Computer Science that Captivates

Ozaria Efficacy Report Summary

Mountain Ridge Middle School

Computer Science, and especially programming should be accessible to all students. The projected job growth from 2018-2028 in all computer science fields is exponentially faster than any other industry. (Committee on STEM Education, 2018) These skills can provide access to employment in growing fields such as software and application development (21% growth), information security (32% growth), and computer research and science (16% growth) (US Bureau of Labor Statistics, 2020). In addition, the skills that students acquire while studying computer science are deemed essential for any future career, such as computational and logical thinking, problem-solving, and digital literacy, among others.

Many students find programming courses intimidating, boring, and/or beyond their ability. Ozaria aims to give all students an authentic, engaging, and challenging experience. It is designed to accommodate students' of all backgrounds, ability levels, and interests, ensuring a positive experience that leads to further studies in computer science related fields.

What is the impact on Outcomes?

Our study looked at the impact Ozaria had on its intended learning outcomes such as:

- Students' level of engagement and enjoyment with the content
- Students' level of understanding of foundational concepts
- Students' ability to apply and extend critical thinking and problem solving skills
- Students appreciation of the real world application of programming skills and concepts and how they relate to future studies and careers

In addition to the student outcomes, we also looked at teachers' perceptions of Ozaria as related to:

- Degree to which teachers found the program easy to implement
- The amount of prep time required to deliver Ozaria lessons

To explore the relationship between the use of Ozaria and its intended outcomes, we conducted a study with:

- Mountain Ridge Middle School, Highlands Ranch, CO
- 2 Cohorts- 57 students total
- Students in grades 7 and 8
- During the 2021 Fall Semester from August to December

How Ozaria Was Used

Course Description

Two cohorts of students were studied. Each cohort had the same instructor, who is an experienced teacher with beginning level coding experience. Both cohorts met 5 times a week for 50 minutes. The course was called Exploring Computer Science, and was an elective general introduction course, assuming no prior CS experience.

- Cohort 1 included 10 female students and 20 male students
- Cohort 2 included 6 female students and 21 male students

The Course Construct

- Before any instruction occurred, students took a pre-assessment/diagnostic to gather baseline data on students' prior knowledge of basic computer science concepts.
- The instructor followed the provided pacing guide, using only the student-facing lesson slides to introduce new concepts.
- Students were instructed to engage with all aspects of the online content independently. They were administered short low-stakes quizzes after each lesson to assess their comprehension of both the Ozaria storyline as well as the new concept.
- Following each Ozaria module, the teacher led a full class period Exploration project where students worked collaboratively to develop a tangible object, report, or other related to CS topics, including Cybersecurity, Networking, Impacts of Computing, Data and Analysis, and Computing Systems.
- The online Capstone projects were used as summative assessments after each Chapter in Ozaria (4 total). The teacher used the provided grading rubrics to assess their students. Students were also asked to do a self-assessment of their capstone projects.

- A criterion-referenced mid-term exam was administered after Chapter 2, and a final exam at the end of the semester-long course, using 70% as the criteria.

