CodeCombat
Implementation Study

Summary Report
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Project Overview and Purpose

CodeCombat is an organization committed to "making programming accessible to every student on Earth." *CodeCombat* empowers teachers to teach computer science via an online course platform that provides all teachers, even those who have no prior experience with programming, with a class-in-a-box solution. *CodeCombat* is a real game that teaches learners of all ages to code by playing through levels and quickly mastering programming concepts. It's not just gamification with bells and whistles, it's democratizing learning to code by making the process more accessible and engaging than ever before. and arts education, and to creating a positive environment for the arts through societal change.

McREL International (McREL), an education research organization, was contracted by *CodeCombat* in August 2018 to serve as the third-party evaluator of *CodeCombat* implementation, and to report results from its current users as of October of 2018. McREL used a descriptive survey research approach to understand teacher implementation of *CodeCombat*, as well as a case study approach of a select number of these users to better under usage of *CodeCombat*. Both the survey research and case study methodologies work in tandem to uncover teacher perceptions of *CodeCombat*, issues associated with processes and implementation, and perceived impacts on student engagement and learning. However, this summary report contains the results from the investigation of teacher implementation and perceived impacts of *CodeCombat*.

About the Study

McREL collaborated with *CodeCombat* leaders to design a descriptive survey research investigation to understand how *CodeCombat* has been implemented among current users, teachers' impressions, the extent to which teacher self-efficacy has changed as a result of using *CodeCombat*, and teachers' perceptions of student levels of enjoyment, engagement, and learning. Table 1 summarizes the research and supporting questions that were used to inform the scope, methods, data collection strategy and instrumentation, and analysis of findings for the investigation.

Table 1: Key Research Questions

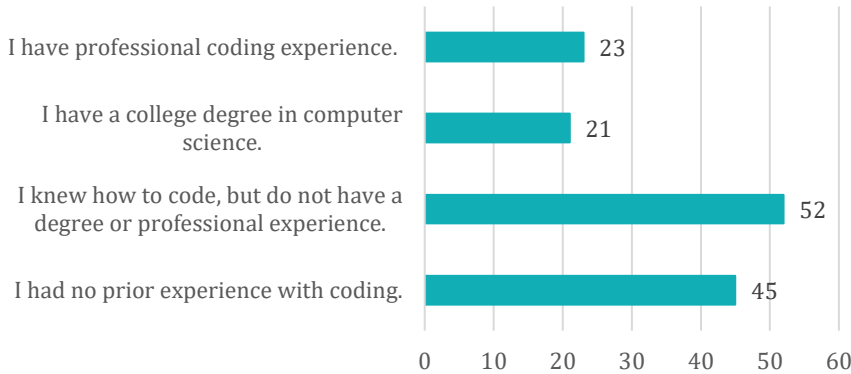| Focus Area	Guiding Research Questions	Supporting Questions
Implementation	In what ways has *CodeCombat* been implemented?	What is the frequency of implementation? Student completion? How do teachers use ancillary materials (lesson plans)? How is *CodeCombat* implemented?
Teacher Impact	What are teachers' **impressions** of *CodeCombat*?	Does *CodeCombat* meet teacher expectations? Are teachers able to incorporate *CodeCombat* with their other lessons / activities?
Teacher Impact	Has **teacher self-efficacy** changed as a result of implementing *CodeCombat*?	What professional development has been completed? What are teachers' comfort levels with different aspects of implementation? What role do teachers serve during student use of *CodeCombat* (has this changed over time)?
Perceptions of Student Impact	What are the **perceived levels of student enjoyment, engagement, and learning**?	Are there differences among student subgroups in terms of their engagement and perceived learning outcomes? How do students experience productive struggle?

Summary of Methods

Consistent with best practice in the measurement of implementation and perception of impact of products and/or services among service-oriented organizations (e.g., Marr & Creelman, 2011; Napier & McDaniel, 2006; Poister, 2008; Primer, 1995), as well as with principles of universal design (Hanington & Martin, 2012), McREL collaborated with *CodeCombat* to develop a Teacher Implementation and Perceived Impacts Survey to collect information for each of the four guiding research questions. Additional *CodeCombat* usage data were gathered from teachers (subject to their individual consent) to provide additional insight into teacher implementation and use. These methods are further summarized below.

- **Teacher Implementation and Perceived Impacts Survey**: Current users of *CodeCombat* (who had used the tool for at least one month as of October 2018) were invited to complete a Teacher Implementation and Perceived Impacts Survey in October of 2018. The survey contained 15 selected-response items that solicited information about teacher implementation and resources utilized, as well as another six items that asked teachers to indicate the key instructional strategies where *CodeCombat* is used, each of which were measured on a 5-point Likert scale (Strongly Agree to Strongly Disagree). Also, to uncover insights about teacher impact (perception of features and expectations), self-efficacy, and perceptions of student impact, the survey also contained multiple items that asked teachers to rate their perception of *Feature Engagement* (6 items), *Teacher Expectations* (8 items), *Teacher Self-Efficacy* (8 items), *Perceptions of Student Impact* (9 items), each of which were measured on a 5-point Likert scale (Strongly Agree to Strongly Disagree). A total of $n = 170$ teachers participated in the Teacher Implementation and Perceived Impacts Survey.

Participants

Figures 1 – 5 describes the *n* = 170 teachers who participated in the Teacher Implementation and Perceived Impacts Survey. *Note: Not all participants identified themselves for each of the demographic questions.*

Figure 1. Prior experience with coding

Figure 2. Prior experience teaching comp science
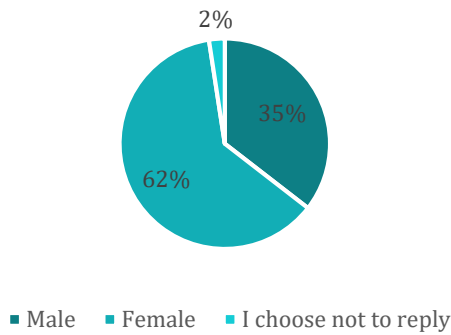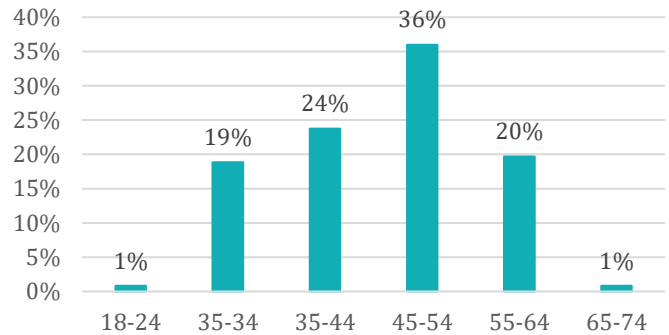
Figure 3. Participant gender identity

