Designing and Evaluating an Interactive Hawaiian Language e-Textbook

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Abstract: Today's college students have access to a wide variety of technologies that can be used to support and enhance their educational careers. One such technology, the digital textbook, or "e-textbook," is leading many to abandon traditional textbooks in favor of these digital alternatives. Research has shown that students enjoy the portability of e-textbooks, and especially appreciate their convenience and ease of use. The textbook currently being used by first year Hawaiian language students at the University of Hawai'i at Hilo is offered in print-only format, and the purpose of this usability study was to develop and evaluate the first two chapters of the textbook as an interactive Hawaiian language e-textbook. Eight first-year Hawaiian language students participated in the study, which included a usability protocol and pre- and post- attitudinal surveys. Results of the study indicated that students found the book easy to navigate and enjoyed the interactive features of the book—which included audio recordings, hyperlinks, and digital worksheets. Seventy-five percent of the participants preferred the digital version of the textbook to the printed version. These findings have implications for how e-textbooks should be designed to best meet the needs of second language students.

Introduction

The textbook currently being used in first-year Hawaiian language courses at the University of Hawai'i at Hilo (UHH) is the *Nā Kai 'Ewalu: Beginning Hawaiian Lessons* textbook written by Dr. William H. Wilson and Dr. Kauanoe Kamanā, and published by the Hale Kuamo'o Hawaiian Language Center. *Nā Kai 'Ewalu* is the primary text being used in Hawaiian language courses at the University of Hawai'i at Hilo. The text is also used by numerous other community colleges, universities, high schools, and private individuals. The instruction in the text is presented through a unique grammatical system, called the *"Pepeke System"* that was developed by the authors of *Nā Kai 'Ewalu*. This system explains the rules and structure of the Hawaiian language through a Hawaiian perspective—equating Hawaiian sentence structures to the body of an octopus, with the *po'o* (head) as the verb, *piko* (navel) as the subject, and the *'awe* (tentacles) as the predicate. All grammatical terms used in the text are also presented in Hawaiian. *Nā Kai 'Ewalu* is currently available in print-only format. Print-only textbooks are by nature less

interactive than their digital counterparts—unable to provide features such as active hyperlinks and embedded media like audio and video—features that are especially useful in the language classroom setting.

Galla (2009) examined the role that technology plays in the instruction and revitalization of indigenous languages. The author identified four key roles, they are 1) preserving the language, 2) using technology to develop and disseminate materials in the indigenous language, 3) providing learners with multiple ways to acquire the language, and 4) providing those in the indigenous language revitalization community with the means to share their methods and practices in language preservation. Galla (2009) noted the importance of converting printed materials into digital form in order to preserve and maintain the resources for future generations. Although there are a number of electronic resources available through the Hawaiian language, for example, those found on the Hawaiian Digital Library website Ulukau.org, the *Nā Kai ʻEwalu* textbook has yet to be developed in digital form.

With an increased presence of tablets and e-readers, such as the iPad and Kindle, in the educational setting, there is an increasing demand for digital textbooks in college courses (Reynolds, 2011). Students enjoy the portability of digital textbooks, called "e-textbooks," and appreciate how easy it is to search for particular concepts, especially for research papers, quizzes, and tests (Weisberg, 2011). Students in first-year Hawaiian language courses at the University of Hawaiʻi at Hilo (UHH) do not have access to the portability and convenience of a Hawaiian language e-textbook since one does not currently exist. Therefore, the purpose of this usability study will be to develop and evaluate the first two chapters of an interactive Hawaiian language e-textbook for first-year Hawaiian language students at UHH. The publisher and authors of *Nā Kai ʻEwalu* granted permission to use the content in the printed text in the development of the digital version of the text. The data collected from this study was used to identify best practices in the design and usability of e-textbooks, especially textbooks used for second language instruction. The specific research questions addressed during the study were:

- How easy or difficult was it for first year Hawaiian language students to navigate the e-textbook?
- How easy or difficult was it for first year Hawaiian language students to access the interactive features in the e-textbook?

