Design Studies

User Studies
We conducted our user studies with sixth grade students at Keys School, a private school in Palo Alto. We worked with a total of 17 students over two computer lab periods. For our first study we wanted to observe the way students interacted with the program, specifically seeking feedback on their level of interest and engagement in the topic of photography and the Civil Rights Movement. Much to our pleasure, all the students enjoyed the program and content - many even suggested we make it longer! We also wanted to see how students interacted with and navigated through the program. The study highlighted areas of weakness within the content and concepts as well as navigation problems. See Appendix 2 and 3 for the procedures and sample observation sheet.

Findings

Study 1 Results:
The observations of the learners’ experience during the Subject lesson of Developing History revealed both the strengths and weaknesses of the program. The students appeared to understand the navigation of the program. However, initially one group exhibited confusion about the method of navigation. The pair interpreted the timeline as presenting choices of different events to study instead of clicking “learn more.” After questioning the pair, it was evident that part of their confusion stemmed from the fact that the “learn more” button was not initially visible on the screen. After scrolling they understood the navigation.

The major issue revealed during testing was the students’ eagerness to progress without completely reading all of the text on each page. Students also failed to take advantage of the opportunities to learn more (view the extra narrative on separation) or view enlargements of the pictures. Of the four groups, only one clicked for the enlarged version of a picture and only for one picture. The “view more images” button was also only clicked by one group. In addition, every group made reference to wanting a back button at some point during the study. “Can I go back?” A few students used the browser button to go back and found that it did not work.

The interactivity of the frames puzzled some students at first. Students were unsure about what to do or how to move the frame. This could be related to the overall lack of reading the directions. Until directed to read the text located at the top of the page, students missed the differences in directions and specific tasks that occurred when they clicked the horizontal or vertical frames. Also, since students received feedback on the initial interactive framing exercise, students expected similar feedback on the next framing activity. This expectation created confusion. One group, after receiving feedback on the first framing page, was not sure if they were supposed to receive feedback on the second framing page. “Is it supposed to say anything?”

At two points, students specifically wanted information that was found on a previous page. During the separation selection task, one student said, “What was this one about again?” in reference to the description of an image seen on the previous page. Also, in answering the journal questions, specifically, “What did you lose?” two students requested to see the original version of the picture.
Overall, the students appeared to enjoy the Subject lesson. They were highly engaged in the interactive components of the lesson. "I liked... interacting with the program." Several comments of "that's cool" were overheard during the foreground/background interaction. The students also enjoyed the framing interaction. "I liked the pictures with the framing change." Additionally, the students requested more interactive segments similar to the framing exercises in their final responses, "more frame pictures."

A couple of technical issues also arose during the study. First, shockwave had to be installed on all the machines. Even after installation, a few computers still failed to show the movie. Secondly, some of the monitors were set to a smaller resolution than the movie was designed for, cutting off the very last line, the navigation. This also demanded that students scroll to see all the information on the screen. One monitor did not have color, which did not show enough distinction between the black and blue text. Lastly, a few of the pictures appeared spotty because of the low resolution on a few computers.

**Study 2 Results:**

The observations and students’ written responses reinforced many of the same strengths and weaknesses highlighted in the first user study. Again, there was some initial confusion in regards to the program navigation. One student thought that the timeline was offering her a number of choices. Two students did not instinctively scroll to investigate if there was any text not immediately visible. Since students could not see the 'learn more' button, they were confused about how to progress forward. However, once students realized that all the information could not be seen without scrolling, students were able to easily move through the lesson.

In this user study, the majority of students appeared to read the text more completely than the previous study. One group even read the directions aloud. However, there were instances when it was apparent that students had not read the text. For example, when a student’s cropped image showed up beside the two experts’ framed images, I asked the student how her image compared to the experts’. She responded, "Which are the experts?" Had the student read the text completely she would have known which images were the experts. However, another group did an excellent job comparing their image to the experts’. She said, "Look at it! That’s the same as ours." Her partner responded, "I think they’re both good.” Interestingly, when three students were asked if they would have preferred to hear much of the information, they all said that reading the information would be better.

Similar to the first user study, the majority of students did not take the opportunity to view additional images (narrative on separation) or view enlargements of the pictures. Only one group of the four clicked to see the larger images. Also, every group wanted to move backwards and revisit pages.

The interactivity of the frames initially puzzled students again. Students did not realize that they could drag the frame around the image. Once again, this could be related to their lack of careful reading of the directions. Students responded to the feedback. They closely read the comments and moved the frame around the entire image to uncover any other feedback. One group expected the feedback on the second framing activity. A student said, "Move it around until it says good..." The pair
kept moving the frame around the image until they were told they would not receive any feedback.

Students liked the “indirect way of teaching” and the “interactive pictures”. Also, a few students said they liked the way history and photography was combined. Several students suggested adding more images and including more "experiments with simplicity or framing.”