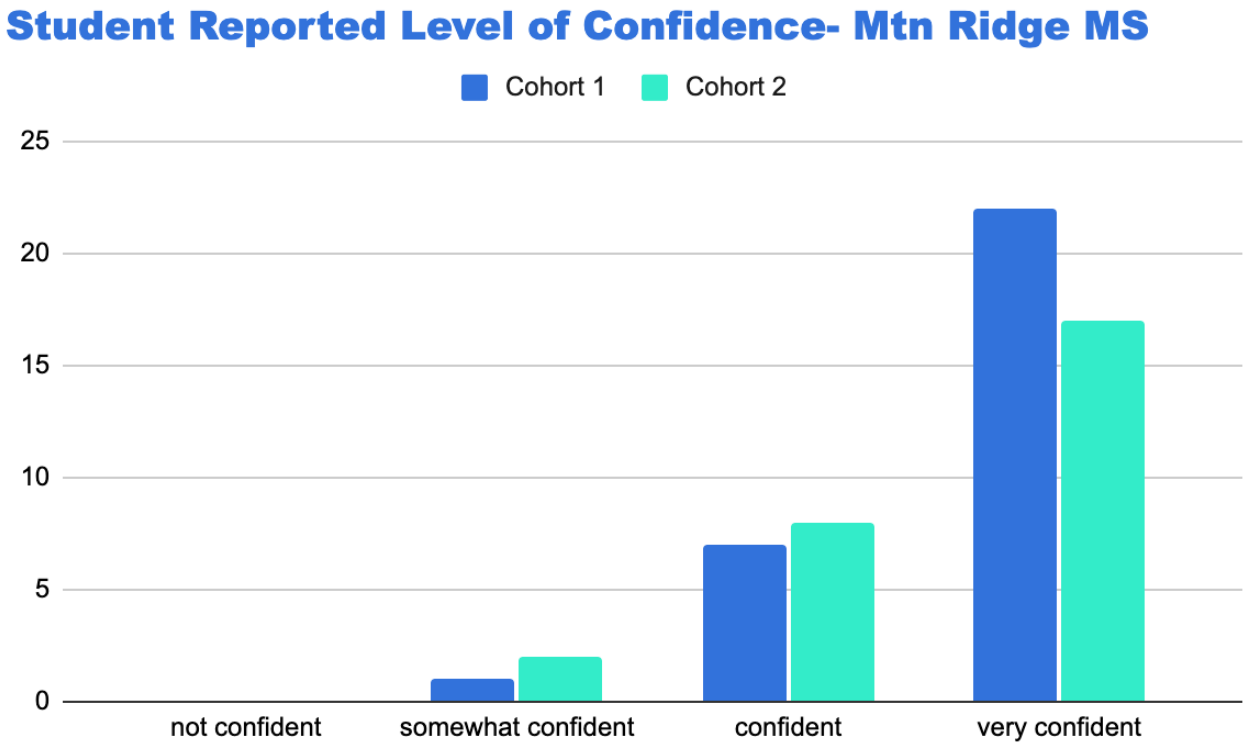
How We Conducted the Study

- To analyze student achievement, we used a combination of quantitative data taken from student scores on pre-, mid-, and post criterion-referenced tests; qualitative data based on intake surveys, mid-point and post-surveys, frequent anecdotal evidence from the teacher, and student self-reported gains.
- To determine the impact of student engagement on performance, we used anecdotal evidence from teacher interviews and surveys of both teacher and students; and quantitative data indicating the correlation between student engagement with cinematics and achievement.
- To determine the degree of student comprehension, we used statistical models to connect student usage of Ozaria and their performance on both formative and summative assessments; and the overall progress made from the beginning of the course to the end based on assessment score data.
- To determine the level of transferable skills acquired through Ozaria, we used qualitative data taken from student surveys and teacher interviews at the beginning, middle, and end of the course.
- To determine the degree to which teachers found Ozaria easy to implement and the amount of time needed to prepare each lesson, we used anecdotal evidence from the teacher.

What We Learned

- Ozaria was reported by students to be a fun and engaging curriculum. Students especially noted the game-based learning platform and the ability to create their own unique games. They also noted how effective it was in teaching text-based coding, (as compared to other products that teach text-based or drag-and-drop).
- Both teacher and students found the platform easy to implement and use.
- Almost all students found the in-game support tools, such as the hints, code bank, and tutorial messages extremely helpful and intuitive.
- After using Ozaria, a majority of students reported a high confidence level in their ability to code, as well as their overall understanding of CS concepts
- After using Ozaria, student level of interest in the area of computer science increased

- The teacher found Ozaria to be a highly effective curriculum for teaching coding as well as essential 21st century skills, such as problem solving and reasoning, critical and computational thinking skills.
- The teacher found that, through Ozaria, her students were able to appreciate the real world application of programming skills and concepts



Pulled from the mid-term student survey

> I like the coding, and how you don't just have to remember everything. You can use the code bank for help which is great, especially since no one likes having to memorize everything so quickly. I also like how much I've progressed in the short time we've been doing Ozaria. I think that's because of the interactive aspects like the character.

