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Assessing the Impact on Learning of Summer Science Camps

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Abstract

Several studies show that educational outreach programs like summer science camps increase K-12 students' interest in and positive attitudes towards STEM-related fields, such as the one conducted by Crombie, Walsh, and Trinneer [1]. However, do these increases also pair with an increase in knowledge of these subjects? Studies like the one conducted by Foster and Shiel-Rolle show that "short-term outreach activities can have a positive impact on the scientific literacy and long-term career goals of the participants" [2]. To assess levels of knowledge, most studies use a pre-test/post-test method [2,3,4] in which students take a quiz to assess their knowledge of content before the camp or activities begin and then take the same quiz at the end of the camp or activities. This is the approach that we chose to use. Across the board, the students achieved gains in knowledge. The data collected will serve as a baseline for future summer work as we continue to align the camps to the Next Generation Science Standards and assess the effectiveness of the instruction.

Methodology

In order to collect our data, we created, distributed, collected, and analyzed one pretest and one posttest for each student who came through each camp this summer. To create the pre- and post- tests, we followed a common procedure. Based on research about age-related attention spans and creating quality assessments [5], we chose to make the length of K-2 tests a total of 5 questions, grade 3-5 tests were 7 questions, and grade 6-12 tests were 10 questions total. Finally, we aligned each test item with a Next Generation Science Standard, either a Disciplinary Core Idea (DCI), a Science and Engineering Practice (SEP), or a Cross-Cutting Concept (CCC).

We chose to aggregate the data and use what is called a Simple Growth Model in the field of education [6]. The pre- and post-test average percent correct for each test item was recorded, as well as an overall average for each pre- and post-test. This is very similar to the data collected in similar projects that we found in our literature review [2, 3, and 4].

