Kumu Connect: Design Thinking for Place-Based Generative Educational Technology in Hawaiian Immersion Schools

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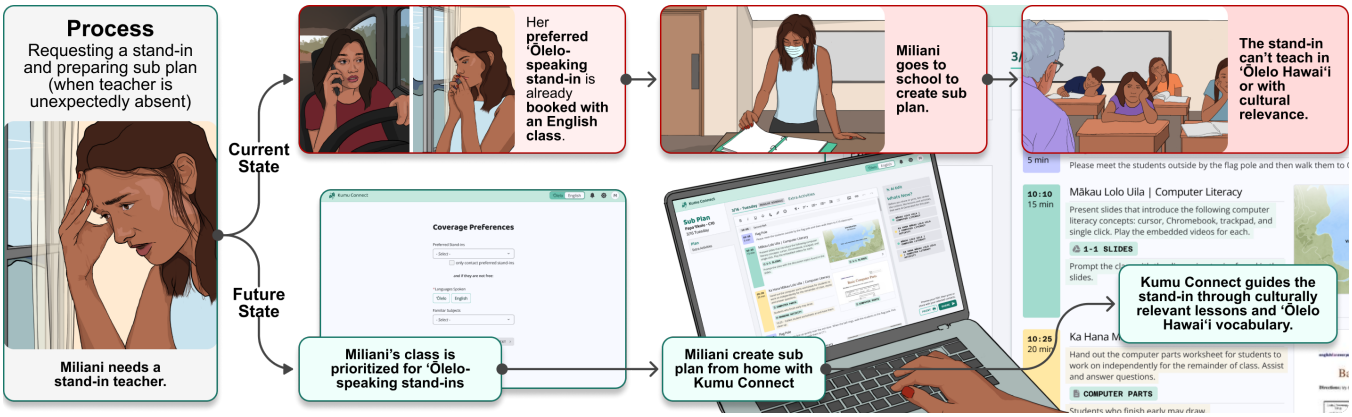


Figure 1: Current and future state process flows for Kumu Miliani requesting a substitute and preparing a lesson plan

Abstract

In the pursuit of place-based, generative AI educational technologies, the field of Human-Computer Interaction (HCI) offers a powerful framework for identifying and addressing diverse user needs. In partnership an Hawaiian language immersion (Kaiapuni) school and 13 educators, this 1-year case study presents a research approach rooted in assets-based design and Design Thinking that leverages rapid iteration, usability testing, and speculative prototyping to co-design a generative AI tool for Kaiapuni educators. Our synthesis of observations, participant reflections, and usability testing feedback provides evidence for such methods in their ability to envision ideal outcomes for Kaiapuni education supported by generative AI technologies.

CCS Concepts

• **Human-centered computing** → **HCI design and evaluation methods**; *Natural language interfaces*; **Usability testing**; • **Social and professional topics** → **Cultural characteristics**.

Keywords

EdTech, Culturally-relevant CS, Place-based computing, Generative AI, Indigenous knowledge, Hawai'i

ACM Reference Format:
Rachel Baker-Ramos, Will Gelder, Leah Cho, Jahnavi Kolakaluri, and Josiah Hester. 2025. Kumu Connect: Design Thinking for Place-Based Generative Educational Technology in Hawaiian Immersion Schools. In *Proceedings of the 2025 Conference for Research on Equitable and Sustained Participation in Engineering, Computing, and Technology (RESPECT 2025), July 14–16, 2025, Newark, NJ, USA.* ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3704637.3734781

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RESPECT 2025, Newark, NJ, USA
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ACM ISBN 979-8-4007-1355-2/2025/07
https://doi.org/10.1145/3704637.3734781

1 Introduction

Public Hawaiian language immersion programs, or Kaiapuni programs, offer placed-based culturally relevant education rooted in *Kānaka Maoli* (Native Hawaiian) values, culture, and tradition, with instruction delivered in *'Ōlelo Hawai'i*, the Hawaiian language [40].

Kumu (teachers), go to great lengths to ensure instruction is culturally and linguistically immersive, such as integrating *oli* (chants) and *mele* (song) into daily education practices. Kaiapuni programs positively impact students' native language development, cultivation of cultural values, development of personal identity, and connection to community, land, and family [33]. Nearly all STEM subject areas are in need of culturally relevant curricula for Kaiapuni learning contexts; including mathematics [27], science [44], and technology and computer science (CS) [34]. The COVID-19 pandemic and distance learning exacerbated the need for technological support by forcing kumu to "produce and adapt their own online curriculum" due to "a lack of readily available, high quality resources" [26]; further straining already limited workload capacities. These challenges are barriers for kumu needing to offer culturally relevant technology and CS education to students and indicates a clear need for tools specifically designed to support their practice of- and vision for place-based, language immersion learning.

Rapidly approaching state mandates for CS education will place further strain on Kaiapuni educators. Passed in 2018, Act 158 requires all Hawai'i public schools to develop and implement statewide CS K-12 curricula by the 2024-2025 school year, and that a CS course credit will be required for graduating high school students beginning in the 2030-2031 school year [23]. For Kaiapuni schools, these looming mandates necessitate rapid development and implementation of culturally-adapted CS standards and instructional guidelines, an effort that many programs do not have the personnel, expertise, or resources to execute. These challenges present CS education researchers and technologists with motivation to create culturally-relevant curricular and technological resources via expedited and lean methodologies. For rapid development of educational technology (edtech), the field of Human-Computer Interaction (HCI) offers practical means for meeting such needs. This work presents a case study for such an approach in the co-design of a culturally responsive edtech platform, *Kumu Connect*, that provides vital resources and support for Kaiapuni educators via place-based, generative AI technologies. In collaboration with a Kaiapuni program on O'ahu and 13 of its educators, we contribute our culturally-responsive HCI research methodology and reflect on how such an approach can be leveraged to design practical educator tools while envisioning ideal technologies with-, and in support of Kaiapuni educators.

