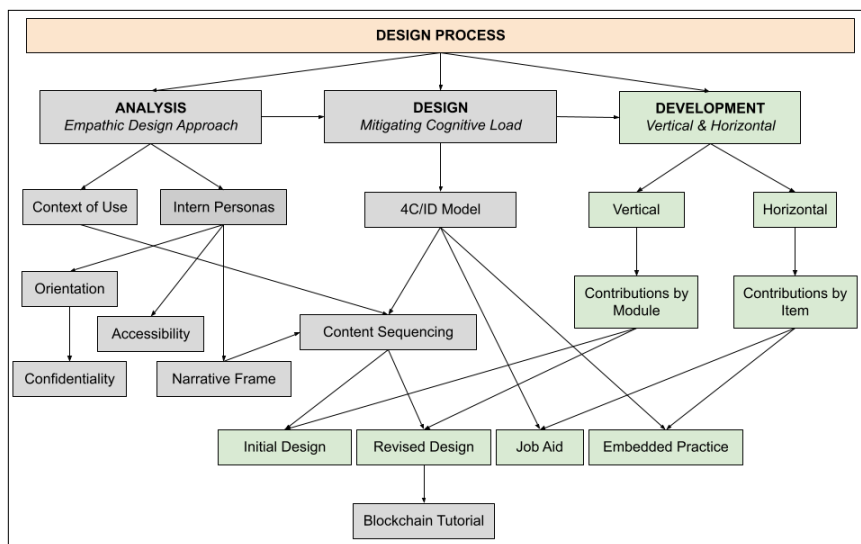


FIGURE 22. Development phase detail from advance organizer, featuring contributions by module and item.

	Module 1 (Jacqueline)	Module 2 (Jim)	Module 3 (Lisa)	Module 4 (Kristin)
Wise Narrative				
Style (Jacqueline)				
Content				
Tutorials and Practice (Lisa)				
Examples				
Quizzes (Jim)				
Media Selection				
Module Assessments (Kristin)				

FIGURE 23. Contributions from each team member. The vertical design of each module is represented by the colored columns; horizontal design elements across modules are represented by the colored rows.

Our vertical drafting allowed us to sketch the outlines of the content, whereas the horizontal revisions established more consistency in expectations across modules and gave the entire course a more unified visual appearance (Figure 23).

EVALUATION PLAN

In the commission for the course, the clients expressed the need for periodic updates based on changes in Virginia's property laws, so we designed knowing that whatever we produced would need to be revisited through summative and confirmative evaluation. We also openly acknowledged to the clients that we expected to see gaps in the training after the first cohort, which we were committed to resolve based on their feedback. The content would likely be as

unfamiliar to most of them as it originally was to us. This was a new land records project, using a new software, which was still being refined even as we finished the course. Revisions are expected.

We presented our final design deliverable to the clients as the first iteration of a "multigenerational" partnership between ODU's Instructional Design & Technology (IDT) graduate program and Wise County's smart land records project. Securing permission from ODU's program director and our clients, we made a team decision that new IDT graduate students enrolled in the introductory instructional design course in Fall 2021 would evaluate our work based on feedback from the first cohort of interns and make the recommended changes to the course for subsequent cohorts. Participants in DeVaughn and Stefaniak's (2020) study suggested that they would have been better prepared to conduct long-term evaluations if their education programs had exposed them to more evaluation models through authentic projects. Our evaluation plan will ensure that the course receives periodic updates as the clients requested and provide new IDT students with opportunities to evaluate an existing course and the agency to affect its continued development.

DESIGNER REFLECTIONS

Our early design decisions adhered perhaps too faithfully to the clients' specifications out of deference to the specialized content. Our lack of prior knowledge about land records abstraction and the complexity of the material

led to early frustration. We temporarily forgot the insights we had earned through the task and learner analyses as well as our strengths: the abilities to empathize with intern, client, community, and system and to design instruction based upon this empathy. Weekly progress meetings allowed for our team to engage in both venting of frustrations and formative feedback. It was through these weekly design iterations and feedback cycles that we were able to return to focusing on need over want and remember one of our most critical tasks: to advocate for the learner (Cennamo & Kalk, 2019). We explored the interns' localized context of use when creating smart land records and contrasted that against the amount of historical and foundational content that we had been asked to include. Advocating for the learners

meant convincing the clients that pruning some of the extra content was necessary to prepare the interns to create smart land records.

We committed early to an asynchronous online delivery mode based on what we understood at the time about the unlikelihood of in-person training during the pandemic and our clients' availability once the course was delivered. The SME informed us later in the development process that Bloqable and Wise County personnel intended to take a more active role in facilitating the course, which might have led us to suggest a hybrid or synchronous online training. However, developing the entire online course for asynchronous delivery resulted in useful assets for any format: worked examples with screenshots; specific examples of abstraction troubleshooting; the scaffolded job aid to help interns transfer information from mxCourt to the SLR Wizard; quizzes with randomized questions to provide more part-task practice; and the blockchain tutorial website if it is deemed relevant.

Although our lack of prior experience in land abstraction was at first a hindrance, it ultimately enabled us to make dispassionate instructional decisions and adapt the curriculum to meet the clients' and interns' respective needs. Furthermore, our common background within an established program of study at ODU allowed us the luxury of thinking beyond the time constraints of one semester. The analysis, design, development, and implementation were all completed within the given timeframe, but our proposal for the design's evaluation was able to extend to the next cohort through our graduate program, providing an ongoing design partnership between ODU, Bloqable, and Wise County.

CONCLUSION

Our empathic design approach to land records abstraction encompassed the interns, our clients, Wise County, and ourselves as designers. The use of learner personas helped us recognize a potentially deeper emotional connection between the interns and the subject matter, which resulted in the composition of the frame narrative connecting the different elements of the course. We found that using a narrative structure (Parrish, 2014) helped us impose a more familiar discipline onto the abstraction process and better interpret it (Schön, 1983).

As our own facility with land abstraction grew, we were better able to understand the interns' localized context of use (Baaki & Tracy, 2019) and refocus attention on the essential performance tasks and away from the seductive details of blockchain technology. Our solution to develop a standalone blockchain tutorial helped us deliver more than the clients had asked while protecting the interns from extraneous cognitive load.

Empathy for ourselves as designers (Fraquelli, 2015) compelled us to examine the gaps in our design and draw from

one another's strengths to create a richer, more coherent course through both vertical and horizontal development. We think that the vertical and horizontal method has potential applications for large design teams working in a variety of instructional contexts to maintain both instructional and aesthetic consistency while meeting tight deadlines. Our evaluation plan to subject the course to the critiques of a new class of designers illustrates our willingness to remain caretakers of our design and our confidence in it even as we acknowledge its inevitable gaps.

ACKNOWLEDGEMENTS

Special thanks to Dave FitzGerald for helping us better understand land records abstraction and providing detailed feedback on successive drafts of the course; our reviewers, whose feedback on successive drafts made this a stronger manuscript; and John Baaki, program director of Instructional Design & Technology at ODU, for reminding us that "you do not need to know how the watch works to tell the time."

IMAGES AND MATERIALS

All figures represent the authors' original work. Screenshots of the Canvas LMS and mxCourt are permitted under their acceptable use policies. Screenshots of the SLR Wizard appear with permission from Bloqable, LLC. All photographic images appearing within screenshots were selected from Google Images under Creative Commons licenses.

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