Literature Review

There has been an increase in the use of digital textbooks in higher education. Reynolds (2011) examined the factors that are influencing the increased use of digital textbooks in colleges and universities in the US. Data were collected from leading e-textbook producers and retailers and from a survey conducted in 2009 by college bookstores that compared e-textbook and printed textbook sales. According to those sources, from 2007 to 2009, the percentage of college students who had used an e-textbook increased by 24%. Digital textbooks are more likely to be purchased if they are affordable and easily accessible. Textbooks that can be accessed on multiple platforms, such as on desktops, smart phones, and tablets, are also popular amongst college students. The most popular

software used to produce digital textbooks is the EPUB format. New, updated EPUB software was released in 2011 that allows for multimedia integration into the digital textbooks. The main focus of this research was on the market and sales aspect of digital textbook publication, and did not provide enough information on the features of digital textbooks that students find most useful. Information on the attitudes and perceptions of college instructors on the use of digital textbooks in their instruction was not examined. A study conducted by Sun, Flores, and Tanguma (2012) examined the impact that digital textbooks have on student learning at a southern university in the United States. This research revealed that students are more engaged and have better learning outcomes when using interactive digital textbooks. Teachers play a large role, however, in providing a venue for the use of the textbooks and incorporating the use of the textbooks into their instruction.

One possible benefit to using e-textbooks for second language instruction was described by Atkinson (2010). In the research report, two approaches for effective second language instruction were described —the extended cognition approach, where learners make connections between what they're learning and the external environment; and embodied cognition, where learners internalize what they're learning by using "bodily states and actions." One advantage e-textbooks have over traditional printed textbooks are that videos and audio features can be embedded into the files to allow for increased engagement between the reader and the material.

An approach for effective second language instruction was described by Paesani and Allen (2012), who believe that a more holistic approach to second language instruction, where connections are made between language, literature, and culture, is the best way to keep students engaged in learning the target language. Second language programs that adopt this holistic approach will also have more success retaining students from introductory language courses to more advanced language courses. This is another area where e-textbooks have an advantage over standard printed textbooks, since videos demonstrating cultural practices and links to relevant literature can be embedded into the content.

A study conducted by Chong, Peng, and Ling (2009) found that the design of the ebook plays a critical role in how the ebook will appeal to the learners. The study examined particular ebook designs that are preferred by learners and reported on specific elements that should be incorporated into ebook design. These elements include "dynamic, interactive visuals" and "hyperlinked cross-references and multimedia" (Chong et al., 2009). A graphic design book entitled "White Space is Not Your Enemy" by Hagen & Golombisky (2013) will be used as the primary resource for the visual design of the *Nā Kai 'Ewalu* e-textbook. Hagen & Golombisky (2013) state that design must be practical and useful. Examples of "good design" are provided in their book, including information on selecting fonts, use of color, and creating visually appealing layouts. Examples were also provided of good design in multi-media projects.

A study by Ellis, Abreu-Ellis, Carle, & Berry (2011) described how students in second language courses prefer instruction that integrates the use of multimedia technology such as PowerPoint presentations and video-conferencing. The use of those types of

technologies enables students to form stronger connections between the content and their own lives. Although it is not possible to include real-time video conferencing in e-textbooks, it is possible to embed links within the content that allow users to navigate to sites where videoconferencing can take place and where presentations can be viewed.

Project Design

In the existing, printed version of *Nā Kai ʻEwalu,* each chapter includes the following elements: *Ka Papa Kuhikuhi* (table of contents), *Ka Papaʻōlelo* (vocabulary list), *Nā ʻŌlelo Pōkole* (short phrases), *Ka Pāpāʻōlelo* (sample dialogue), *Nā Pahuhopu* (language objectives), *Ka Hoʻoilina o ka ʻŌlelo Hawaiʻi* (the legacy of the Hawaiian language), and *Nā ʻŌlelo Hoʻākāka* (sentence structure clarifications). For the purposes of this project, the existing printed text of *Nā Kai ʻEwalu* was transferred into Apple iBooks Author software, where the digital interactive features were designed and created. Sample pages of the e-textbook are shown in Figure 1. In addition to the elements from the printed text listed above, the digital textbook included the following interactive elements:

- audio recordings of the Hawaiian vocabulary words and dialogue in the *Papaʻōlelo, ʻŌlelo Pōkole,* and *Pāpāʻōlelo* sections;
  - QuickTime software was used to create the recordings, which were embedded in the e-textbook as MP3 files.
- links to external Hawaiian language resource websites, such as the Hawaiian digital library Ulukau.org, in relevant areas of each chapter;
- digital worksheets of each lesson in the *Pahuhopu* sections of the text;
  - Adobe Acrobat software was used to create form-fillable PDF worksheets
- navigational features, such as cross-referencing links (i.e., from chapter-chapter, within each chapter);
- and graphical elements to make the text visually appealing.

