Program Evaluation

An Evaluation of a Modified Delivery of the Beauty and Joy of Computing Curriculum for High School Students

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Table of Contents

Abstract

This study evaluates the effectiveness of a modified delivery of the Beauty and Joy of Computing curriculum at Berkeley High School. Administering the modified curriculum as a new website, the author of this evaluation implemented checkpoints directly integrated into assignments and created a flexible format for teachers to edit material. Data from students and teachers were collected to determine perception of usefulness and extent of utilization of the features. The data implies that students overall perceive the website positively and utilize checkpoints effectively to complete assignments. In contrast, the data implicates that there are potential curriculum gaps that could be reduced further. Recommendations such as implementing a collaboration structure for teachers and increasing the frequency of formative assessments in checkpoints are made to improve this website.

Introduction

Located in Berkeley, CA, Berkeley High School (BHS) is the sole public high school that receives students from the district's three middle schools. The school has a total enrollment of around 3,200 students. Of the students, 11.6% are Black or African American, 22.2% are Hispanic or Latino, and 7.6% are Asian. Socioeconomically disadvantaged students account for 23.8% of the population and students with disabilities account for 11.6%. (BHS, 2024, p. 4). The diversified population of BHS and its urban environment is reflected in the policies around student enrollment in courses, including computer science. In a single graduating class, over 8% of students have enrolled in a computer science pathway course within the school's Career and Technical Education (CTE) program. Introductory courses are typically open enrollment for any student that is interested in the course. The AP Computer Science Principles (CSP) course at BHS serves as such an example. Given its introductory nature, it is important to examine the instructional approaches in CSP to foster enrollment, retention, and growth within the computer science pathway.

This paper evaluates the fidelity of the instructional materials and approach used in CSP at BHS. The current website for the course (dubbed "JacketCSP" for the purpose of this evaluation), was developed by the author of this evaluation. JacketCSP incorporates several features that contribute to a cohesive digital platform for both students and teachers. These features are of interest to all computer science teachers at the course, as they all utilize digital platforms. Furthermore, the CTE administrator, who promotes CTE pathways within the district, would be interested in how computer science courses are shaping their instruction. In the two years since its implementation, JacketCSP has not had a formal evaluation–it is now an opportune moment to evaluate how well these features are affecting student learning experience and share the evaluation results with the stakeholders.

Program Background

JacketCSP is a website that is currently used as the primary medium of curriculum presentation for the CSP course at BHS. CSP courses have the flexibility to select their curriculum and programming language; the teachers chose to implement the Beauty and Joy of Computing (BJC) curriculum, which is based on the CS 10 course offered at the University of California, Berkeley. JacketCSP is a modified version of the BJC curriculum that targets multiple perceived needs which emerged during implementation of BJC. Therefore, JacketCSP has never been formally evaluated in depth; this evaluation aims to formally evaluate the program and determine the effectiveness of the aspects of JacketCSP that were intended to enhance BJC.

The main objective of BJC (or more broadly, CSP) is to teach students "seven 'Big Ideas' (things to learn) and six 'Computational Thinking Practices' (things to do)" (UC Berkeley, n.d.). To meet this objective, BJC uses the Snap*!* programming language in its instruction. Snap*!*'s presentation of programming constructs and elements such as variable assignment, procedures, iteration, etc. differ to that of how students would encounter them on an AP aligned assessment.

BJC consistently employs daily lab-based assignments and utilizes a pair working model. According to UC Berkeley (n.d.), “Too much scaffolding in a project and the joy is gone; too little scaffolding and the student feels helpless and incompetent.” Teachers consistently observed students skipping crucial instructions and then asking questions about subsequent steps dependent on the skipped information. A feature added to JacketCSP is integrated Google Form check-ins throughout labs (checkpoints). Checkpoint tasks range from students verifying the completion of features via a checklist to answering questions that assess their understanding of specific concepts or implemented code. The checkpoints are also intended to enable continuous data collection on student progress throughout the course. The purpose of the data collection is to enable teachers to closely monitor students’ progress and be able to view the data when modifying and differentiating instruction. A goal of this evaluation will be to understand how well students are responding to this additional structure. An instruction-aligned goal will be to understand how the data is influencing teachers in being able to understand student progress and the steps that they are taking with what they notice from data.

The website also serves as a central source for students to immediately access and reference throughout the course of the year. This cohesive experience aims to reduce student confusion in locating materials and provide more explicit, structured instruction. Rather than having multiple Google Documents scattered in a Google Classroom, the website centralizes the materials in a more intuitive user-facing interface. The teachers need to understand whether these features are being utilized by students and whether they think it is an effective instructional strategy.

