Objectives

The objective of this study is to design, build, and evaluate an e-Learning system teach HIragana, a Japanese character set. Before any design considerations were made, learning objectives were developed to guide the design process.

Hiragana has a specific order. Traditionally, native Japanese speakers are taught a rigid structure for the language. They use a table of 46 basic characters that relies on knowledge of Japanese vowels and vowel-consonant pairs. This table structures the lesson plans for native speakers, but it assumes a great deal of knowledge of the language that non-native speakers need to have explicitly explained. With this in mind, the learning objectives were developed for the first 20 characters.

Upon completion of the system, learners will understand the structure of Japanese syllables, the vowels or vowel-consonant pairs mentioned earlier. They will also understand how the characters they learn represent these syllables. They will understand the general guidelines for writing Japanese characters, and know the specific stroke count for each character taught in the lesson. They will be able to recognize and reproduce the 20 characters.

The learning objectives were evaluated against Bloom's taxonomy for learning to determine the functional processes of learning that the lesson should stimulate. The resulting evaluation was used to determine practice functionality for users and to develop an exam for evaluation. The system should penetrate to the Evaluating level of the hierarchy. The following questions were developed for each level of the hierarchy:

- Remembering – How are the characters structured? What do they represent?
- Understand – How many characters should a given word have?
- Applying – Can the learner write the 20 characters on demand in no specific order?
- Analyzing – Can the learner differentiate the characters they have learned from each other?
- Evaluating – Can the learner pick out characters they haven't learned yet? Can they select specific characters from a group of similar characters?

Methods

The e-Learning system was developed as a website. Many design elements were influenced by this decision. Traditionally, websites have a high level of user control, users may view the different pages at their leisure and may have an intended order of information, but this order is usually not strictly enforced. Generally, websites are also open for revisiting. In this case, learners may use to the website multiple times over the course of a set duration. This method is also asynchronous, as a group of learners can move at their own individual pace. Therefore, the website should be built with novice and expert users in mind.

Hiragana is a phonetic character set, so in order to teach learners, they must have a basic understanding of English grammar and pronunciation. Additionally, the e-Learning system is a website, so learners must be able to open and use a web browser and be familiar with clicking on links to move from one page to another.

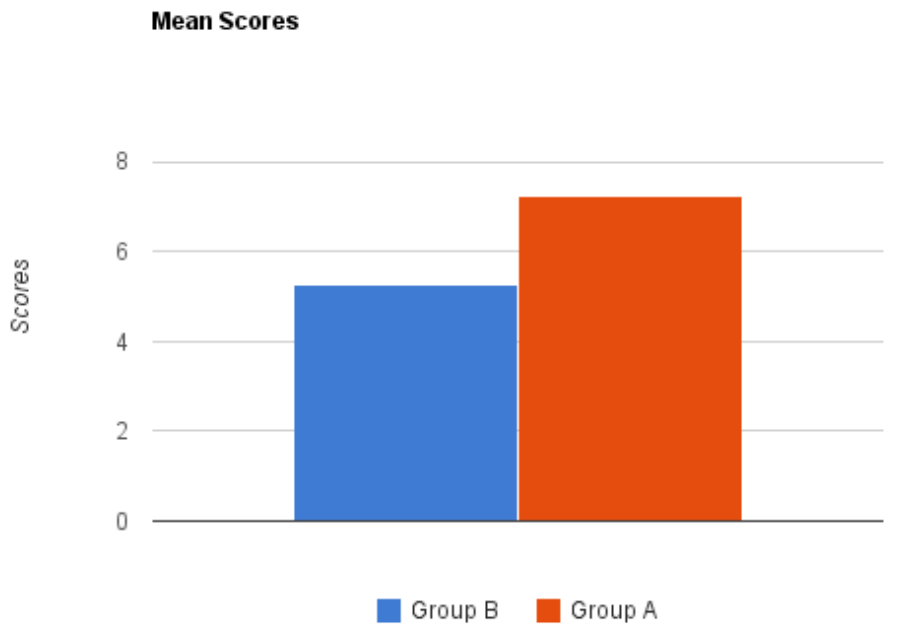
After completion of the design and implementation, the system was evaluated to test the questions relating the Bloom's taxonomy and the learning objectives. The website was made live at http://hiragana.tnels.com. 24 individuals were recruited to complete the lessons at a distance across three countries. Each was presented with an informed consent form and asked to sign and return it.