Figure 4. Participant age

Figure 5. Participant state of instruction
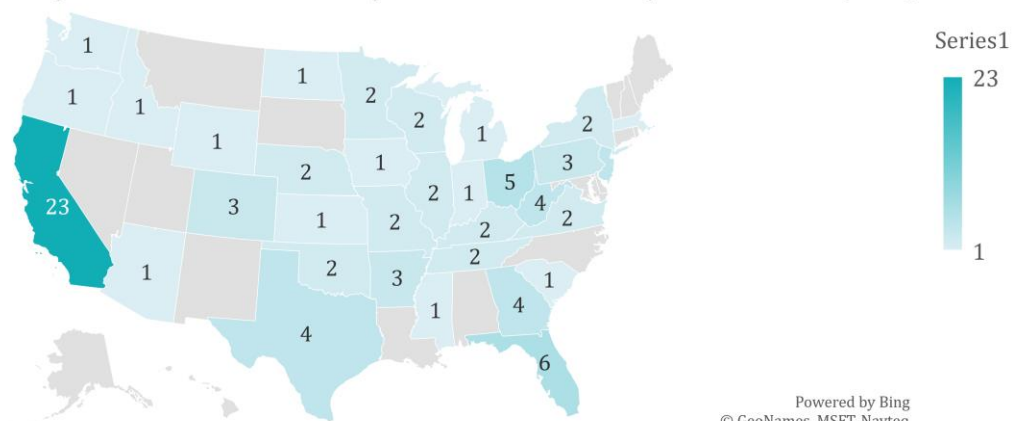
Results

Implementation

The Teacher Implementation and Perceived Impacts Survey was utilized to understand the ways that *CodeCombat* is implemented by teachers. The survey asked teachers to indicate the methods they use to embed *CodeCombat* into their instruction, describe other critical attributes of their implementation of *CodeCombat* games, and report on how they utilize the use tools and resources within the *CodeCombat* program (Figures 6 – 11).
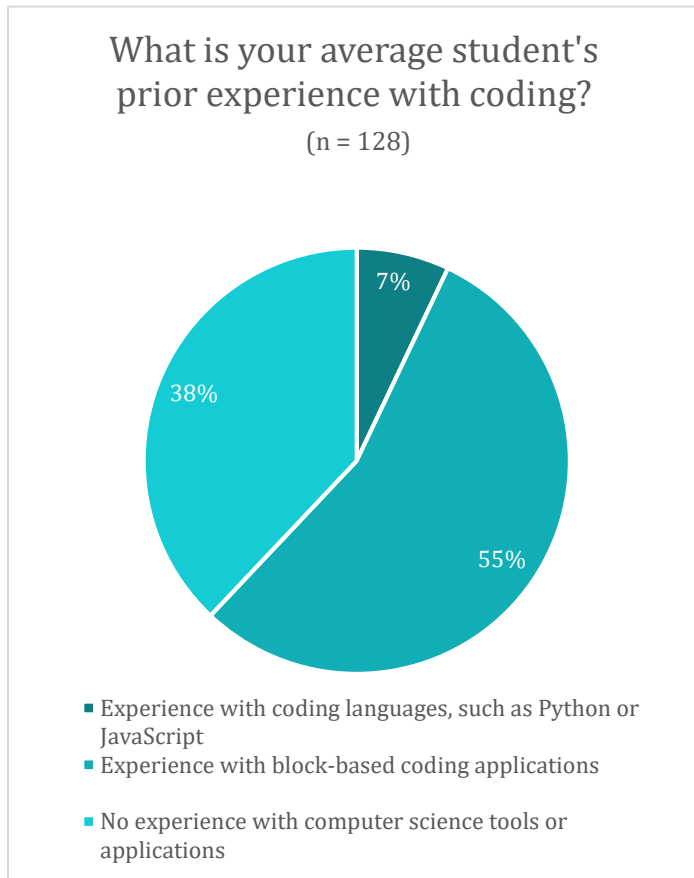