Figure 1. Sample pages from the *Nā Kai ʻEwalu* e-textbook.

Figure 2 is an image of a section of the audio from the chapter 1 vocabulary list. The audio was accessible in two different ways. The first way was through the use of an embedded audio slider bar, shown in black. Participants could click on the white triangle on the bar to hear all of the words in that section read aloud in a list. The white diamond slider could also be used to fast-forward or to rewind through the list. The second way to hear the audio was to click on each of the individual words that were underlined in blue. Once the participants clicked on the word, they were taken to an external website on the Safari browser where the audio was stored, where they listened to the individual word. They then needed to navigate back to the e-textbook in the iBooks program. Participants in this study commented that they liked having both options to listen to the audio.

Figure 2. Sample section of audio from chapter 1 vocabulary list.

Apple iBooks Author software was chosen as the program base for the design of the e-textbook due to its simple user interface and its compatibility with Apple iBooks software, which was used to display the book during the usability study. The other programs used in the e-textbook development, QuickTime and Adobe Acrobat, were chosen for their compatibility with the Apple iBooks Author software.

Although graphical elements were added to the e-textbook, the visual design of the e-textbook very closely resembled the printed version of the textbook. The reason for using a similar visual design was so a student using the e-textbook could work alongside a student using the printed textbook with minimal confusion. This is a scenario frequently seen in the modern classroom— where in the same class, some students use printed textbooks and some use tablets with e-textbooks.

Each usability test session was recorded with the use of the Screencast-O-Matic program. This program not only recorded the audio of each session, but also recorded the on-screen movements of each participant.

Methods

The target audience of this project was current first year Hawaiian language students at UHH. The average Fall/Spring enrollment in first-year Hawaiian language courses at UHH is between 40-60 students per semester. Students in these courses come from a broad range of demographics. In this study, the eight participants ranged in age from 18-

55+. While all of the students were current first year students, 50% of the students had more than one year of Hawaiian language coursework.

During the prototype development phase, a copy of the draft e-textbook was provided to the instructors and to fellow cohort members for review and feedback. The information was used to improve the design and function of the final e-textbook. Once the final prototype was completed, the usability sessions were scheduled as one-on-one sessions. An invitation, in the form of a flyer, was sent out to all first year students to participate in the study. The first eight students to respond were invited to participate in the study and evaluate the usability of the e-textbook.

All participants were asked to sign a consent form indicating their agreement to participate in the study and have their voices recorded during the session. Each participant also completed formative evaluations in the form of an entrance survey, that collected demographic and baseline e-textbook use information; and an exit survey, that collected feedback on the usability and design of the *Nā Kai ʻEwalu* e-textbook.

Upon signing the consent form, participants first completed the entrance survey, and then were provided access to a developer version of the e-textbook in iBooks. A laptop was provided by the facilitator so the students could view the e-textbook and participate in the usability session. Audio and screen movements of each session were recorded and notes were taken from the recordings to document comments made by the participants during each session.

The format of the usability testing followed the format described by Krug (2009), where the focus is on obtaining the participant's opinion on the usability of the material being tested, and no quantitative data is collected. Krug (2009) also described how each participant should be given scenarios and a set of tasks they will need to complete during the session. The tasks in this usability study included navigating to specific locations in the e-textbook, listening to the recorded audio, and completing one of the embedded worksheets. Each session lasted between 45 minutes to one hour. Participants were reminded throughout the session that the focus of the study was on the product and not on the participants themselves— a technique encouraged by Barnum (2010) to put the participants at ease.