To test the efficacy of the multimedia principle, the 24 participants were divided into two groups. Group 1 had access to the videos for stroke order and writing, while Group 2 did not. They were each given a unique username and password to facilitate tracking of site use. A combination of Google Analytics and custom tracking was used to gather information regarding time on site, page views, lesson completion times.

The participants were instructed to use the site for five days and were then asked to complete an exam. The exam consisted of 10 questions that were similar to those in the practice section of the site. Both groups were given the same exam.

Results

Group 1 scored much higher on the exam than Group 2. Group 1's average score was 7.25 while Group 2's average score was 5.25. The probability of these scores, given a null hypothesis is 0.022. Therefore, the result is statistically significant $p < 0.05$. Using the multimedia technique does impact learning in this evaluation.



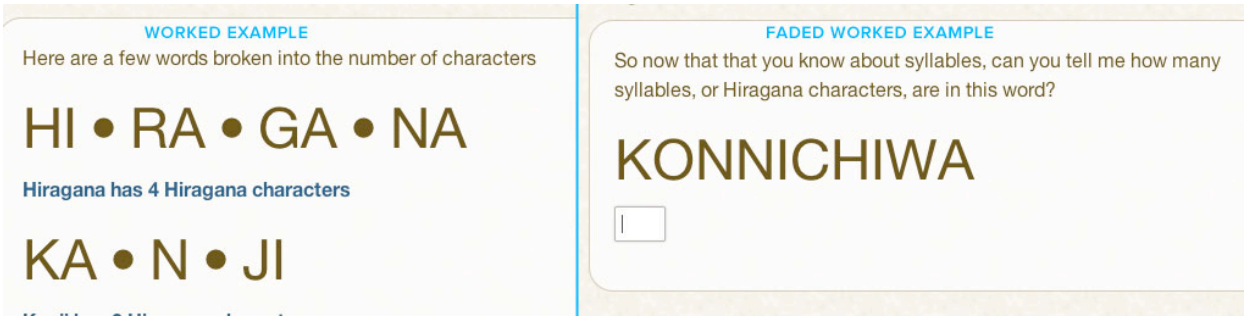
Additionally, it should be noted that only 60% of users finished all the lessons. Nine learners from Group 1 and five users from Group 2 completed the lessons. These learners also had the highest time on site. Group 1 had an average number of visits of 3.1 and an average time on site of 59 minutes. Group 2's average number of visits was 2.67 and their average time on site was 47 minutes.

Discussion

The website, Learn Hiragana, was designed and developed with the above learning objectives and guidelines in mind. It featured many design decisions intended to influence the learner from the Learner-centered Design principles and help them move through Bloom's taxonomy from Understanding to Evaluating. The design principles implemented include: Segmenting and pre-learning, user control, feedback, multimedia, contiguity, personalization, worked examples, and practice. This section will explain the design itself and describe the evaluation of the system.

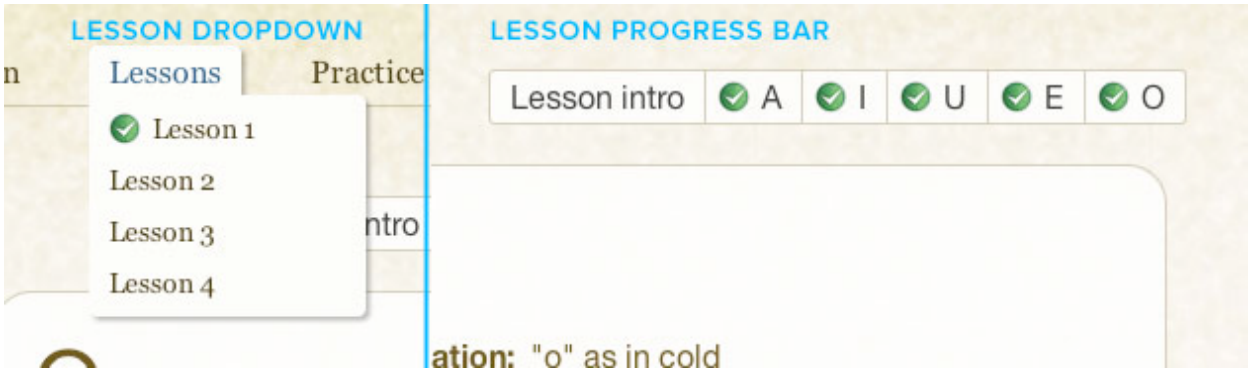
The site was divided into three main sections: Introduction, Lessons and practice. Both the Introduction and Lessons were segmented into subsections. The introduction taught the basics of Japanese syllables, the difference between English vowels, the relationship between vowels and vowel-consonant pairs, and introduced the Hiragana chart, in that order. Each subsection built on knowledge in the previous subsection. This required less user control (no linked progress indicators, see explanation of the lessons below) as skipping ahead would prevent the learner from continuing properly.