Figure 6. Teacher-reported student coding experiences
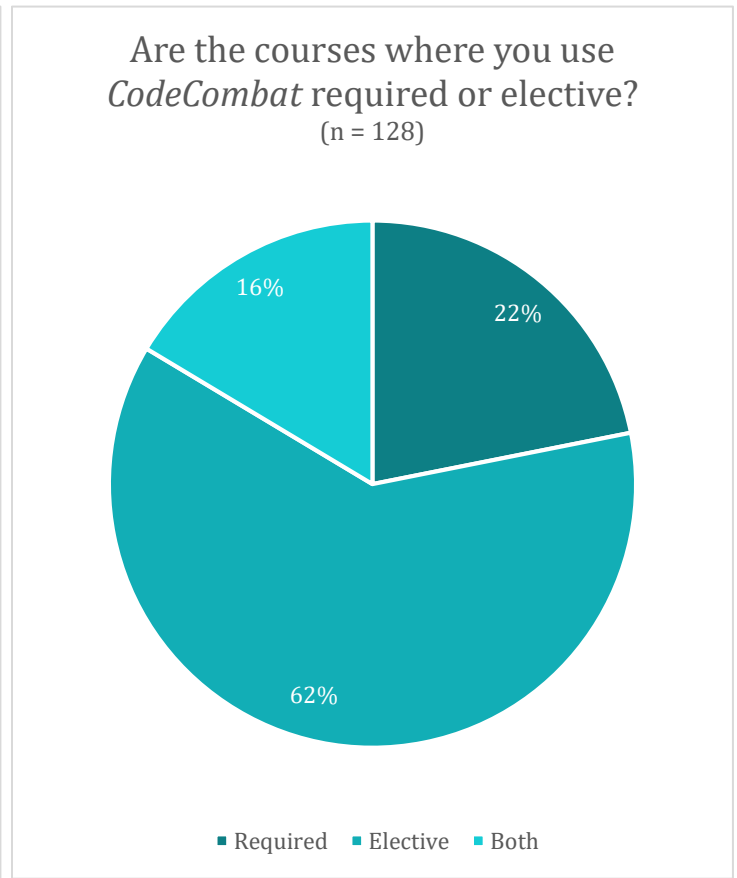
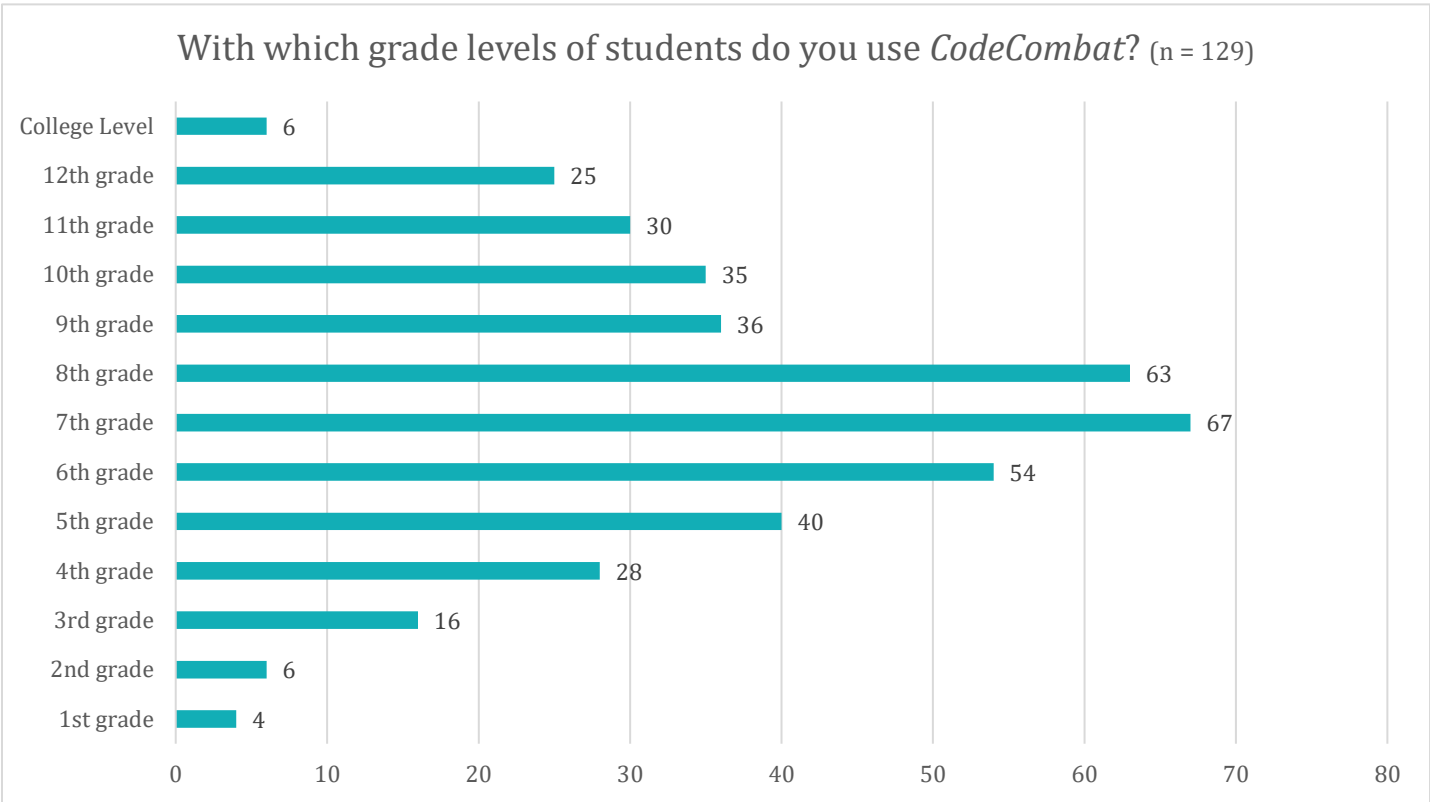*Figure 7. Course type during CodeCombat use*