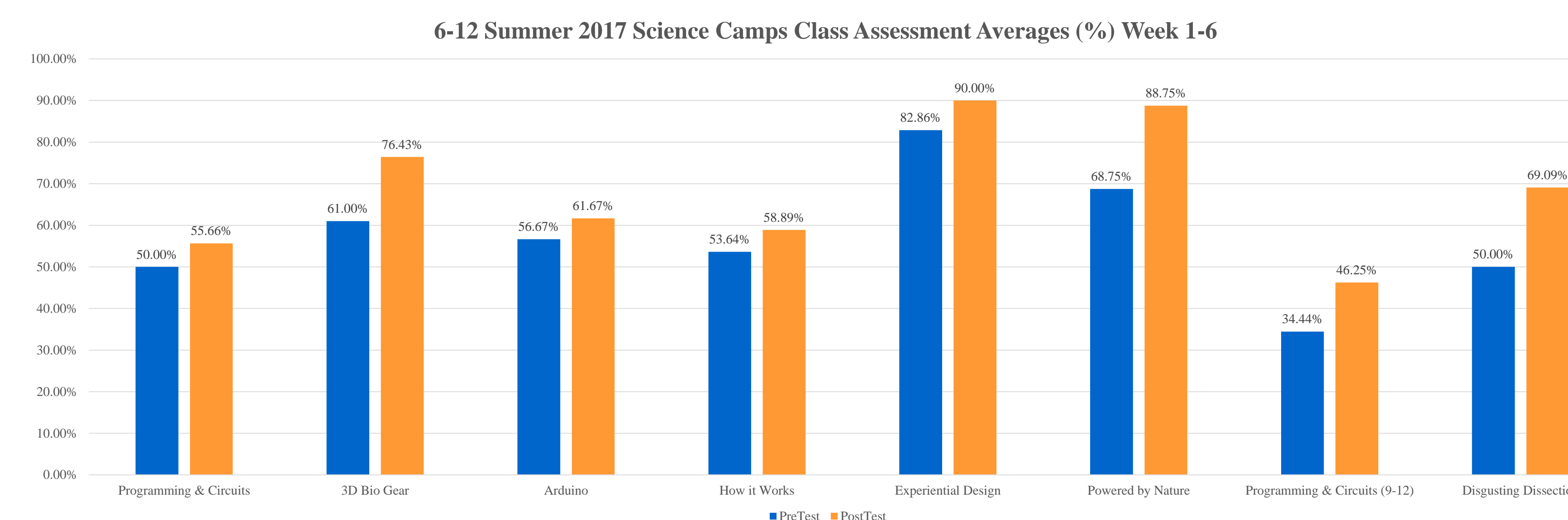
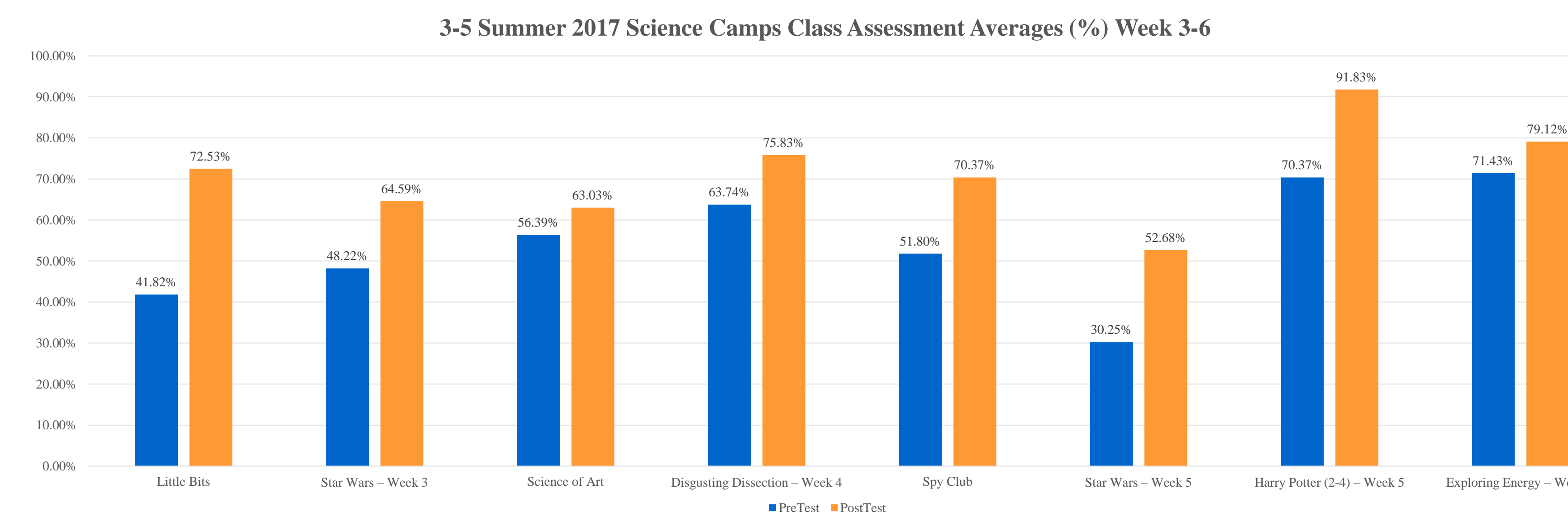
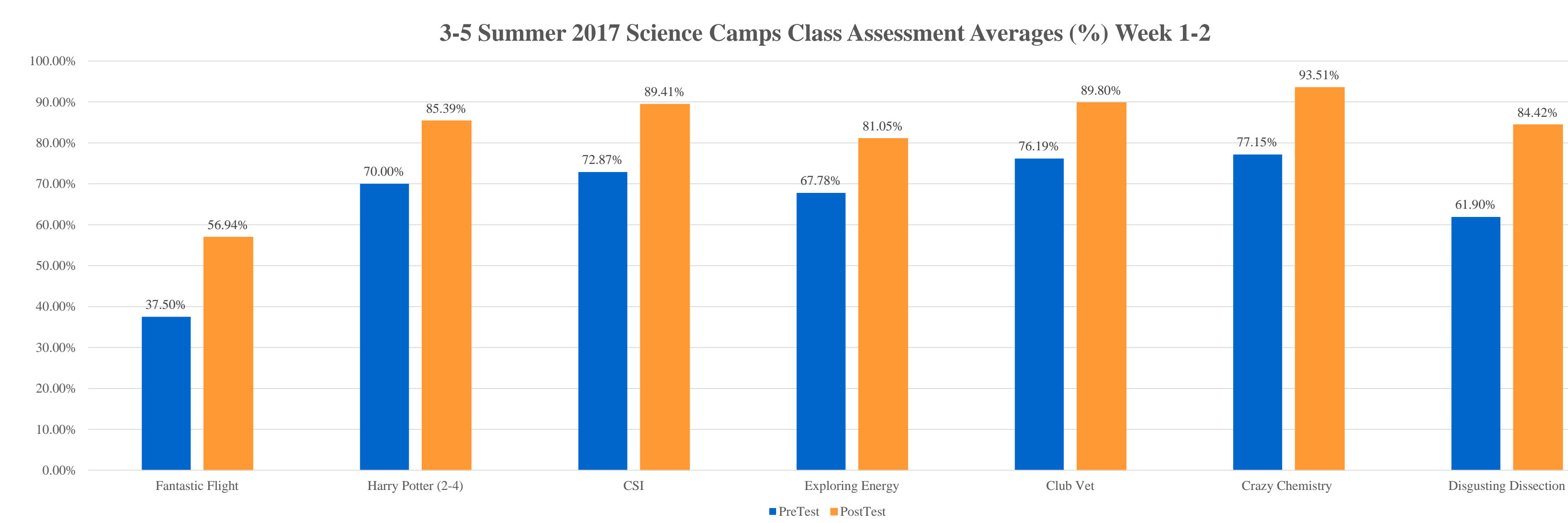