This section also featured worked examples as understanding of Japanese syllables is very important for understanding the relationship between characters and their phonetic translations. The worked examples faded to allow users to test their knowledge without leaving the flow of the lesson.



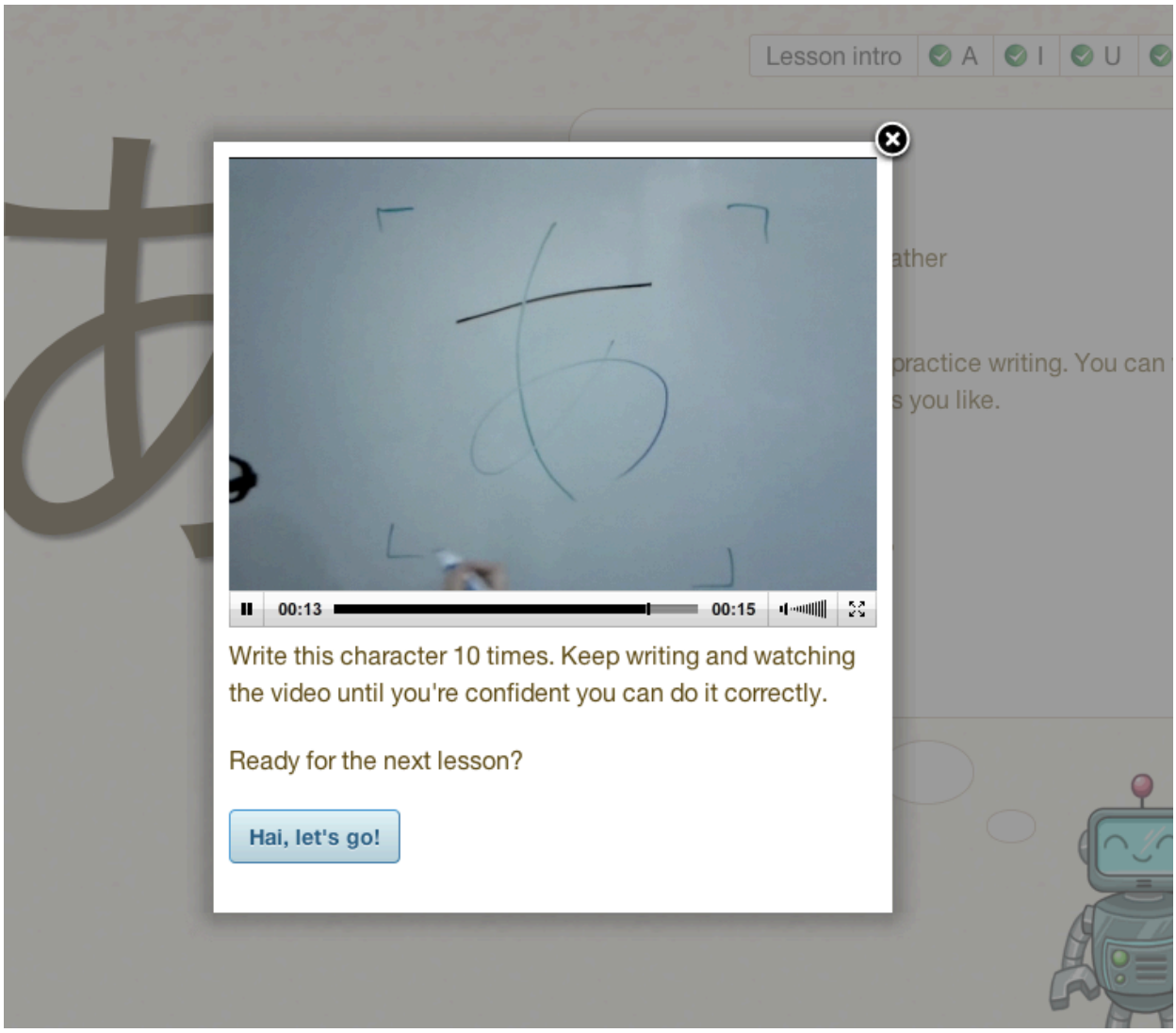
The segmented lessons, however, featured a high level of user control, as they would most likely be revisited by more advanced learners as a reference. Each lesson consisted of a row in the Hiragana chart.