2 Theoretical Framework

The theoretical basis of this work is drawn from Kaiapuni education, CS education in Hawai'i, and inclusive research practices. We reviewed 20 published works related to these areas, including 3 key works by the Hawai'i Department of Education [35, 39, 41] and 17 academic and media resources [2, 5, 7, 12, 14, 15, 17, 20, 28, 29, 34, 38, 42, 43, 46, 49, 50]. Our approach is informed by HCI methodologies: the Design Thinking Framework [45] and Speculative Design [13].

Language immersion and culturally revitalizing education are core to Kaiapuni programs. Such learning environments are responsible for "developing and maintaining Hawaiian language in all contexts", "supporting the unique and educational needs of Kaiapuni students", "encouraging the use of Hawaiian practices and traditions", and "promoting Hawaiian world views and histories" [41]. For CS education, these responsibilities present a challenge because most resources and edtech platforms are designed from Western worldviews, thus lacking support for 'Ōlelo Hawai'i and an awareness of Kaiapuni student needs and Hawaiian epistemologies. However, Kaiapuni teachers do see value in such technologies, as "tool[s] that can be adapted to meet the demands of the schools and community, but only when shaped by Hawaiian values and intentional human agency" [51]. Therefore, it is vital that Kaiapuni-supporting edtech platforms are shaped by Hawaiian perspectives.

To design such tools, it is imperative that the design process adopt inclusive research approaches. Several frameworks are effective in this endeavor, such as co-design [2, 7], participatory design [12, 28], and assets-based design [43, 50]. Regarding the latter, assets-based design is an approach that positions and adapts currently available resources to maximize the likelihood of sustainable innovations, as opposed to establishing deficiency models and proposing unsustainable innovations. Such an approach is conducive for partnerships with Kaiapuni educators, given their limited resources and capacity for participation.

As a multidisciplinary field at the intersection of psychology, social science, computer science, and technology [6], HCI offers an array of investigation and design frameworks well-suited to support Kaiapuni educators. HCI seeks to understand human behaviors, motivations, and needs, and investigates how technology can be tailored to meet preferred outcomes. This is done through the iterative Design Thinking process [45], that uses iterative phases of needs-finding, problem framing, ideation, and evaluation. This process is often represented by the *Double Diamond process model* [8]. As this work seeks to design technologies that embody Kānaka Maoli values, *Critical design* offers a useful lens for imagining preferred Hawaiian futures. In contrast to *Affirmative design*, which seeks to reinforce present norms, *Critical design* embodies alternative values to challenge current norms [3] and seeks to present alternative realities to spur critical discussion, debate, and reflection [13]. For Kaiapuni educators, Critical design could be valuable in identifying intangible aspects or values that should be incorporated into their support tools.

3 Research Questions

This work explores the design of place-based generative AI educational tools that meet the needs of Kaiapuni educational settings and responsibly support place-based, Indigenous perspectives. To that end, we frame our research questions to ask: (1) Can HCI methods be effective for informing the design of place-based generative educational technologies for Kaiapuni educators?; and (2) How can such methods be used to envision ideal outcomes for Kaiapuni educators from their perspective?

4 Positionality Statement

The authors of this paper have varied backgrounds and experiences in relation to themes of culture, under-representation, and Computer Science education. Hester is of Kānaka Maoli descent and an insider to Hawaiian culture while all other authors are cultural outsiders. All authors are racial/ethnic minorities in the U.S.; Baker-Ramos, Gelder, and Hester are underrepresented in Computer Science. Baker-Ramos and Gelder attended predominantly

White, east coast schools for their K-12 education, with minimal CS instruction. Cho and Kolakaluri experienced varying-to-robust K-12 CS education at international schools in Seoul and Paris. Hester graduated high school in Hawai'i.

5 Research Design

This project was conducted between April 2023 through May 2024 and remains ongoing. The research team consisted of five core members: PI of Kānaka Maoli descent, two user experience researchers, and two user experience designers. This work was enabled by the existing partnership between the PI and a K-9 Kaiapuni school. The research team was based in a tier-one research institute located in the lower-east continental United States. Table 1 describes participating teacher-partners, the language branches that they worked within (i.e., 'Ōlelo Hawai'i vs. English), the grades that they taught, and the project phases in which they participated.

ID	Branch	Subject	Grade	Ds	Df	Di	Ev
P1	Both	Tech	K-10	X	X		
P2	'Ōlelo	SPED	K-2				X
P3	English	Homeroom	3-6	X	X	X	X
P4	English	Homeroom	K-2				X
P5	'Ōlelo	Homeroom	K	X		X	X
P6	Both	Tech	K-10	X	X	X	X
P7	'Ōlelo	Homeroom	5			X	X
P8	'Ōlelo	Homeroom	4	X			X
P9	Both	Library	K-10	X			X
P10	English	Homeroom	2	X			X
P11	'Ōlelo	Homeroom	6-10	X			X
P12	'Ōlelo	Homeroom	8-10	X			X
P13	'Ōlelo	Homeroom*	9-10	X			

Ds = Discovery, Df = Definition, Di = Design, Ev = Evaluation

* = Student Teacher

Table 1: Educator Demographics and Participation by Phase

5.1 Project Phases

The goals of this project were to research and design place-based support tools for Kaiapuni teachers needing to teach CS. Its research design is modeled after the Double Diamond process [8] consisting of four key phases: *Discovery*, *Definition*, *Design*, and *Evaluation & Iteration*.