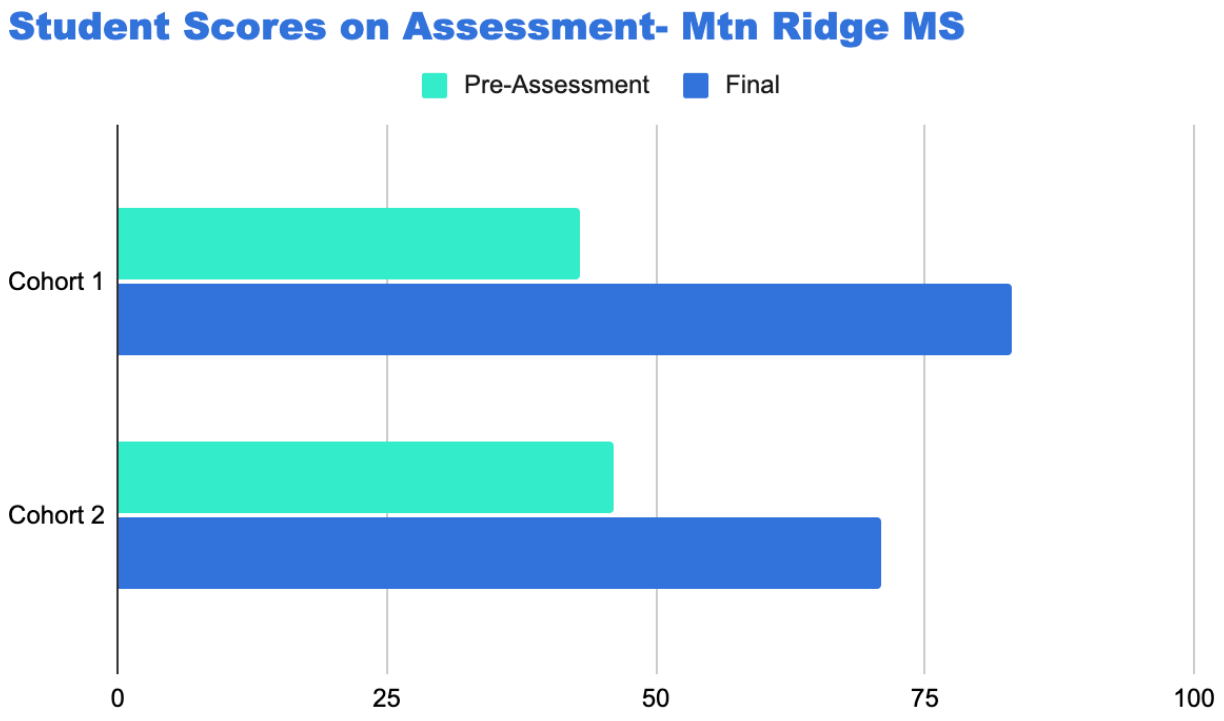
Mountain Ridge Student

> I have absolutely loved using Ozaria in my Exploring Computer Science class for the past three years. My students have thoroughly enjoyed the story line as they learned Python in a self paced learning environment. I would highly recommend Ozaria for teachers that know little to nothing about coding, as the support for teachers is very in-depth.

Lynette Personett
Mountain Ridge Middle School Teacher

Descriptive Efficacy Statements

- By mid-point of the semester, more than 90% of students rated their coding confidence level as Confident or Extremely Confident after using Ozaria
- Between the pre-assessment and the final assessment, students made an average gain score of 33%



> I like that it teaches how to code in an intuitive way that many people can easily understand.
>
> Mountain Ridge Student