Each section displayed its subsections before the learner could continue, to use the cognitive process model of learning, where the user understands what is being taught, and is able to gauge their progress. This concept was further reinforced by the progress indicators found in both the Lessons dropdown menu and the lesson progress bar, pictured below. The progress bar and lesson dropdown show the linear qualities of the lesson, but both are clickable as a shortcut. As sections are completed, they receive a small checkmark icon. In this way, novices will follow the linear lesson, and expert users can skip to the section they wish to review. It also functions to help returning learners continue where they stopped previously. These are examples of both the user control and feedback design principles.



To teach learners the writing of individual characters, the multimedia principle was employed. On individual character pages the learner was given an oversized example of the character and a brief explanation of the pronunciation of the character as well as the stroke count for writing the character. Then users were prompted to watch a video and write the character down (shown below). Each stroke was written in a different color and the same colors were used for each stroke (first stroke: black, second stroke: green, third stroke: blue, fourth stroke: red). The video is intended to give users a specific process for writing, and to reinforce the general writing rules explained in the introduction.

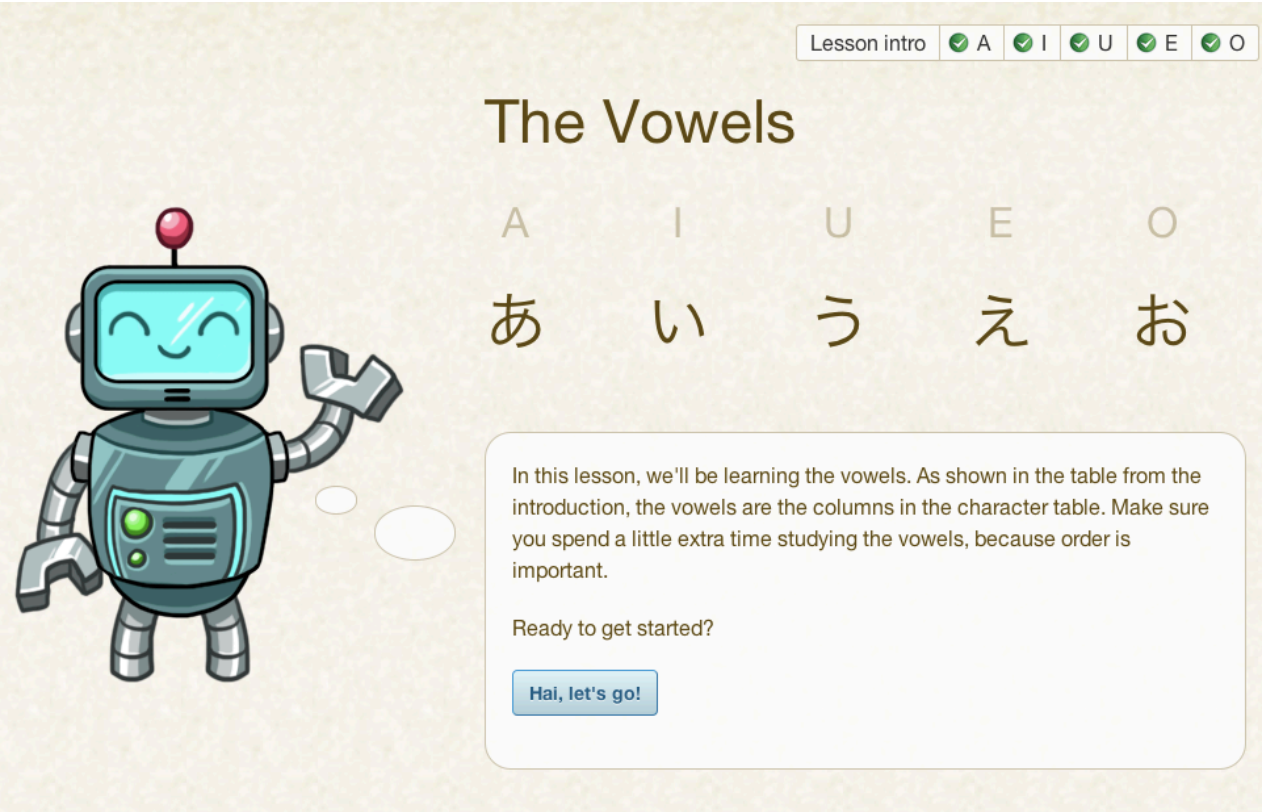
The contiguity principle was used in this section as explanations of characters were next to their counterparts. Each video also featured a set of instructions for writing the