The **Discovery Phase** established foundational knowledge surrounding Kaiapuni education. Secondary research consisted of *literature review* while primary research involved *site visits* [18] and *talk story sessions* [18]. Researchers were meant to adopt a divergent mindset; being open to all experiences. [8]. The **Definition Phase** synthesized all data collected during the Discovery phase. Its specific goals were to: (1) formalize our definition of the target user group; (2) frame their most pressing needs; and (3) translate those needs into actionable design requirements. Analysis methods included *grounded theory method [48], affinity mapping* [31], and *asset analysis* [18]. Artifacts were produced to illustrate the problem space via *personas* [4], *storyboards* [22], and *journey maps* [47]. Findings were formalized into design requirements that acted as guiding principles for the Design phase [See 2]. The **Design Phase** articulated a design solution through a cyclical process of divergent and convergent design activities. Divergent activities produced a large volume of possible solutions and included rapid ideation methods like *Crazy 8's* [24], *mind mapping* [19], and *sketching*. Convergent activities included *dot voting* [10] and *concept testing* [21] with Kaiapuni teachers. Collected feedback informed subsequent design iterations that culminated in a testable prototype to be used during evaluation. The **Evaluation & Iteration Phases** evaluated the effectiveness of the solution for teachers and informed next iteration design improvements. We conducted evaluation via a *Wizard of Oz usability test* [9] and *System Usability Scale (SUS) questionnaire* [30]. We analyzed results via descriptive statistics and grounded theory method, and prioritized and implemented needed enhancements in final designs.

6 Data Collection & Analysis

The following sections describe our data collection and analysis activities in greater detail. For brevity and narrative flow, high-level results and phase outcomes are integrated. However, results from the Evaluation & Iteration phase are fully presented in Section 7 Results.

6.1 Discovery Phase

Beginning with **secondary research**, we conducted literature and media reviews investigating the topics described in *Section 2: Theoretical Framework*. These included: the current CS education landscape in Hawai'i, Hawaiian history, culture, knowledge systems, and current socio-economic issues [5, 14, 15, 17, 29, 34, 38, 42, 46, 49]. Our synthesis determined that: (1) CS resources for teachers vary widely across islands and schools; (2) community, connection to place, and family are core Kānaka Maoli values; and (3) academia has repeatedly exploited Hawaiian culture with minimal reciprocation. Additionally, we identified assets-based design as a promising research framework for producing sustainable interventions [43, 50]. These findings, especially in the context of the 2023 Maui wildfires [1], emphasized the importance of trust-building data collection and design methodologies that acknowledge past and current harms that Western research has inflicted on *Kānaka Maoli* (Native Hawaiians). With team members of *Kānaka Maoli* descent as our guides, we critiqued each research method under consideration and asked: "How invasive is this method?" and "Does this method build or break trust?." We opted for practices that centered Hawaiian viewpoints, prioritized trust and relationships, respected educators' limited availability, and afforded co-creation with community partners.

To gain further understanding of Kaiapuni learning environments, we engaged partners in planning two on-location school and community **site visits**. Visits focused on context building, building trust, and needs-finding. Onsite, we intentionally modified our classroom observation protocols; steering away from silent observation and more towards immersion and offering support. This meant that our approach varied between classrooms with each teacher dictating the appropriate level of our interactions with students based on how distracted or excited students were in response to our presence. In some classrooms, we sat behind students and took

Finding	Design Requirement
Stand-in teachers have varied backgrounds	Accommodate range of backgrounds/expertise
Frequent subbing creates discontinuity in learning	Serve as a centralized resource for teachers
Most teachers do not feel confident teaching CS	Feel approachable & not overwhelming
Place-based schools lean on low tech solutions	Align with existing teacher expectations
Teachers are open to new tools that improve efficiency	Demonstrate immediate practical application
ʻŌlelo branch has fewer teaching resources	Use language & references relevant to ʻŌlelo branch

Table 2: Findings to Design Requirements

notes, while in others, we participated in activities or assisted with classroom management, writing our observations down afterwards. In total, 21 hours were spent immersed in the learning environment across both trips. After visits, we recorded internal debriefing conversations and used our notes and transcripts to identify questions, ideas, and findings to add to our Discovery phase affinity diagram. Post-visit analysis informed our research goals for a second five-day visit two months later that aimed to identify and catalog educator assets in the classroom [43, 50] and deepen teacher relationships. We re-framed semi-structured interviews as **talk story sessions**, the Hawaiian term for spending quality time with one another in conversation. Before each session, we internally aligned on our research questions, allowing us to have said questions in mind while keeping sessions informal. Prioritizing trust, we took no recordings or notes during talk story sessions, and instead recorded our internal debriefing conversations directly afterwards. A total of 10 talk story sessions were conducted. Again, resulting questions, ideas, and findings were added to our Discovery phase affinity diagram.

6.2 Definition Phase

Employing **grounded theory method**, we analyzed all photos, audio recordings, and observation notes to surface several themes including: subbing scenarios, branch resources, substitute teacher resources, teacher resources, and teacher pain points. We used **affinity mapping** to analyze all notes to produce thematic clusters around teacher pain points. School visits and talk story sessions surfaced critical teacher perspectives related to: (1) teaching motivations; (2) tools; and (3) considerations when creating, planning, and implementing lessons. **Asset analysis** revealed disparities between resources available in ʻŌlelo Hawaiʻi compared to resources available in English. English assets were often helpful for their off-the-shelf nature, while ʻŌlelo Hawaiʻi assets were often modifications of existing resources (e.g. editing worksheets in Canva) or completely made from scratch by kumu (e.g. ʻŌlelo Hawaiʻi lesson created in Google Slides). Assets that could not be modified in ʻŌlelo Hawaiʻi, such as digital education platforms and resources, were not usable as Kaiapuni resources; especially for student-facing assets.