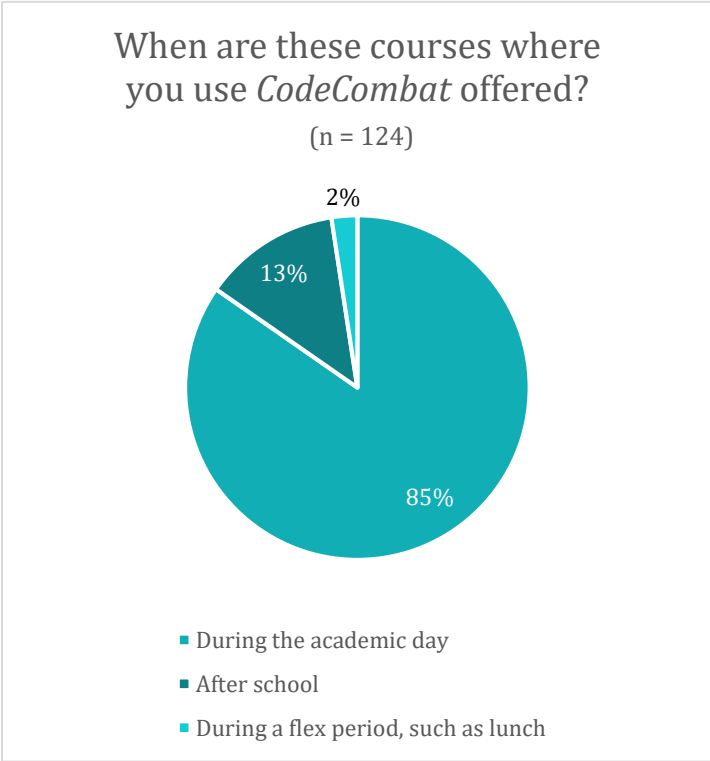*Figure 8. CodeCombat use by grade*

Figure 9. Timing of CodeCombat courses
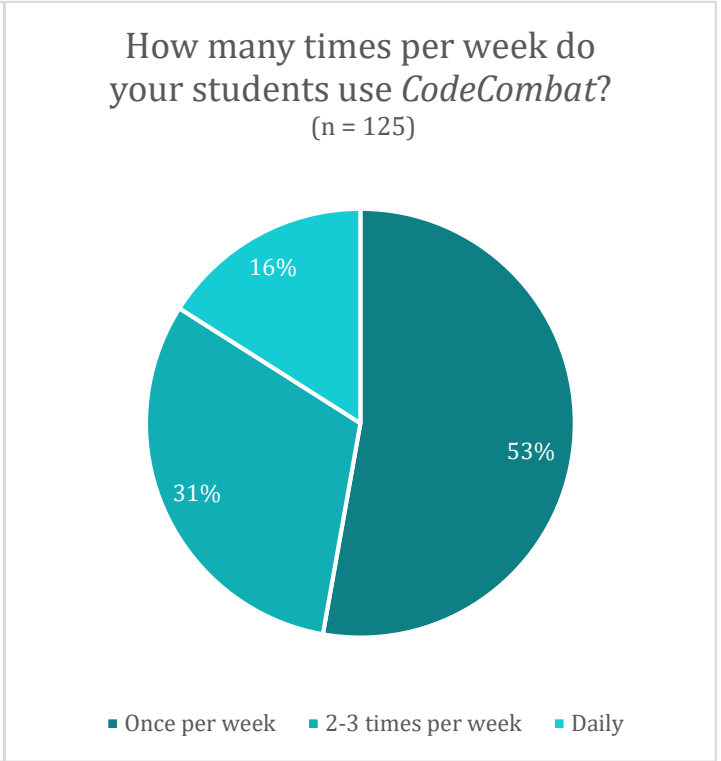
Figure 10. Weekly use of CodeCombat
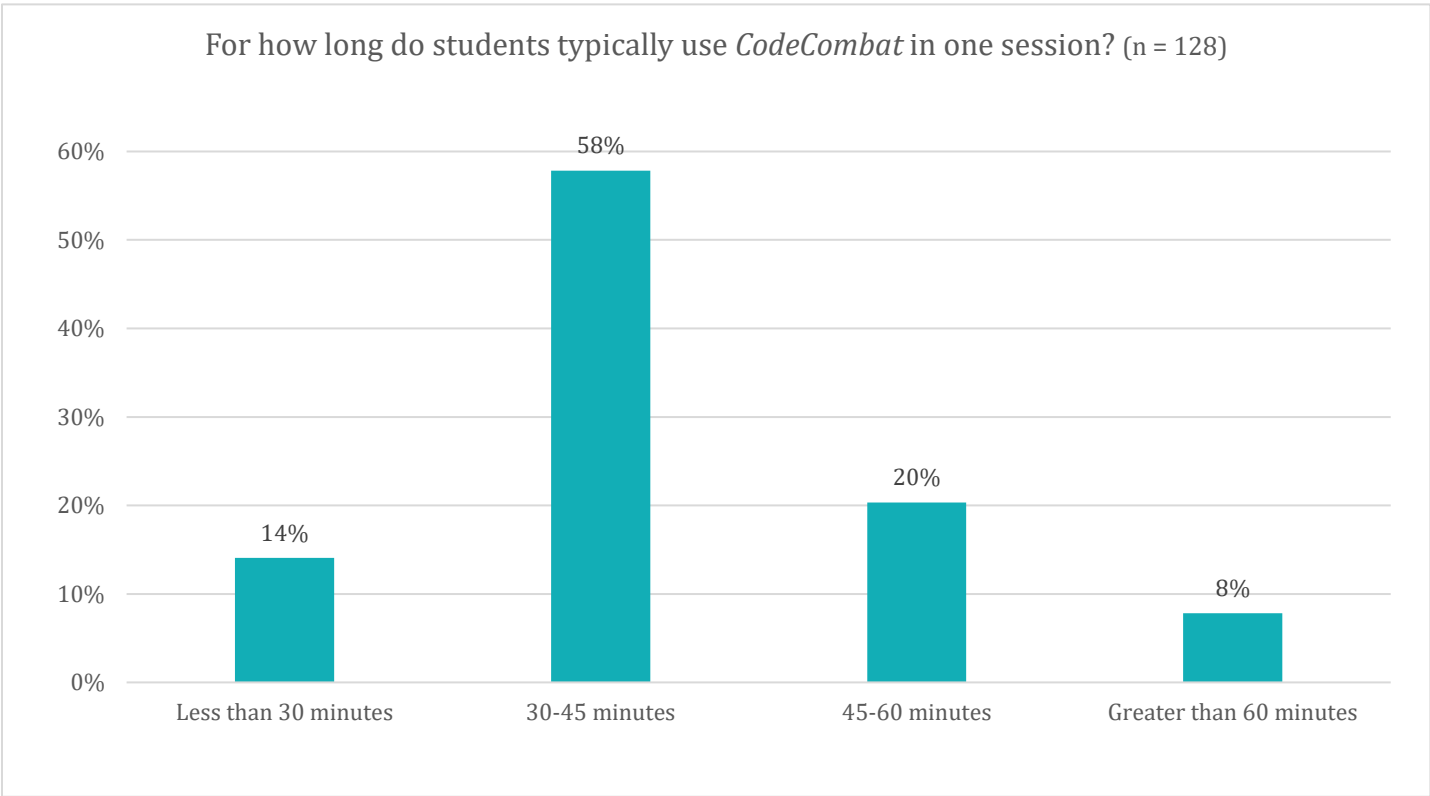
Figure 11. Length of typical CodeCombat session