character to give learners more focus. Videos were displayed in a modal window to separate them from the main content and increase user focus. This is another example of segmenting.

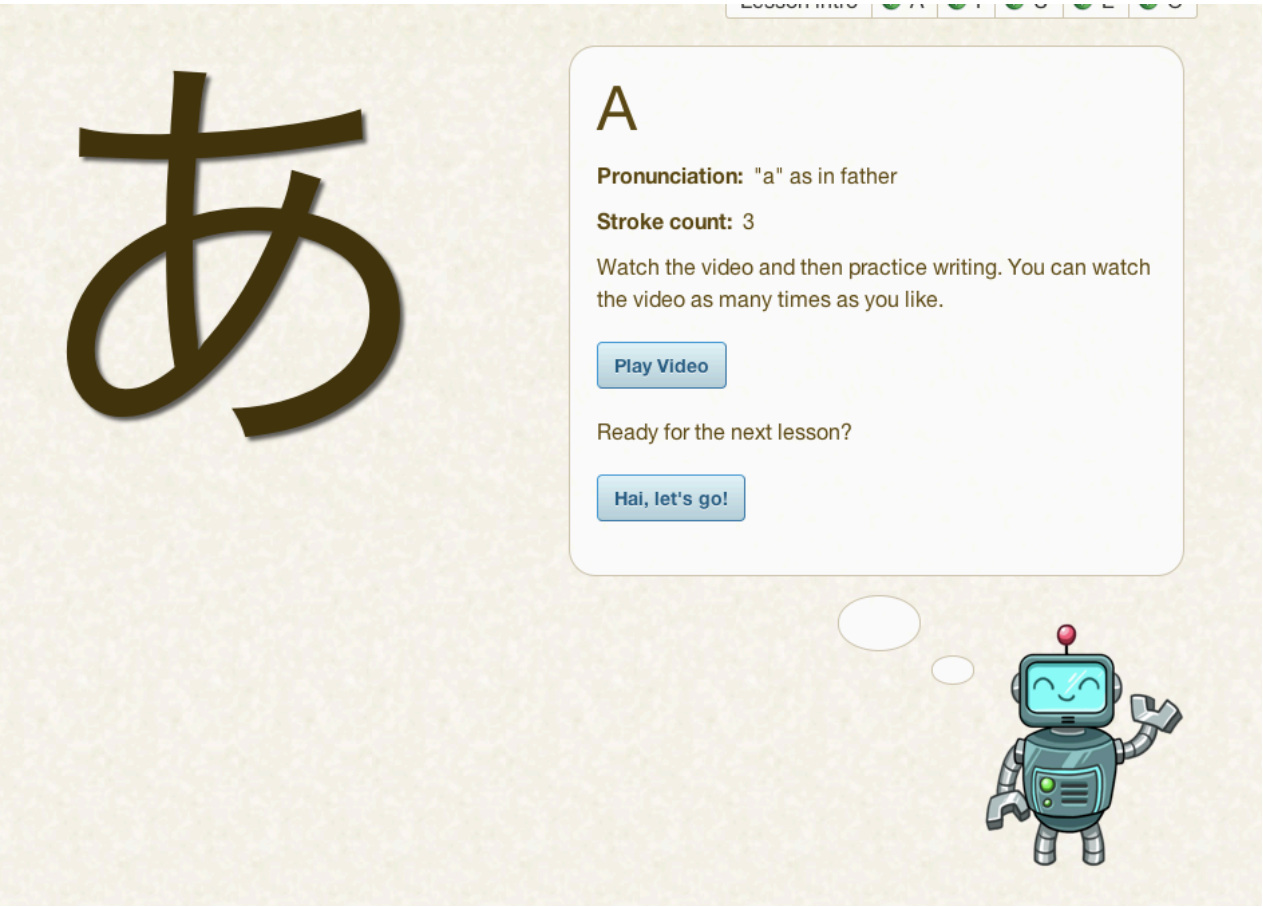
To personalize the system, AI was created. AI is a cartoon guide who is present throughout the lessons. AI was given a casual voice in written form. AI directly addresses the learner throughout the system. AI has a different orientation based on the section the learner is in, to prevent AI itself from distraction from the content. In the introduction, AI is explaining concepts, so it is omnipresent and does not move. This