Lastly, as an in-house modified curriculum, the efforts have been made to ensure that material is accessible to all students. Specifically, a common challenge is the language demands associated with the AP alignment of the course. The AP CSP exam utilizes terminology that differs from that used in BJC, and these differences have not been touched in JacketCSP. This evaluation

seeks to determine how accessible students feel the materials are and will use an evidence based approach to determine whether students are understanding concepts in the course and are finding the format of the curriculum appropriate to the learning objectives of the course.

Evaluation Process

This evaluation aims to determine the extent to which JacketCSP influences student progress in the course and teachers' instructional strategies. This program evaluation will inform computer science teachers and the CTE administrator of the influence of digital platforms like the program in question. The evaluation collects perspectives of CSP students and teachers as well as academic scores to identify areas of strengths and weaknesses–thereby enabling development or implementation of better instructional tools.

Evaluation Questions

Evaluation questions were determined with consideration of the perceived needs that JacketCSP was designed to address: student experience in the course, data collection for teachers to modify instruction, and the common disconnect that students had with AP aligned tasks.

1. How is the intended cohesive experience of JacketCSP benefiting students as indicated by the value students place on the experience?
2. Do the integrated checkpoints effectively influence students to follow directions?
3. To what extent are the checkpoints influencing teachers to modify and differentiate instruction based upon the effectiveness of the data collected?
4. How well does the presentation of computational thinking concepts in JacketCSP support student understanding–based upon the (a) value placed by students on the materials and (b) scores on assessments?

Literature Review

The main goals of the features in JacketCSP are to facilitate students' self-efficacy and sustained effort in problem solving and to support their performance on assessments. This literature review grounds each of the evaluation questions for this evaluation of JacketCSP in student learning theories and success of digital learning environments similar to JacketCSP.

Cohesive Experience

The cohesive experience of JacketCSP intends to help students experience effective digital instruction, self-regulated learning, effective goal setting, and the power of reflection and differentiated instruction to enhance student engagement. JacketCSP has introduced many aspects to facilitate student learning, mainly focusing on a self-contained website for materials. Burch et al. (2016) emphasize that understanding the impact of digital education necessitates a thorough assessment of program characteristics, student access to services and the specific context delivered. This framework directly relates to how students derive benefits from JacketCSP– highlighting how well students believe that JacketCSP supports them likely stems from the quality and accessibility of the curriculum.

This raises the question of whether students believe that JacketCSP is a well-designed, cohesive learning environment, since such environments can scaffold students' practice of self-regulated learning and metacognitive skills (Azevedo & Hadwin, 2005). These skills are vital in a computer-based learning environment, enabling students to continuously monitor, adapt, and scaffold their own learning processes. The value students place on JacketCSP may reflect their active engagement in these self-regulatory processes, and this engagement leads to improved learning outcomes. For instance, Loksa et al. (2022) explicitly highlight the importance of metacognition and self-regulation for student success in programming education–demonstrating that instructional designs must foster such abilities.

The JacketCSP environment also aims to facilitate effective reflection. Effective reflection is strongly correlated with enhanced learning motivation, comprehension, and performance (Lin et al., 2014). Consequently, a cohesive program that thoughtfully integrates opportunities for student reflection encourages deeper engagement with the material (Lin et al., 2014). Additionally, acknowledging and catering to individual learner differences and interests within the program can positively influence students' engagement levels (Moallemi, 2024). While Elliott (2015) primarily focuses on Opportunity to Learn (OTL) and achievement growth, the value students place on a cohesive experience can be indirectly linked to how well the program provides and optimizes their OTL, thereby contributing to their perceived benefit and engagement. Students are more likely to value an experience that they perceive as effectively contributing to their learning and growth.

Checkpoints

JacketCSP makes an attempt in facilitating effective reflection by integrating checkpoints into the website. While the checkpoints aim to influence students to follow directions, the principles of goal setting, self-regulation, timely feedback, and continuous progress monitoring can also substantiate this influence. According to Zimmerman (1998), academic studying is fundamentally about students managing their own learning processes, and following directions constitutes a core component of effective self-regulation. Therefore, tools that aid in self-management, such as checkpoints, can significantly enhance adherence to instructions.

Checkpoints explicitly set clear goals for students through specific tasks or required responses. Latham and Locke (1991) illustrate this as a significant factor because goals powerfully regulate conscious human behavior, directing both attention and effort. Latham and Locke (1991) further elaborate that establishing clear and specific goals likely results in students accurately following directions, as compared to vague or undefined instructions. While Lin et al. (2014) focuses on reflection abilities, this concept can be broadly applied; if checkpoints are thoroughly designed to

prompt reflection on task completion or understanding, this metacognitive engagement could indirectly influence students' diligence in following subsequent directions by reinforcing the importance of accuracy and attention to detail.