Teacher Impact

To understand teachers' impressions and self-efficacy as a result of using *CodeCombat*, the teachers were asked on the Teacher Implementation and Perceived Impacts Survey to assess whether *CodeCombat* met their expectations (Figure 12) and contributed to their self-efficacy (Figure 13).
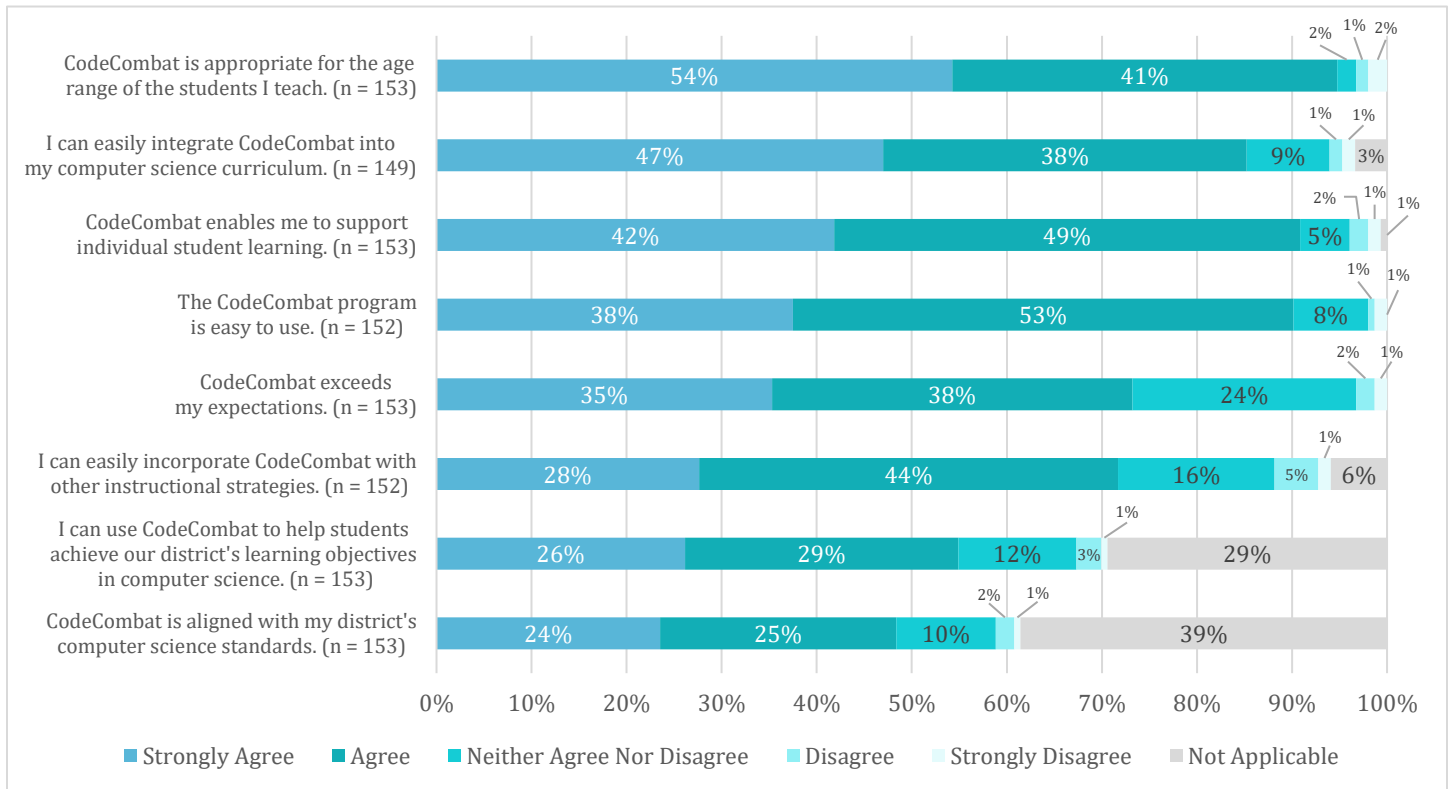
Note: Response categories receiving 0% of responses (after rounding) were excluded from Figure 12.

Figure 12. Teacher expectations for CodeCombat use
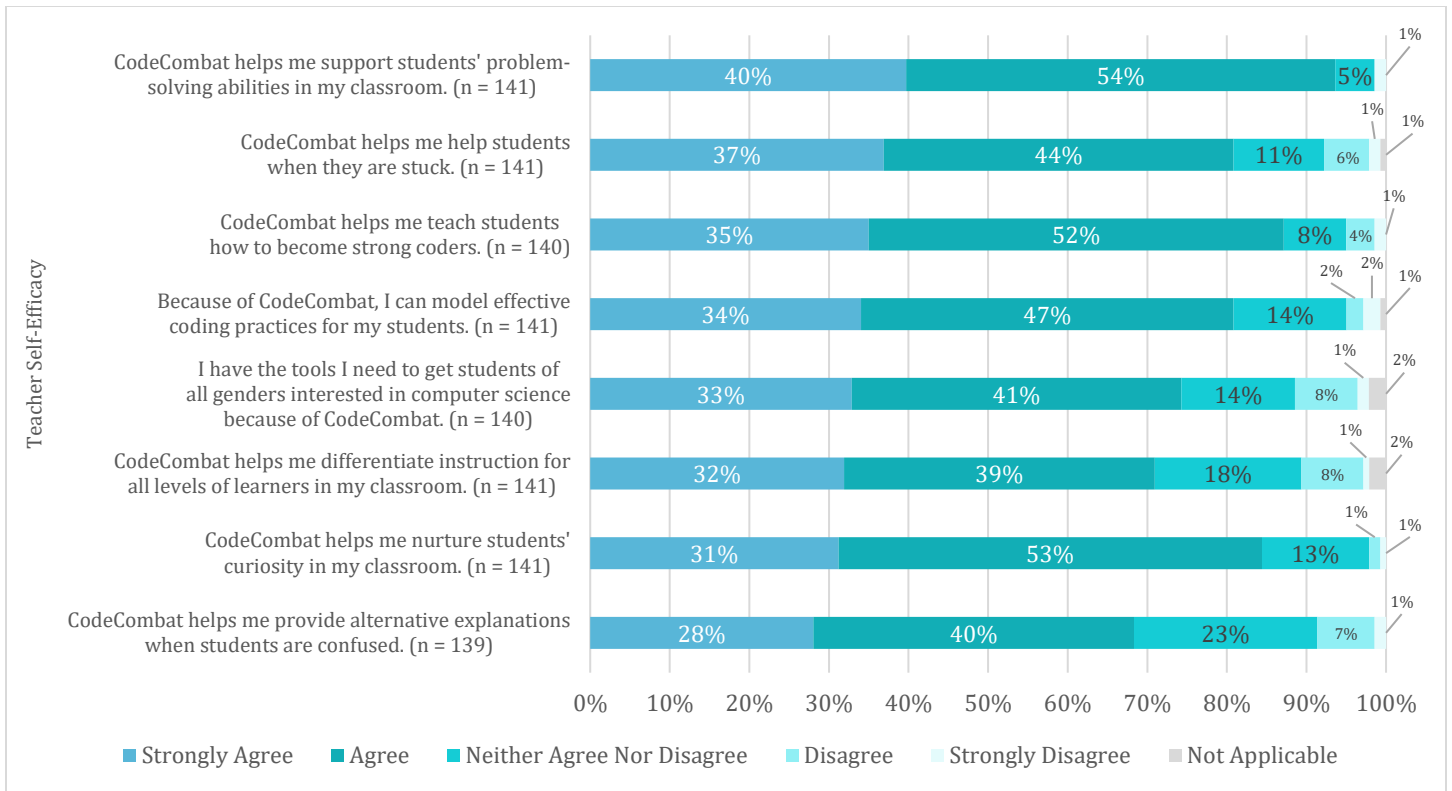
Note: Response categories receiving 0% of responses (after rounding) were excluded from Figure 13.