way the user can focus on the concepts being explained. AI is also large and present in the lesson introductions. But during individual character lessons, where the character and writing the character are the focus, AI is smaller and in the corner.



AI as instructor

The modality principle suggests that AI's voice should be sound rather than text, but because this is a website and user control is very high, AI's voice is in text form. Adding audio would have required additional controls to allow users to repeat instruction, which would have distracted from the lesson. Also, because video is used, bandwidth is also a consideration. Loading both audio and video may have slowed the site down, leading to more learner distraction.

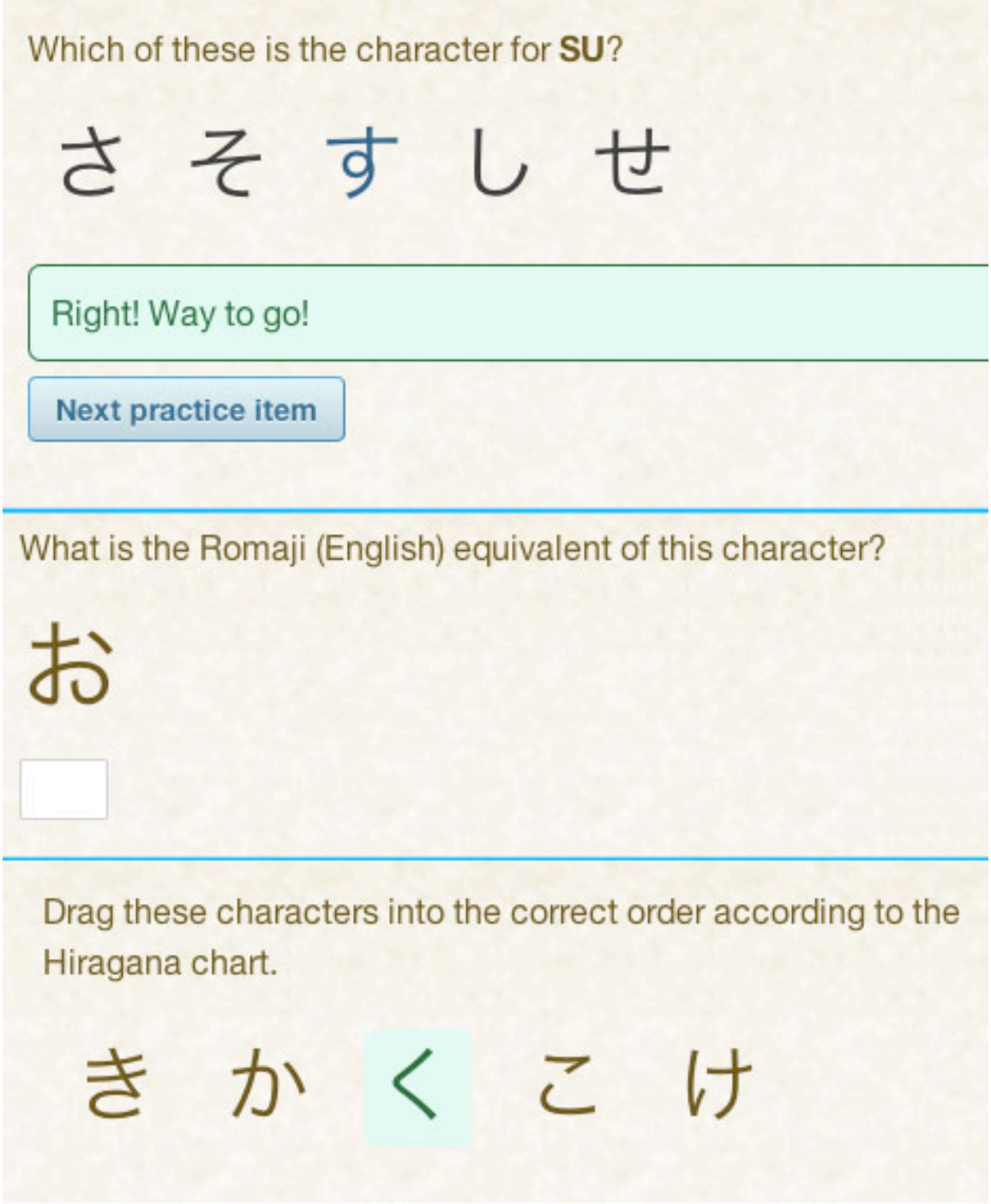


AI's focus is moved to prevent distraction from the lesson

After the completion of each lesson, learners were prompted to either continue to the next lesson or to practice. Practice was encouraged in the study instructions and the exam questions were developed in a similar format to the practice questions. The practice questions focused on a given lesson and were designed to simulate the different levels of Bloom's taxonomy. The learners had full access to the site and their notes during the practice should they require it.

Some questions were simple recall (remembering) questions asking the user to identify the English phonetic equivalent of a given character. Others asked users to identify a specific character given its English phonetic equivalent (Pick out the character for A from these characters). A similar question asked learners to identify a character that did not belong within a row of characters from the Hiragana chart. These questions use both the analyzing (differentiate) and evaluating (select) levels of Bloom's. Users were also asked to arrange the corresponding lesson's character into the correct order

according to the Hiragana chart. This type of practice used all five levels of Bloom's taxonomy (remembering, understanding, applying, analyzing, and evaluating).