Upon conclusion of all analysis, we synthesized our results to produce actionable findings statements as presented in Table 2. Each finding was juxtaposed with a corresponding design requirement. For example, the finding *stand-in teachers have varied backgrounds* implies that a design solution should acknowledge this fact by *accommodating a range of backgrounds or expertise.* These open-ended design requirements provided the necessary creative space for exploring diverse solutions during the Design phase.

6.3 Design Phase

During this phase, the team engaged in **ideation sessions** prompted by our research findings and design recommendations. These sessions produced 3 concepts: (1) Printable Worksheet Generator — a web-app that could generate ready-to-print place-based resources based on teacher input; (2) Stand-In Connector and Plan Hand-off — a phone-based solution that could connect teachers to (ʻŌlelo-Hawaiʻi-speaking) stand-in teachers and also creates substitute lesson plans; and (3) Lesson Plan Generator — a web-app that could generate place-based lesson plans via guided prompt engineering. [Figure 2].

To refine our concepts, we conducted remote **concept testing** with two partner-teacher. Sessions were kept conversational as one team member shared each concept and another took notes. Each concept was introduced with a brief description and sketch, and time was given for participants review and ask clarifying questions. We asked for their initial reactions and ratings on how *unique*, *appealing*, *believable*, and relevant they found each concept. At the end of each session, we asked teachers about their most and least favorite concepts. Both teachers expressed positive affect towards concept #2: *Stand-in Connector and Plan Hand-off*, and concept #3: *Lesson Plan Generator*. Both teachers valued the potential of these concepts for saving time and energy in finding stand-ins (i.e., adults affiliated with the school who could cover for teachers when needed) and preparing substitute teacher plans. They also valued the possible increase in consistency of Kaiapuni learning experiences. In response to concept #2, P3 shared that *"Right now there isn't anything digital available for sub teachers"* and that there was a great need for *"a centralized way to collect different curriculum to share between grades."* P6 described concept #3 as *"really accessible,"* expressing that they liked how the concept *"built in enough resources to support the substitute if they really don't understand what they're doing."* Findings from these sessions led us to combine concepts #2 and #3, merging stand-in coordination, resource centralization, prompt engineering guidance, and lesson plan generation.

Concept testing findings necessitated **task analysis** for further investigation of current processes for *requesting subs* and *preparing sub plans*; specifically, for when a teacher needs to take unexpected leave. We created a current and future state process flow with sketched wire-frames that were then validated with two additional partner-teachers.

With current and ideal process flows defined and validated, a persona and journey map were created to distill our understanding of the problem space. Our persona, *Kumu Miliani*, is informed by talk story sessions and site visits, and captures the background

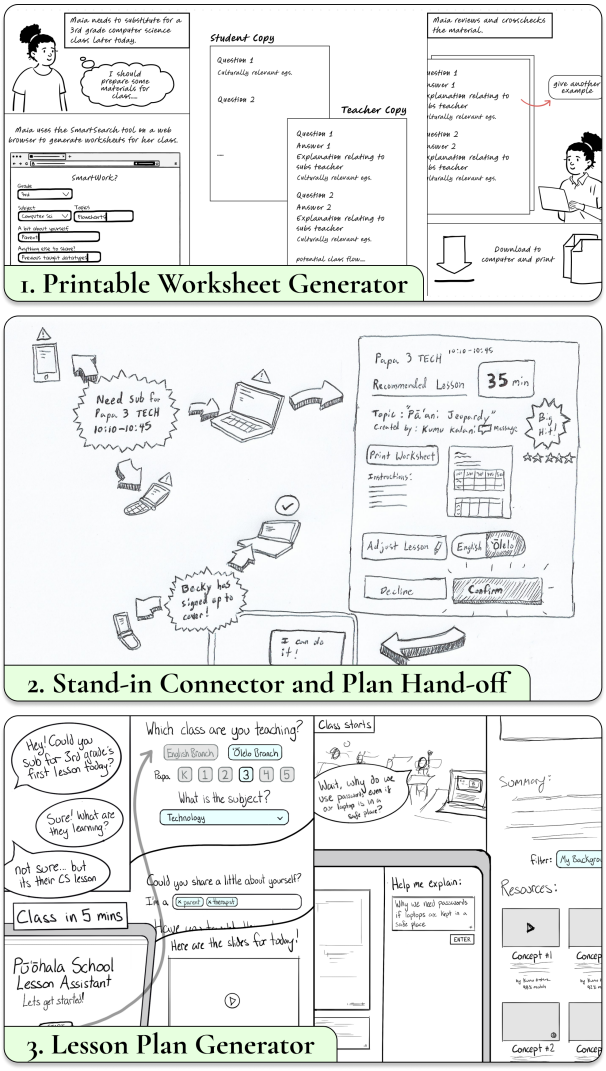


Figure 2: Concept Testing Sketches

and assets available to Kaiapuni educators (e.g., routines, printer, smartphone, etc.). Our journey map illustrates Miliani's process of finding a sub for her class, including her pain points (e.g., feeling ill), anxieties (e.g., "I need to call out sick"), and trust levels (e.g., "will the sub speak in ʻŌlelo Hawaiʻi?"). Figure 1 illustrates both Miliani's current and future state process flows. Currently, she calls her ʻŌlelo Hawaiʻi-speaking friend to ask for coverage (her friend cannot), submits a sub request (using a limited legacy platform), goes to the school to prepare her sub plan (despite feeling ill), and feels disappointment when she finds out that the sub did not speak in ʻŌlelo Hawaiʻi or attempt to incorporate cultural relevance. In the ideal process flow, Miliani submits a sub request (using a platform tailored for kumu), generates and edits a culturally relevant lesson (from home and with ease), and rests assured that immersion for her students will be maintained (knowing that an ʻŌlelo Hawaiʻi-speaking sub has been found).