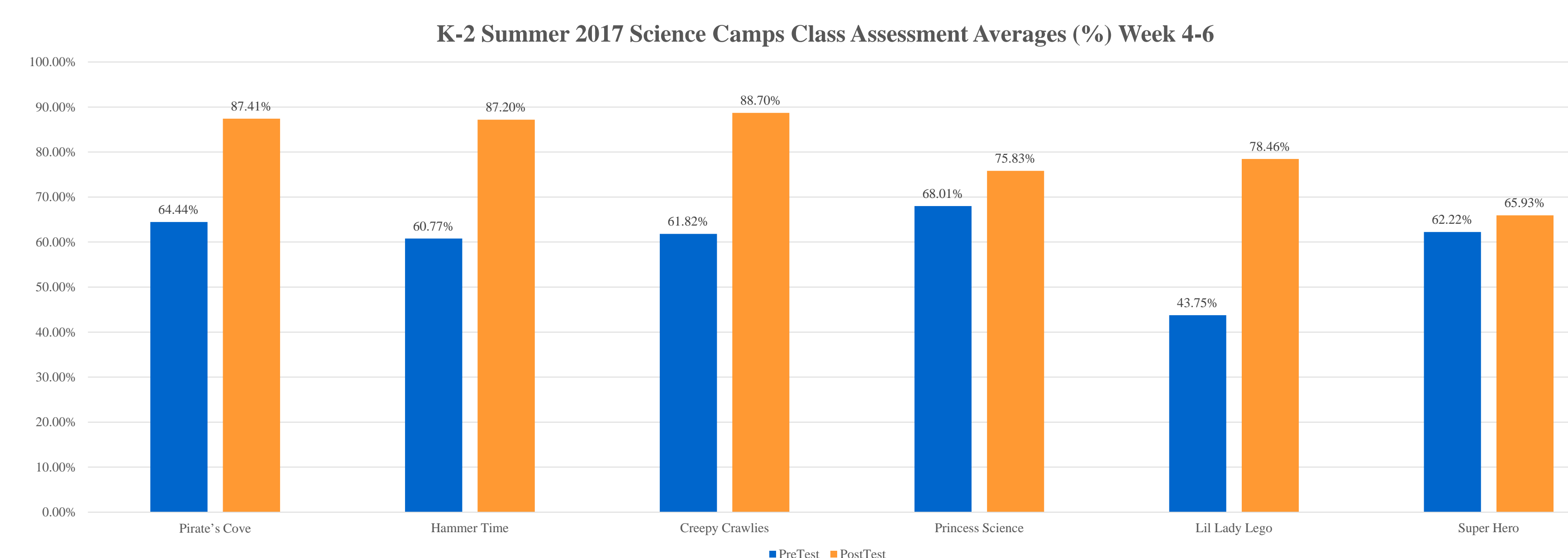
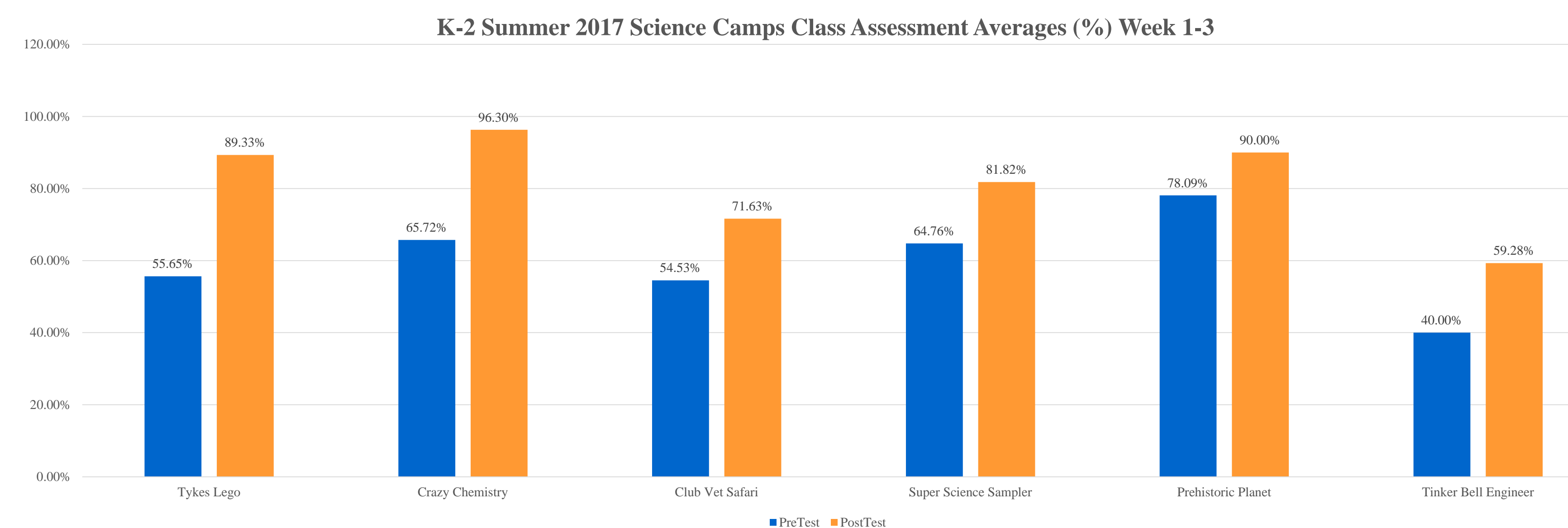
Results