Sample practice questions and feedback

Feedback was an important principle for the practice section (shown above). When users were correct they were allowed to move to the next problem. When they were wrong, they only told that they were wrong, and given no hint. It was up to the learner then to continue trying until they were correct, or to look up the answer. During the exam, no feedback was given, learners were merely prompted to continue with the exam.

Conclusion

Clearly the multimedia principle had an affect on learners. It impacted exam time and seems to have contributed to time on site. Group 1 spent more time on the site and used the practice section more. They also had a higher completion rate for the lessons. Multimedia was intended to help reinforce remembering the characters by allowing learners to not only understand their relationship to their pronunciation, but to learn the process of writing them. I believed that writing the characters would help users remember their shapes better and to help them recognize their shapes. The videos also added an element of practice the seems to helped learners categorize the characters and the character shapes in their minds more clearly.

It is worth mentioning, however, that learners writing abilities were not tested. As they were all distance learners, face to face testing and evaluation of the stroke order were not possible.

Further Research

There are many potential further research opportunities. I would like to finish the entire Hiragana chart and offer it as supplemental course material for an introductory Japanese class. Additionally, it seemed that time on site influenced scores. More testing with limiting time on site versus allowing unlimited time on site may yield interesting results. Because the modality principle was omitted, it would be interesting to test this against the current version of the site. Due to the remote testing, I was unable to test the learner's ability to write the characters. It would be interesting to develop a system for testing user's writing skills.