We began **prototyping** our concept, building an interactive Figma [16] prototype of the core features needed to support the future state process flow. These features were: (1) Coverage Request — which requests a stand-in teacher to cover one's class; (2) Sub Plan Generation — which generates a sub plan for said coverage request; and (3) Sub Plan Editor — which allows kumu to edit and export a sub plan. This prototype would then be evaluated during the next phase.

6.4 Evaluation Phase

We conducted onsite **Wizard of Oz usability testing** with 11 teachers to evaluate the general usability of the designed features, and to elicit teacher reflections on generative AI tools for Kaiapuni education. Consent to record sessions was obtained from each participating teacher. The test comprised of three parts: (1) background questions related to the teachers' background and comfort level with technology; (2) two tasks to be completed using the prototype; and (3) an exit questionnaire measuring perceived usability of the system (System Usability Scale [30]). One team member facilitated the test while another took notes and tracked user experience *Key Performance Indicators* (UX KPI's) throughout. These included behavioral KPIs that tracked *task success rate* and *user error rate*, and attitudinal KPIs tracking perceived usability via System Usability Scale (SUS) questionnaire responses. Participants were tasked to (1) create a sub request, and (2) create a sub binder. We leveraged the Wizard of Oz [9] testing method in which a remote team member manually simulated system responses in order to mimic natural interaction between users and generative AI agents.

Finally, all usability testing results were analyzed. UX KPIs and SUS scores were calculated via descriptive statistics and session recordings were analyzed via grounded theory method. Findings identified opportunities for improvement and were prioritized by the team using a priority matrix along two axes: impact vs. effort. For example, opportunities for improvements that were rated *low effort* to implement yet were *high impact* for teachers were categorized as *quick wins* and should be among the first to be considered for design enhancements.

7 Results

7.1 Usability Testing Results

Results from the Evaluation phase are gathered and presented here for further discussion. UX KPIs were calculated and 105 total findings were identified and organized into three types: *usability issues*, *validations*, and *speculations*. Speculations comprised the majority of our findings and are defined as suggestions for improvement by teachers.

7.1.1 UX KPIs. UX KPIs measured task success rate and user error rate, while attitudinal KPIs measured perceived usability via System Usability Scale scores (SUS) [30]. We calculated a 100% task success rate and 12.11% user error rate but noted usability issues related to editing the generated sub plan. For attitudinal KPIs, the average rating for first impressions was "Slightly positive," with 4 participants reporting "Very positive", 4 "Slightly positive," and 2 "Neutral." We calculated a SUS score of 87, which corresponds to an *"A" or Excellent* rating of perceived usability [30].

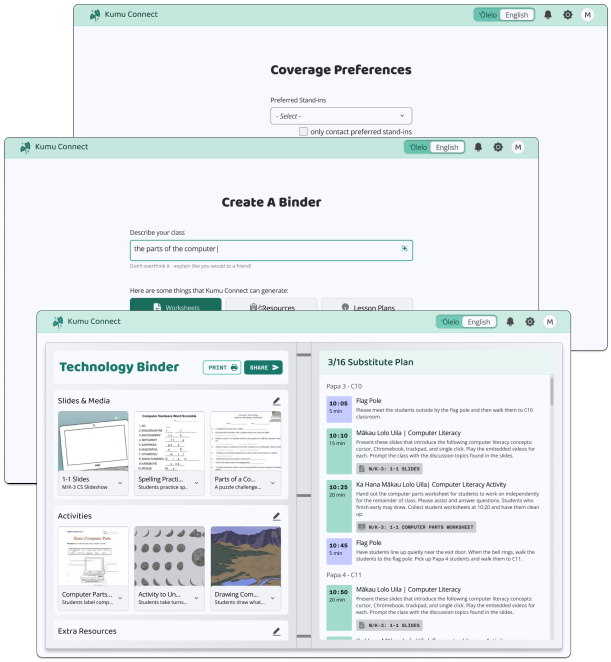


Figure 3: Kumu Connect prototype for requesting subs and generating lesson plans

7.1.2 Usability Issues. **Kumu Connect's sub plan generation screen and sub plan editor did not convey the distinction between static content, generated content, and editable content, making it difficult for teachers to understand what they were tasked with generating.** When tasked with generating a sub plan, P10 voiced their confusion: *"Is this something that he's already generated? Am I pulling up what he's creating or am I - I'm starting from scratch?"*. Similar to the issues with the sub plan generation screen, participants could not tell which content in the sub plan editor was already there and which content had just been generated.

Visual hierarchy of the sub plan editor was confusing, failing to align with existing mental models. Our presentation of the sub plan editor was meant to emulate a physical binder, however this lead to confusion regarding visual hierarchy and misinterpretation of the lesson resources within the left-hand section of the page. P8 described the overall look as *"not friendly,"* making it difficult for them to *"understanding what we're gonna do."* P9 specifically called out the left side as confusing and seemly extraneous, as *"everything seems to be here on the right."* **Additionally, the sub plan editor had counterintuitive editing interactions, making it difficult for educators to discover and make use of these functions.** P10 and P6 illustrated how the editing interaction did not align with familiar mental models – *"I'm just old school, you know? That [editing button] is confusing."* – and was not easily discoverable – *"I didn't know I could do that. Maybe if there was a little edit icon on each one, then I would know that I can change it"*.