- The following graphs compare the pre- and post-test scores for each camp. The graphs are organized by grade spans, K-2, 3-5, and 6-12.
- Overall, the assessment averages increased from 3.71% to 34.71%.**
- As discussed in the Methodology, **this type of data represents a Simple Growth Model [6].**
- Based on this model, **our data shows that there is a consistent positive impact on student learning in the Summer Science Camps.**



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Conclusions and Limitations

We conclude that our results do show an increase in knowledge from pretest to posttest in each camp using the Simple Growth Model [6]. While we cannot conclude that this increase is statistically significant, we can use a modified version of our research methodology to continue the work next summer and hopefully analyze the data statistically. There are several limitations that we discovered as we worked through the project, including a wide range of literacy skills and fine motor skills needed to take the tests, a great variance in the sample size or number of students in each camp, and variation in how the tests were administered by individual instructors. These limitations will be addressed in future iterations of this study.

Future Work

In the future, several modifications will need to be made in order to find statistically significant results. First, paired responses should be recorded so that we can run matched-pairs tests and find p-values that can be trusted. Collecting data this way would also allow us to analyze the Performance Index Scores [6] of each student and draw conclusions about proficiency in relation to the Next Generation Science Standards (NGSS). Second, the assessment questions should be reviewed and revised for clarity and to insure alignment with the camp content and with the NGSS. Third, we need to have a common set of directions on how to complete the tests as well as how and when the teachers should administer them.

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