Based on the findings, we agreed to make the following changes.
1. Reduce the amount of text - perhaps integrate audio to convey information.
2. Introduce a back button.
3. Create an informal formative assessment of foreground and background to ensure understanding of both concepts.
4. Establish directions that distinguish between the interactive framing exercise and the informal assessment of framing; the directions should indicate when feedback will be given and when students are on their own.
5. Display, on the journal page, the original version of the exercise picture and the learner’s cropped picture to allow for comparison.
6. Make the tasks more visible on the framing exploration activities.
7. Use two voices for the experts’ explanations of their choices.
8. Make the affordance for larger images on page 2 more visible and more attractive.
9. Provide a way to review the descriptions of the pictures on the select page (pg 3).
10. Make the navigation more obvious by changing the buttons to appear more button-like in appearance.
11. Make the interactivity of the frames more obvious - perhaps use an animation to show movement first.
12. Provide an opportunity for learners to revise their cropped picture if they are not satisfied with their first action.
13. Include more exercises to reinforce framing knowledge.
14. Include more images.

The following questioned need to be discussed.
1. Should the screen size be reduced slightly for small resolution computers?
2. Should a connection to the students’ lives be built into the computer aspect of the curriculum?
3. Should color contrasts be more obvious for black and white screens?

Learner Studies
The pilot study conducted focused on assessing the effectiveness of Developing History, a module of ARTiFACT. Developing History strives to help students tie the formal features of photography to the intended meaning of a photograph. By comparing students’ visual literacy abilities prior to and after use of Developing History, the effectiveness of the module was examined. Several measures were used to address this question as well as to answer more specific questions relating to whom, if anyone, best benefited from Developing History. The first two measures examined the quality of students’ answers in relation to tying formal features to the meaning of a photograph. The third measure analyzed the consistency of student performance in regards to both differentiation and problem-solving skills. The final measure offered
students a chance to apply their formal feature knowledge and examine the effect of context on their decisions. Results of the pilot study suggest that Developing History is an effective tool for teaching visual literacy skills to a subgroup of the middle school population. Further studies need to be conducted to examine extending the efficacy of the tool and expanding the population who may benefit from using it.

We conducted a within-subject experiment with 17 sixth grade students at Keys School, a private school in Palo Alto. Since the learning experience relies on the differentiation learning mechanism, our design focuses on evaluating the students’ ability to notice.

For the first and second measure, the independent variable was the use of ARTiFACT. The pre-test included a set of three questions. Students were shown a photograph and asked to answer the following three questions: 1) what do you notice about this photograph? 2) what do you think the photographer was trying to convey through this photograph? 3) what were the choices the photographer made when composing this photograph? In addition to the first measure consisting of the abovementioned questions, the post-test included three other measures. The second measure involved students answering the same three questions in response to a new, transfer image. This measure attempted to show whether students were able to transfer their visual literacy skills to a new image. It is important to highlight that the transfer image (a photograph of the Montgomery Bus Boycott) related to the topic covered in Developing History (Civil Rights Movement), although students were not told of this relationship. The third measure involved students ranking four versions of the same photograph based on the effectiveness of each image to convey a particular message. Finally, the fourth measure required students to crop an image. Within this measure, we used a between-subject design. Half the students were provided with the context of the image as well as directions to crop the image to tell a specific story. The remaining students were not provided with the context and were simply asked to crop the image.

The dependent variable for all the measures was the quality of students’ answers. Specifically, we looked for evidence of students’ increased awareness of meaning in images and improved articulation and use of key vocabulary. For post-test measures 3 and 4, we not only looked for students to make the best choice but also looked for evidence of clear and logical rationale behind their decisions. At the conclusion of the assessment, if students showed increased awareness of the use of formal features and connect their use with meaning, Developing History has proved successful in achieving the desired learning outcomes.

Results
Measure 1: Overall, the results indicate that, after using Developing History, students mentioned more formal features in connection with the meaning of the photograph. This is highlighted in Chart 1. In general, a stronger improvement was noticed when the same photograph was viewed in the post-test. Question 2 (What is the photographer trying to convey?) is the exception, with greater gain shown for the transfer photograph. Most of the differences between pre-test and post-test were greater than the standard error. Question 1 (What do you notice?) was the least conclusive of the three questions, with the most overlapping occurring on the transfer photograph used in the post-test.
Measure 3: The ranking measure demonstrates that gains were fairly consistent for learners. Learners that showed more gain (above average) on measures 1 and 2 showed higher quality answers on Measure 3.
where students were or were not provided context for their cropping decisions, a small gain in quality of answer was demonstrated for students who did not receive the context of the photograph. It is important to point out that two students who were not given the context inquired about it during the study. One student asked, “Are we trying to show rich or poor people?” Another student inquired, “How am I supposed to know what this is about? I don’t know what I am supposed to show.” However, further study of this issue is necessary because of the small increment of gain.

Formal Features Mentioned in Cropping Justification With and Without Context

The complete research report is located at http://ldt.stanford.edu/~pagemc/ed229d/assessment.pdf