7.1.3 Validation. **Kumu Connect could save time and support remote capabilities.** Teachers appreciated its time-saving potential and support for remote use, using positive adjectives (easy, simple, fast) to describe the coverage request feature. Educators specifically appreciated the AI-enabled lesson preparation feature (2 participants) and the ability to create sub plans from home (3 participants). Regarding the latter, 2 teachers brought up this benefit for supporting sick teachers as it would allow them to create sub plans from home. P3 explained how *"it would take me at least an hour"* to create a sub plan *"for one day's worth of lessons,"* contrasting this with the Kumu Connect prototype, which *"took 10 seconds"* to do the same task. P3 followed this up with *"And if I'm sick, this would be amazing."* P7 explained how the process of generating a sub plan and seeing the sub plan editor stood out to her: *"I always hear about AI, but I never trusted it enough to actually check it out. But seeing like how useful it was and how easy it made everything... it's kind of scary, like, in a good way."*

Kumu Connect's included resources were relevant and actionable. Educators gave positive feedback regarding the resources included in the sub plan and the time-stamped delivery schedule. P3 explained that they *"like how it's broken down by the minutes too and how you have an option to put the extra resources in."* P3 appreciated how the prototype included additional resources and details such as *"class lists... and the lunch line... and tips for that day..."* and reflected on how the prototype made them feel: *"Wow, you guys listened! I love that. Ok, this is amazing."* **Similarly, Kumu Connect plugged into existing practices and contexts, reflecting teacher's reality.** P5 shared that he enjoyed the user experience and felt that the project was *"on the right track"* in the way that it integrated with existing school practices, including *"the technical stuff... letting the office know what's going on,"* and, in general, being *"connected to the whole system."* P10 shared that she appreciated the testing experience, as it *"is good to see that someone's thinking about educators, so [I'm] very pleased that someone thinks more about what we're doing. Very, very good"*.

7.1.4 Speculations. **Systemically prioritizing ʻŌlelo Hawaiʻi immersion could alleviate multiple pain points specific to Kaiapauni learning environments.** Educators brainstormed how a tool like Kumu Connect could alleviate their pain points around transferring responsibilities to stand-in teachers, especially in regard to maintaining language immersion. Two ʻŌlelo branch teachers – P8 and P11 – suggested enhancements to the Coverage Request feature to either automatically prioritize ʻŌlelo Hawaiʻi-speaking stand-ins or filter out all non-ʻŌlelo Hawaiʻi-speaking stand-ins, which would allow them to quickly connect with stand-ins who could maintain language immersion. P11 gave an example of a situation that could have been improved by including languages-spoken as a factor in the substitute-matching process: That very morning, 2 English branch classes and 1 ʻŌlelo branch class needed stand-ins, and one of the available stand-ins, a parent in the community who spoke ʻŌlelo Hawaiʻi was assigned to an English branch class.

Inspired by the activity titles shown in English and ʻŌlelo Hawaiʻi, P7 commented on how the platform could be optimized for subs who don't speak ʻŌlelo Hawaiʻi, yet who need to stand-in for Kaiapuni classes; an unfortunately common occurrence:

> *"If a sub doesn't speak Hawaiian, at least the sub could reference the name of the assignment or what they're gonna do. Like, 'Hana Mākua Lolo Uila' and the kids*

> *will know. Versus if you tell them, 'Ok, we're gonna do a computer literacy activity', they might have a hard time understanding."*

P4 shared how providing ʻŌlelo Hawaiʻi resources would also be helpful beyond immersion classes, as all students and teachers participate in practices like morning *oli* (songs). P4 explained how *"It'd be really nice to have links to [the oli],"* not just *"so you don't look like the insane white person not knowing what the words are"* but also because *"you're trying to get the kids to do it,"* which is an important part of their daily routine that often is omitted in stand-in teaching.

Guided incremental prompt engineering could make AI generation features accessible to educators who are not confident with new technologies. In both the initial sub plan generation page and in the sub plan editor, educators expressed that they would like to see examples and options for prompt creation. As P8 asked before creating her prompt, educators wondered *"What can [Kumu Connect] generate?"* P3 brainstormed ways for prompt engineering to be more friendly for teachers who *"are not as technology savvy,"* speculating on the idea of providing *"categories that they could just click instead of typing it in."* When reflecting on the difficulty of editing the sub plan, 5 teachers expressed that they would like on-screen guidance - voicing this as a need for themselves or for their less technical colleagues. P6 , P3 , and P10 offered the idea of instructional videos, P8 described a step-by-step tutorial with *"the actual screen and arrows,"* and P6 , upon seeing a micro-interaction in the prototyping software itself, shared how helpful it could be if buttons *"blinked"* to draw attention to next steps.

Teachers held varying expectations for the volume of generated options. Teachers varied in how many generated options they would like to have when re-generating a lesson or activity in the sub plan editor. In response to our testing scenario, which asked teachers to regenerate a generated worksheet into an interactive game, P5 expressed that he would like *"an option to say 'no, next game'"* rather being presented with many options that he would have to read. Similarly, P4 expressed that she liked how Kumu Connect, in comparison to another AI lesson plan generator she had used, was *"simplified"* and didn't produce *"four paragraphs of a response."* Instead, *"it just gives you a little bit, which I like."* In contrast, P3 expressed a desire for many options, saying:

> *"Can you imagine? If you typed in 'third grade games for that [standard]', if underneath it popped up like 50 different games that are all on target for what you're trying to teach at that time. And then I have the option to pick and choose what I want to actually put into that [sub plan]."*

Teachers' varying desires for these outputs did not correlate with how tech-savvy they considered themselves to be.