Figure 13. CodeCombat effects on teachers' self-efficacy

Perceptions of Student Impact

To assess teacher perceptions of student impact, the Teacher Implementation and Perceived Impacts Survey asked teachers to rate their perception of student engagement and impact on students (Figures 14-15).

Note: Response categories receiving 0% of responses (after rounding) were excluded from Figure 14.

Figure 14. Teacher perceptions of student engagement with CodeCombat
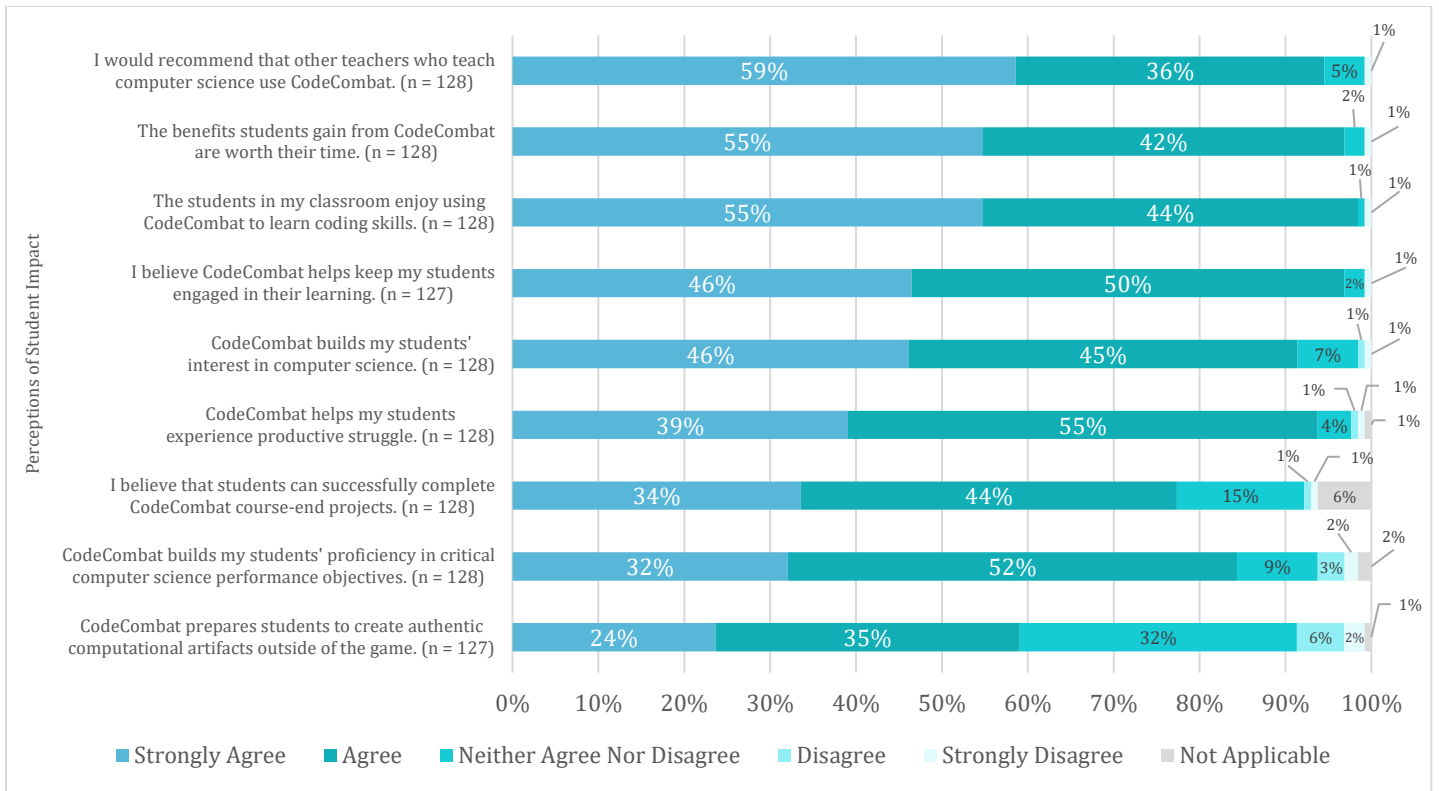
Note: Response categories receiving 0% of responses (after rounding) were excluded from Figure 15.
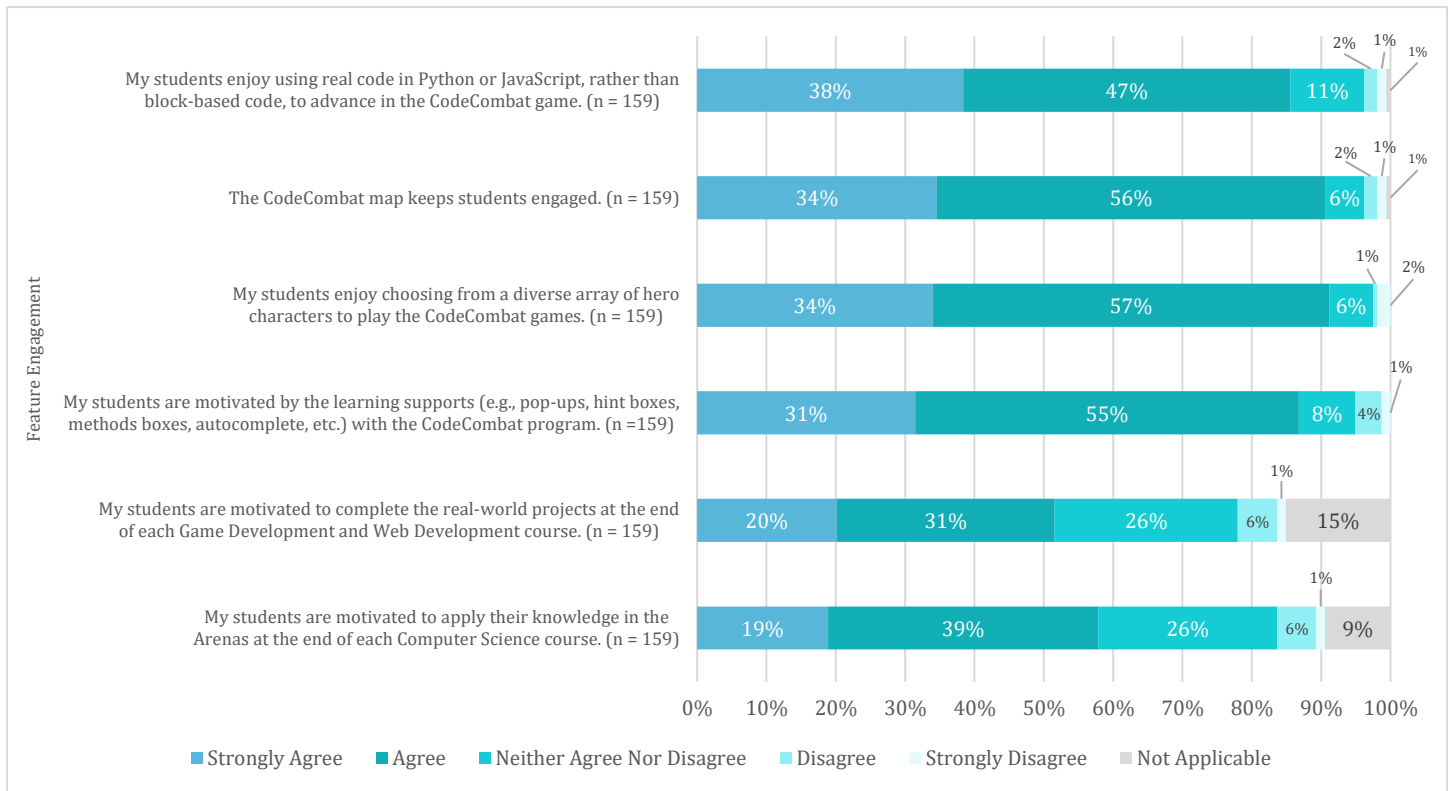
Figure 15. Teacher perceptions of CodeCombat impact on students