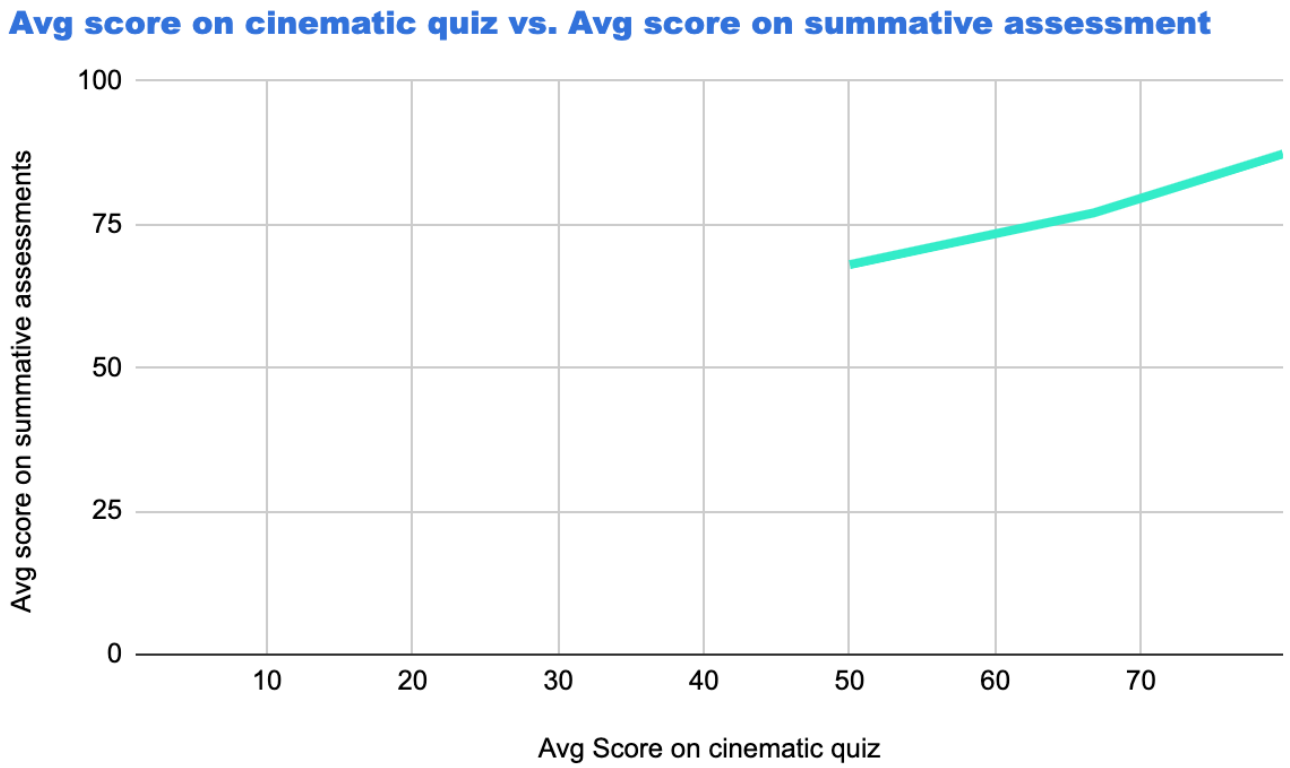
> One thing I am able to do now that I could not do before is actually believe I can code.
>
> Mountain Ridge Student

> I now know how to use lines of code for different things and can now identify conditionals, variables, and lots of other lines of code.
>
> Mountain Ridge Student

Correlational Efficacy Statements

In comparing the averages across all students from 3 different schools and 7 classes, a positive correlation (r=1) was found between performance on formative cinematic quizzes and summative exams.

What this means: the cinematic dialogues provided effective instruction and context as related to the concepts applied and assessed



This chart illustrates a positive correlation (r) of .99 between performance on formative cinematic quizzes and summative assessments using results from 3 schools (n=3)

Final Conclusions

Ozaria has proven to have a positive impact on the student learning outcomes that matter most to both students and educators. Using defined populations and statistically sound research methods, our studies indicated the following:

1. Both students and teachers find Ozaria to be a fun and engaging platform
2. Students' score gains on assessments are statistically significant after completing Ozaria
3. Students' level of confidence in coding and computer science concepts increases greatly after completing Ozaria
4. Students and teachers find Ozaria to be a highly effective curriculum when implemented as intended

CodeCombat's Commitment to Efficacy

We are committed to ensuring our products have a positive and measurable impact on learning outcomes. We create meaningful learning experiences, with the learning outcomes that matter most to students, at the center of everything we do and use evidence-based best practices to design content that will realize those outcomes.