7.2 Final Designs

After analysis of the results above, we created design recommendations for all findings. We then created a priority matrix, categorizing design recommendations by their level of needed effort to address with their potential impact for teachers, prioritizing Quick Wins (low effort, high impact) and Critical Changes (high effort, high impact) for our next round of design iteration, outlined below.

Coverage Request. We updated the Coverage Request form to include information such as CS standards identifiers and codes that aligned with the currently used absence request platform.

Sub Plan Generation. We included a step-by-step tutorial, as well as "previews" of other teacher inputs, to provide more guidance for prompt engineering. In response to teachers not being able to recall details of their request while creating a sub plan, all request details were now shown within a left-side panel in the editor.

Sub Plan Editor. We updated the style and layout of the sub plan editor page to align with what teachers liked about the initial design - specifically the step-by-step guidance of the generated plan. The updated layout prominently features the sub plan, offering navigation to other resources in a side menu, and incorporating AI assistance on a floating right-side module. Due to the high degree of confusion around pre-prepared versus newly generated material, we leveraged a model similar to "comment" features found in cloud word document editors, featuring newly generated content via highlights and corresponding AI "comments". We addressed confusion over the affordances of editing, as well as manual editing vs AI-assisted regeneration, by making the two editing approaches visually distinct and discoverable. Manual editing was updated to align with familiar functions found in word document editors, allowing users to directly edit as they would in common text editing programs. AI-assisted editing - or regenerating - is supported by the right-side module, where newly-generated material is not only highlighted, but has a corresponding prompt input and suggestions for regeneration options. Lastly, we improved the print and share flows - a feature of high priority due to its alignment with existing assets - making the action itself more discoverable through layout changes, and clearly conveying the final output through a pdf preview.

8 Discussion

This case study explored the use of HCI methodologies to collaboratively design place-based, generative AI tools with Kaiapuni educators. Below, we discuss insights related to generative AI for teachers and trust-based HCI research practices, and call for increased research partnerships in support of Kaiapuni education.

Generative AI edtech tools can embody Kaiapuni values (but only if feedback is iteratively integrated). As culturally appropriate and immersive learning environments are core to Kaiapuni education [41], it is vital for edtech platforms to be shaped by Hawaiian perspectives. This work saw teachers provide ideas for how language immersion could be maintained in the face of substitute teaching scenarios (e.g., by prioritizing ʻŌlelo Hawaiʻi-speaking stand-ins, supporting stand-ins who don't speak ʻŌlelo Hawaiʻi, and providing ʻŌlelo Hawaiʻi resources like daily oli). This level of feedback was only made possible through an iterative Design Thinking process in which we partnered with Kaiapuni teachers during school visits, concept testing, usability testing, etc. This case study strengthens evidence for Nyaanba et al.'s call for iterative refinement processes that partner with Indigenous educators to greatly enhance cultural responsiveness of generative AI and their usefulness to educators [36, 37]. Design Thinking and assets based design embody these user-focused and grounded iterative process

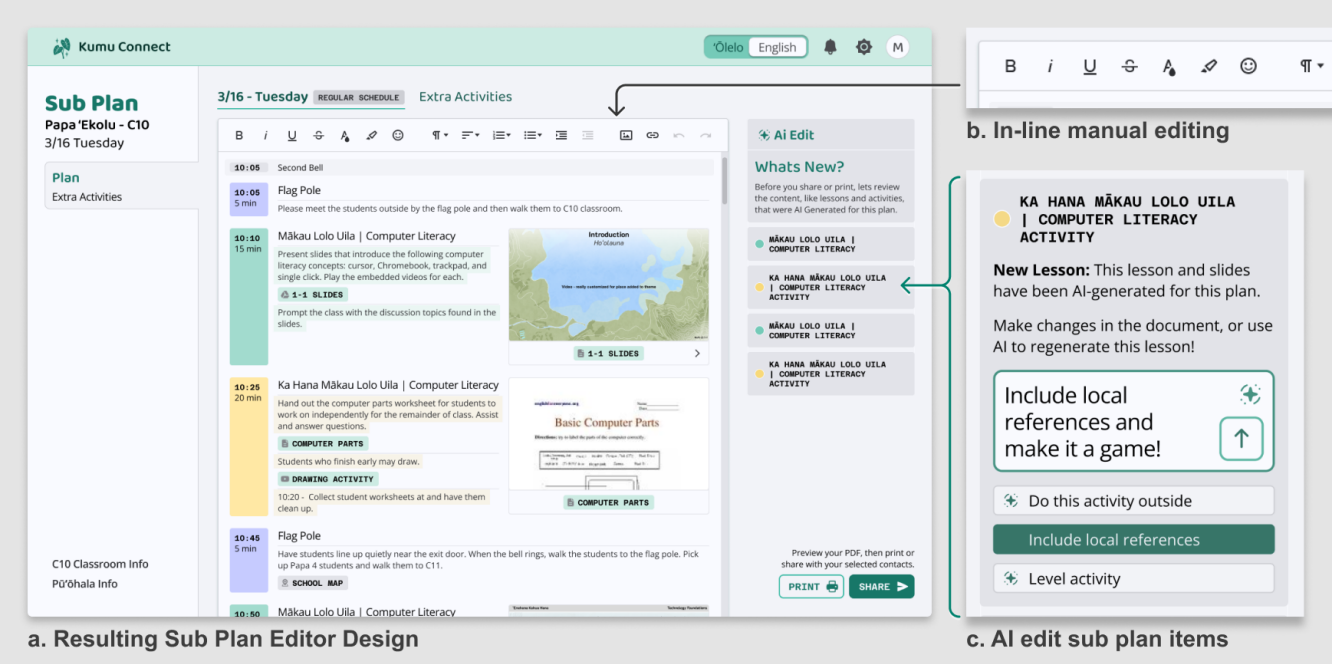


Figure 4: Resulting design of the Kumu Connect lesson plan editor

by their very nature, and offer powerful frameworks for informing culturally responsive generative AI tools.