Results

In the entrance survey, participants were asked to share the number of hours they spend per day using digital devices. The majority of participants (75%) spend more than 3 hours per day using their devices. These devices include laptop computers, desktop computers, tablets, smartphones, and e-readers, with laptops being the device they use most frequently (87%), and e-readers, like the Kindle and Nook, being the device that they use least frequently (37.5%). Participants were also asked whether they prefer printed books or e-books for reading in general, and the responses were split evenly (50%-50%). However, when asked which they prefer for academic reading, 62.5% preferred e-books.

All eight participants successfully completed each of the six tasks. However, not all participants followed the predicted clickstream in their completion of each task. For example, in task 1, participants were asked to navigate to the chapter 1 vocabulary list. The researcher predicted that in order for the participants to complete this task, they would first scroll to the table of contents in the book, then they would click on the shortcut link that would take them directly to the chapter 1 vocabulary list. The majority of participants did not follow that predicted clickstream, choosing instead to swipe through the pages until they reached the requested page. Table 1 shows the frequency at which the predicted clickstream was followed for each task.

Table 1. Frequency at which Predicted Clickstream was Followed

Task	Description	Followed predicted clickstream	Did not follow predicted clickstream
1	Navigate to chapter 1 vocabulary list.	25%	75%
2	Listen to audio pronunciation of vocabulary word.	100%	—
3	Download and complete worksheet.	100%	—
4	Navigate from beginning of book to chapter 2.	75%	25%
5	Use in-text shortcut to navigate to chapter 2 vocabulary list.	100%	—
6	Navigate to chapter 1 vocabulary list from within chapter 2 lesson.	87.5%	12.5%

For each task, participants were asked to rate their level of frustration in completing the task on a 0-3 scale—with 0 for "zero frustration," and 3 for "very frustrating." Results of each session are shown in Table 2. The results show that the majority of the participants completed each task with no frustration. Task 4, where the participants had to navigate from the front of the book to chapter 2, was the least frustrating task, with 100% of participants rating it as 0 frustration. In this task, the majority of the participants used the hyperlink to the chapter in the table of contents, making the task very simple. Task 3 had the most varying levels of frustration, with some finding it not frustrating at all, and some finding it very frustrating. This task was frustrating for some participants because they had to leave the iBooks program to access the worksheet with the Adobe Acrobat program, then navigate back to the iBooks program—which was difficult for some. Task 6 was the most frustrating task, with the majority of participants rating it as little to somewhat frustrating. Participants commented that this task was frustrating because they wanted to be able to click on the word in the chapter 2 language lesson and go directly to the definition of the word in the chapter 1 vocabulary list. This feature was not included in the book, which meant that participants had to swipe back and forth between the pages.

Table 2. Scenarios and Levels of Frustration

Task	Description	Frustration=0	Frustration=1	Frustration=2	Frustration=3
1	Navigate to chapter 1 vocabulary list.	62.5%	25%	12.5%	None
2	Listen to audio pronunciation of vocabulary word.	37.5%	50%	12.5%	None
3	Download and complete worksheet.	50%	25%	12.5%	12.5%
4	Navigate from beginning of book to chapter 2.	100%	None	None	None
5	Use in-text shortcut to navigate to chapter 2 vocabulary list.	87.5%	12.5%	None	None
6	Navigate to chapter 1 vocabulary list from within chapter 2 lesson.	37.5%	37.5%	25%	None

In the exit survey completed by each participant at the conclusion of the usability session, all eight participants indicated that the e-textbook was either very easy (37.5%) or somewhat easy (62.5%) to navigate. All participants also thought that the visual appeal of the e-textbook was either excellent (37.5%) or good (62.5%). Participants stated that their favorite feature in the e-textbook was the audio recordings of each of the vocabulary words and short phrases. Some participants found the book difficult to navigate, especially when the task required leaving the iBooks program to access an external website where some features were stored (i.e., audio links and worksheets). Participants stated that the book could have been improved by including more audio links, more visual icons, more navigational aids, and interactive games and activities throughout the book. The majority of the participants (75%) indicated that they prefer the digital version of *Nā Kai ‘Ewalu* to the printed version, one (12.5%) indicated that they like both versions, and one (12.5%) indicated that they still prefer the printed version. Among the reasons given for their preference for the digital version, were that it is convenient, user friendly, and has better features. The reason given for preferring the printed version was "I'd rather not carry my iPad around with me at all times."