Participant Reasons to Recommend *CodeCombat*

The Teacher Implementation and Perceived Impacts Survey also asked participants, "Would you recommend *CodeCombat* to other teachers? Please use the space below to tell fellow teachers why they should use *CodeCombat*?" Figure 16 illustrates the key themes that emerged from their responses, and Table 2 lists sample comments for each key theme.

Figure 16. Teacher reasons to recommend CodeCombat

Table 2: Sample Comments – Reasons to Recommend

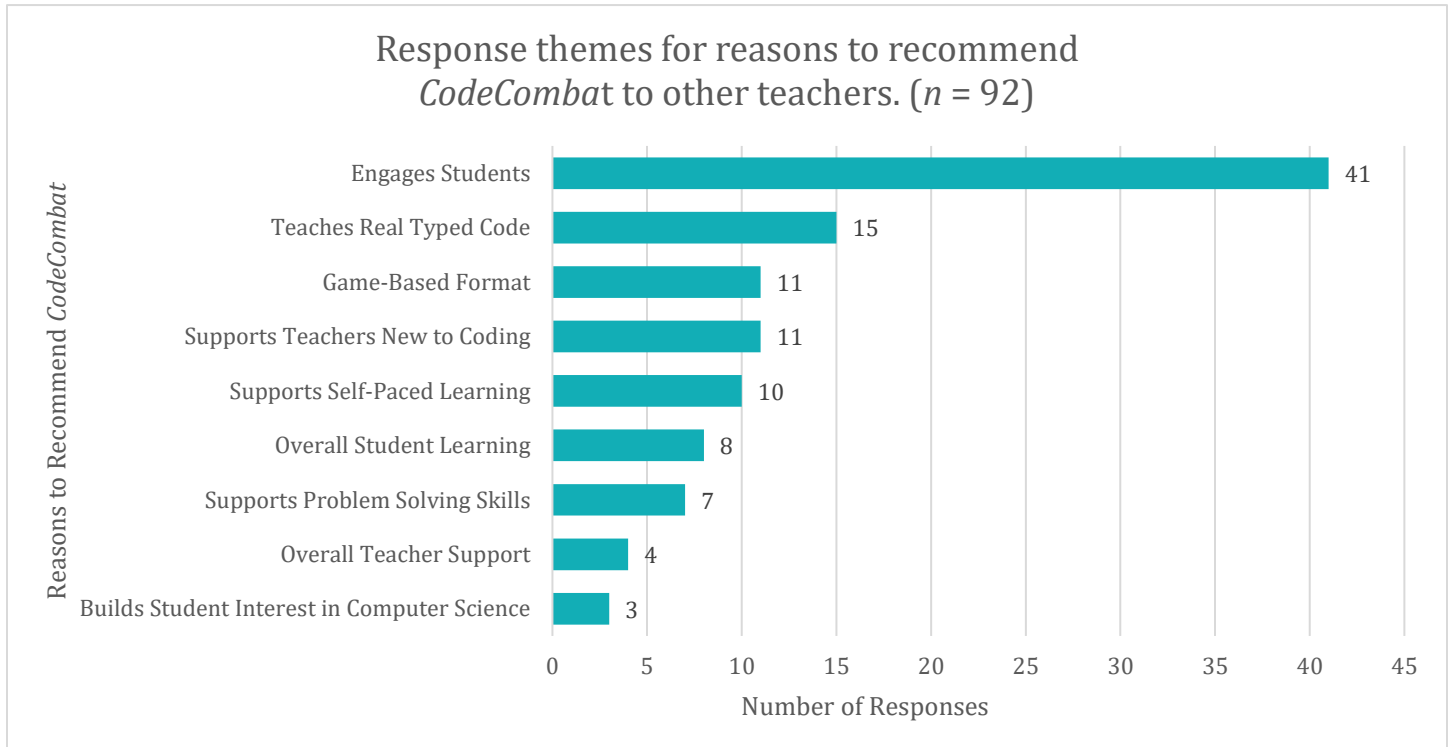| Topic	Sample Comments
Engages Students	• CodeCombat gives my student the ability to apply the concepts taught in class in a fun and low-stress manner. • Coder combat offers an engaging, fun platform for students to learn coding basics for both Python & javaScript. It engages all students, even non-gamers and those that have trouble grasping computer science concepts. • It is a fun and easy way to get students engaged in learning about computer science and coding.
Teaches Real Typed Code	• Highly engaging for students yet provides the additional challenge of using text-based coding that relies on things such as punctuation and indentation to function properly. • CodeCombat is an excellent tool for your child to learn "real" coding in a fun way. • I am glad that the program starts the kids writing code out instead of drag and drop blocks. This helps them learn the importance of syntax and makes it easier to transition into other aspects of code and programming later. • The best way for children to begin real coding!
Game-Based Format	• All the children in my class are gamers, so having them play a game that teaches them something is a win-win • Code Combat has a game like format that encourages students to use coding to solve programming problems and make their hero move forward in the game. This provides motivation for them to keep pushing through difficult problems. • CodeCombat combines what students love to do (gaming) with what skills teachers need to teach (coding) in a platform that allows students to play the game while also learning how to design the game code.
Supports Teachers New to Coding	• A great resource for the teacher who is new to coding and easy to learn with your students. • CodeCombat provides a complete lesson plan package. As a teacher, I'm given all the materials I need to do my own lesson, then the students can go at their own rate online with an entertaining and informative application. The student coding includes help for the students, and it encourages them to work with each other. At the end of the lesson, CodeCombat has provided me with the questions for students to reflect and write in their journals. • As a first-year Computer Science teacher my first thought was "Where do I start?" Combat Code introduced me into the syntax which was a great jumping in point.
Supports Self-Paced Learning	• Allows them to work at their own pace and provides hints to help them complete a level. The teacher has more time with individual pupils and can encourage pupil to help each other. • CodeCombat is a great way to engage students in a structured self-paced program to learn to code. • As a teacher, I'm given all the materials I need to do my own lesson, then the students can go at their own rate online with an entertaining and informative application.
Overall Student Learning	• Codecombat was beyond my expectations as a teacher. I learned and watched a lot the development and progress of my students. Congratulations to the whole team. Perfect computer programming language learning tool. • A thoroughly engaging and challenging program that has assisted many, many students to gain a good understanding of coding and software creation.
