MIDTERM REPORT
Parson Programming Puzzles and Field Studies

November 18, 2019

Rebecca Cawkwell rgc2137
Emily Li el2895
Sandy Zhao bz2328
Juvaria Shahid js5160

0.1 Abstract

In this report, we will discuss the progress made on the Loop and Sequence puzzle creation as well as updates made to the field study. We have created 14 different puzzles. We have met with two different teachers to receive feedback on our study design. In the future, we will be continuing to iterate through puzzle creation and finalize field study documents. The features that are currently in progress are: Parson's Field Study (452), Parson's Formative Evaluation (533) and Parson's Summative Evaluation (534).

0.2 Architecture

The fieldwork with teachers is done over a video call. We utilize a shared screen in order to go over the content of puzzles and surveys with the teacher. After interviews, we make updates to our surveys and our puzzle design. If the teacher is able, we will have a follow up interview to review changes we have incorporated. Parson puzzle's have been create in the affinity space as various quests under the header "JRSE." These puzzles have been created through researching commonly taught algorithms and incorporating feedback from the teachers we interview. The field study materials have been created on Google Surveys in a shared google folder. They have been based off of previous work done by SAGE research students and feedback from teachers.

0.3 Implementation

Thus far, we have successfully scheduled meetings with three teachers in the NYC area for the formative evaluation. We had our initial meeting with Mrs. Levy on Nov. 5th, and will be meeting with Mrs. Rivera and Mrs. Quinones on Nov. 18th.

For the pre-test and post-test surveys for loops, more questions are added to the surveys while maintaining a three-section structure. The three sections are, single concept section, combined knowledge section and combining blocks section. In total, there are 19 questions designed for each section, although more work need to be done ensure isomorphism between the two. The single concept section includes questions testing forever loops, repeat x time loops and repeat until loops. The combined knowledge section includes 7 questions that either tests on harder single loop questions or on more complex loop structures, such as nested loops. The final section requires students to build their own puzzles utilizing given blocks, which simulates more closely their actually learning

experience in SAGE.

After implementing feedback from our call with Mrs. Levy on our initial set of pre and post-test surveys for loops, we iterated another set of pre and post-test surveys for sequences. In this iteration, we focused on making the pre and post-test questions isomorphic to better measure what concepts students had learned from the lesson. Similar to the surveys for loops, they also contain single concept questions and constructing puzzles from blocks questions that simulates the structure of SAGE. The final section introduces simple loops to transition into the teaching of loops after the students have learnt sequences.

For our cognitive load component survey, we simplified the language used to make the questions more easily understandable for the students. In addition to updating the slides for the SAGE environment tutorial and loops lesson, we also started creating the slides for the sequences lesson.

0.4 Limitations and Assumptions

As we had to wait for teachers to respond to our emails, we weren't able to gain feedback to implement in our study design and puzzle creation. Additionally, we only recently learned that for the study we could do a lesson, but that they would have no programming experience. This means that instead of doing loops, it made more sense to switch our focus to creating sequence puzzles that very slowly build to loops. While creating the Parson puzzles, the SAGE system has changed. Now puzzle blocks are only allowed to be used once per puzzle making it difficult to create sequence puzzles that lead to the understanding of loops. Also, before speaking with teachers it is hard to create puzzles with valid distractors as teachers provide key insights into what students find confusing about loops and puzzles.

0.5 Future Work

Building for the meetings we have already had with teachers we will continue to build and edit parson puzzles in the SAGE system. We will incorporate this feedback to create the 4-5 puzzles we will use during the field study. We will also incorporate feedback about the various surveys - pre, post and cognitive load tests in order to ensure that they are age appropriate and are testing the knowledge of sequences and loops. More specifically with the pre and post-test surveys, we will have more questions to test on their ability

to distinguish among the different types of loops, and reduce the complexity of booleans and conditionals for existing questions to put more focus on loops exclusively.

After we feel confident that our materials are well prepared, we will finalize the exact date of when we can complete the field study with Mrs. Levy's physics class.