Trust-based research practices are successful in surfacing Kaiapuni educator perspectives. To foster collaboration, it is imperative that design processes proactively work to establish trusting relationships. For our Kaiapuni teacher-partners, previous site visits and talk story [18] accelerated our participant recruitment (via word of mouth), and allowed us to easily probe into important specifics (e.g., details in the sub request process and the importance of finding ʻOlelo-speaking stand-ins). We also hypothesize that this trust allowed educators to be frank in their speculations and ideas for improvement at each touch point, similar to Keaulana et al. [25]. Behaviorally, our trust-building methodology produced results that highlighted an important distinction between individual teachers: those who are comfortable with new technologies desire greater control within a platform like Kumu Connect, and those who feel less comfortable with technology desire straightforward and assistive features.

Design Thinking and assets based design can produce real and future value for Kaiapuni educators. HCI methodologies and assets based design [43, 50] offer rich frameworks for investigation and design in the context of Kaiapuni education. This was evidenced by the overwhelmingly positive reactions to Kumu Connect, despite its initial usability issues. Usability testing findings were used to inform value-driven enhancements such as pivoting from a "binder" metaphor to a text editor, and the display of sub request details while generating sub plans. As this work seeks to design technologies that embody Native Hawaiian values, *Critical design*, represented via our speculative prototype, allowed teachers to reflect on how a system could help their current teaching practices (e.g., place based generative AI, peace of mind when requesting leave, etc.). This reflection is of not unlike Dator's "Alternative Futures" exercise in which participants convincingly experience a potential future scenario and determine "how they might successfully thrive in such a future." [11]. By extension, final designs incorporated teachers' reflections to successfully embody aspects that they deemed preferred and valuable. An assets-based design approach proved to be effective in driving teachers' want to adopt the platform. Its potential to integrate into current assets was met with approval (e.g., its use of known sub request codes, facilitating coordination and communication between teachers and school staff, inclusion of well-known routines, and its ability to print out resources). Each of these aspects amplified current practices and thus teachers were able to easily envision their value and use.

Dedicated CS education research in support of Kaiapuni education is sorely needed. This is evidenced by teacher stories about inequitable stand-in processes (e.g., ʻŌlelo Hawaiʻi-speaking sub assigned to English branch, stand-ins speaking only in English) and teacher excitement of and positivity towards Kumu Connect (e.g., "good to see that someone's thinking about educators"). This sentiment was best represented by P3 : "*You guys listened! I love that! Where were you guys 10 years ago? Ok, this is amazing. I'm floored with what you guys came up with from the last time that we talked!*" This statement, and others like it, provides strong evidence for the effectiveness of trust-building research practices for Kaiapuni and Indigenous learning environments and indicates the positive potential for place-based, generative AI educator tools.

8.1 Limitations and Assumptions

Several limitations are present within this work that warrant acknowledgment. First, our attitudinal results (i.e., UX KPIs and SUS score) while reflective of high perceived usability were in contrast to behavioral results. We hypothesize that due to our trust-based approach, positivity bias may have been a factor. Second, while Wizard-of-Oz testing simulated culturally responsive generative AI outputs, much work is still needed before actual implementation to guard against unintended outputs that perpetuate educational neocolonialism, Western biases, and hallucinations [36]. Third, this case study may not be reflective of wider Kaiapuni programs across the Hawaiian islands. Finally, while informed by Kaiapuni educator perspectives, final designs reflect our interpretations of findings which inherently may reflect unconscious biases.

8.2 Future Work and Conclusion

Our future work, and CS education research as a whole, requires further investigation into several areas. First, subsequent usability testing is needed to validate latest designs and inform next iteration improvements. Second, additional research is needed related to Native Hawaiian generative AI models [32]. Finally, there is a need to bring this work to an expanded set of Kaiapuni schools to compare methodologies, identify other place-based needs, and inform needed features and enhancements.

Place-based education and language immersion are vital Kaiapuni learning environments that embody Native Hawaiian values, cultivate community, and revitalize Hawaiian culture. However, disparities between ʻŌlelo Hawaiʻi and English language resources present ongoing challenges for Kaiapuni educators. Through this case study, we collaboratively designed a generative AI teacher support platform in partnership with a Kaiapuni program that leveraged methods from the field of Human-Computer Interaction (HCI). This work provides evidence for such methods in their ability to bring form to the aspirational needs of Kaiapuni teachers, and acts as an exemplar for culturally revitalizing generative AI technologies for Indigenous learning communities.

Acknowledgments

We thank our partner school, kumu, and community members for sharing their knowledge and experiences with us, and welcoming us into their classrooms and communities. None of this work would be possible without the support from our Kaiapuni partners, families, and community. This research is based upon work supported by the National Science Foundation under award numbers CNS-2137784 and CNS-2345488. We would also like to acknowledge support by the Alfred P. Sloan Foundation, VMWare, Google, and Catherine M. and James E. Allchin. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or other supporters.

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