Supports Problem Solving Skills	• Excellent for teaching children problem solving skills. • I love Code Combat because it teaches students to problem solve and use their critical thinking skills in a game-based lesson.
Overall Teacher Support	• It's easy to create classes and add students and the Google Single-Authentication makes the process a lot easier if you're a Google District. • The teacher dashboard allows me to easily track student progress. • CodeCombat comes with lesson plans as well as the actual coding game which engages students and allows them to use real code!
Builds Student Interest in Computer Science	• Prior to using CodeCombat I probably had about 6-7 students total who were interested in learning Coding or taking AP Computer Science Principles. After letting CodeCombat spread via word-of-mouth I've actually had to open a second section of Coding and later turn away students because the room/lab would not accommodate additional students.

Note: A total of n = 99 users provided explanations for why they would recommend CodeCombat to other teachers. Participant responses in Table 2 are provided verbatim.

Summary of Findings and Recommendations

Summary of Findings

Theme 1. Teachers' **perceptions of student impact** reflect a widespread belief that *CodeCombat* supported student engagement, motivation, and interest in coding and computer science.
- 90% of teachers agreed or strongly agreed that *CodeCombat* keeps students engaged; 97% agreed or strongly agreed that the benefits students gain from *CodeCombat* are worth their time.
- 99% of teachers agreed or strongly agreed that students in their classroom enjoy using *CodeCombat* to learn coding skills.
- 95% of teachers agreed or strongly agreed that they would recommend *CodeComba*t to other teachers who teach computer science.

Theme 2. Responses to questions about **teacher impact** indicated that *CodeCombat* generally surpassed teachers' expectations as an easily-integrated tool to support students' learning, while improving self-efficacy in teaching computer science and coding.
- Most teachers agreed or strongly agreed that *CodeCombat* was appropriate for their students' age range (95%), enabled them to support student learning (91%), and was easy to integrate into their computer science curriculum (85%).
- *CodeCombat* supported teachers' self-efficacy by helping them support students' problem-solving, model effective coding practices, and nurture students' curiosity in the classroom, among others.

Theme 3. *CodeCombat* **implementation** occurred most frequently with middle school students (grades 6-8) during school-day computer science courses.
- 46% of teacher reported using *CodeCombat* to supplement existing computer science curricula; 38% used *CodeCombat* as their core curriculum resource for computer science.
- Most teachers (53%) reported using *CodeCombat* once weekly; approximately 16% of teachers reported using *CodeCombat* daily.
- Teachers reported that students' *CodeCombat* sessions typically lasted approximately 30-45 minutes, with 82% of students completing between one and three *CodeCombat* courses in a semester.

Theme 4. Teachers reasons for recommending *CodeCombat* included increased student engagement and motivation, ease of implementation, and the fact that the program introduces students to "real" coding in a fun and motivating way.

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