Discussion & Conclusions

The data presented in Table 1 and in the exit survey addressed the first research question of this study of how easy or difficult it was for the Hawaiian language students to navigate the e-textbook. In both sources of data, 100% of the participants felt that the book was easy to navigate. One observation made by the researcher was that some students chose to forgo using the provided shortcuts and in-text navigation aids to jump ahead to a particular page, and instead chose to swipe through the pages until they found what they were looking for —just as if they were using a printed book. However, the choice to not follow the predicted clickstream did not impede their ability to complete the tasks. Based on the data received, it can be deduced that the book was easy to navigate. The participants requested that more navigational aids be included in future versions of

the e-textbook, such as more arrows to indicate page direction, more shortcut tabs, and the inclusion of an index that will allow users to go directly to a specific word.

The data presented in Table 2 and in the exit survey addressed the second research question of this study of how easy or difficult it was for the Hawaiian language students to access the interactive features in the e-textbook. Although all of the participants were able to access the audio files and worksheets that were included in the book, several participants commented that their level of frustration increased whenever they had to leave the iBooks program to listen to one of the audio recordings (stored in Google Drive), or download the worksheet (requiring the Adobe Acrobat application). They found it difficult to navigate their way back to iBooks once they were done accessing the external documents. The participants requested that in future versions of the e-textbook, audio files and the worksheets be embedded into the iBooks program. In spite of the frustration they experienced accessing these interactive features, particularly the audio files, all of the participants commented that the included features were "very helpful" and "really cool."

This study was limited by the small sample size, however based on the data and feedback received, it is possible to draw some conclusions relating to best practices in e-textbook design. E-textbooks, especially those designed for second language instruction, should include as much audio as possible. One participant in this study commented that the whole book should be recorded in audio form, and another requested that in future versions, snippets of Hawaiian language conversation be included at the end of each chapter. Second language learners appreciate the ability to hear the details and nuances of a language, such as proper pronunciation and intonation—something that is not possible with printed texts.

E-textbooks should also include other interactive features, such as worksheets and active hyperlinks, that captivate readers and add interest to the book. Some participants in this study commented that they would have liked to see more word popups in the book, where you can click on the word, and the translation pops up–removing the need to have to navigate to and from the chapter vocabulary list. Other ideas for interactive features in e-textbooks include activities such as links to digital flashcards, vocabulary games, translation games, and built-in quizzes and assessments.

E-textbooks should be accessible on a variety of devices, and should not be limited to just one platform (i.e. Apple). One drawback of the iBooks program is that it is only accessible on devices running the Apple operating system. The *Nā Kai ‘Ewalu* e-textbook used in this study further limited participants in that it was only accessible on a desktop, laptop, or iPad. Students use a variety of devices to learn, including mobile phones, and in order to make e-textbooks accessible to as many students as possible, they need to be available across all platforms and a variety of devices.

The design of e-textbooks should be clean and clutter free, with large fonts and lots of white space to improve readability. Graphics should be included, however, the graphics should have a purpose, and should complement the content rather than compete with it

(Hagen & Golombisky, 2013). Features such as cross-referencing links and navigational aids (i.e., chapter-chapter) should also be included in the books to make them easy to navigate. As was demonstrated in this study, some users resort to familiar devices such as flipping (or swiping) through the pages rather than using the navigational aids. However, once the users get more familiar with these features, they are able to navigate through the book much more efficiently.

Finally, the e-textbook should be a self-contained unit, that is, all features should be accessible and embedded within the native program of the e-textbook (i.e., iBooks). Frustration levels definitely increase whenever there is a need to switch between apps, so features like audio snippets, and videos, and worksheets should be emebedded into the e-textbook.

In conclusion, this usability study was successful in the development and design of a Hawaiian language e-textbook that was both visually appealing and easy to navigate. Data collected from this study will be used to increase the selection of Hawaiian language resources at UHH and other educational institutions where the Hawaiian language is taught. Future research could explore the further development of the entire two volumes, and 27 chapters of the *Nā Kai ʻEwalu* textbook in digital form, as well as the digitization of other printed texts used in Hawaiian language courses.

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