Moreover, computer-based learning environments offer the capability to monitor and scaffold a learner's progress, providing adaptive support throughout the learning process (Azevedo & Hadwin, 2005). Ysseldyke & Bolt (2007) add that when these data collection tools feed into a continuous progress monitoring system that actively tracks student data, they can markedly improve students' diligence in following directions, as the system constantly monitors and utilizes their progress to inform instruction. In the context of JacketCSP, checkpoints can function as a direct feedback mechanism, allowing students to gauge their adherence to instructions and adjust their work. The checkpoints directly submit data into a Google Spreadsheet which the teacher uses during or after a class period to monitor student completion of objections.

Instruction Modification and Differentiation

Consequently, JacketCSP's checkpoints offer substantial potential to influence teachers' instructional modification and differentiation by providing actionable data that supports data-driven instruction and facilitates the implementation of differentiated pedagogical approaches. Differentiated instruction (DI) is recognized as a critical education strategy, particularly in classrooms with diverse learners, as a uniform teaching approach often proves ineffective (Dosh & Zidon, 2014; Moallemi, 2024; Tate, 2021). DI enhances learner engagement by addressing individual differences and relies on teachers' understanding of student needs (Moallemi, 2024).

Checkpoints allow teachers to access invaluable data regarding student comprehension and progress, empowering them to tailor content and instructional strategies to meet the varied requirements of their students (Tate, 2021). For instance, Dosch and Zidon (2014) highlight DI as a

student-centered model that has shown success in higher education by accommodating diverse learners, underscoring the role of data in effective differentiation.

Furthermore, the implementation of technological continuous progress monitoring systems have shown to result in significant student gains, especially when teachers actively use the data to manage and differentiate their instruction (Ysseldyke & Bolt, 2007). Checkpoints serve as such a system, providing teachers with up-to-the-minute insights into student performance. Elliott (2015) suggests that data enables teachers to strategically adapt their "Opportunity to Learn" (OTL), which he defines as the instructional time and content coverage dedicated to curriculum objectives. By providing robust data on student performance, checkpoints should empower teachers to make informed, data-driven decisions to optimize the student learning experience. Teachers using JacketCSP should effectively utilize data to optimize student learning, and if they are not, determine the gap in why data is not being effectively utilized.

Support for Student Performance

A final aspect of JacketCSP support for students includes scaffolds for student understanding within the website. An examination of the scaffolds implemented through JacketCSP for problem-solving behaviors and metacognitive engagement will evaluate how effectively JacketCSP supports student learning. According to Eichmann et al. (2020), the effectiveness of instructional approaches for computational thinking can be observed by analyzing students' behavioral patterns during problem-solving tasks. Sufficient scaffolds and instruction in these areas should lead to demonstrable improvements in how students approach and resolve problems, directly correlating with a deeper understanding of the concepts.

Developing metacognitive and self-regulatory skills is crucial for students to comprehend and apply in programming (Loksa et al., 2022). Azevedo and Hadwin (2005) indicate that metacognition, involving students' active monitoring and regulation of their own cognitive

processes, is essential for effective learning. If JacketCSP's design properly fosters such metacognitive processes–including effective planning, continuous self-monitoring of progress, and systematic debugging–it will likely enhance student understanding.

As a digital learning environment, JacketCSP's format and delivery link to student understanding and academic achievement (Burch et al., 2016). Burch et al. (2016) note that specific characteristics of digital learning environments, such as instructional format and underlying curriculum drivers , are positively associated with student achievement. Thus, the design choices within JacketCSP can directly impact learning outcomes.

Lastly, the ability to reflect on one's learning significantly improves motivation, comprehension, and performance (Lin et al., 2014). JacketCSP intends to encourage students to reflect on their learning, which should contribute to how well students believe JacketCSP supports them. When teachers tailor instructional presentation to differentiate learning, it leads to higher student engagement and, ideally, better assessment outcomes (Moallemi, 2024). Hopefully, JacketCSP fosters a deep understanding and strong performance through its comprehensive approach that combines effective instruction with opportunities for self-regulation and reflection.

Methodology

This section describes the participants, data sources, instruments, and procedures that are used to analyze data for this program evaluation of JacketCSP.

Participants

This program evaluation involves data collection from students and teachers.

Students. Students who took the AP CSP course in the 2023-2024 and 2024-2025 school years were invited to take the student survey.

Teachers. A total of three teachers have taught AP CSP, including the author. The teachers, excluding the author, were asked to fill out the teacher survey and then were followed up with an interview to gain clarification on their responses.

Question and Procedure Matrix

Evaluation Question	Information Required to Answer	Source of Information (Audiences to Provide Information)	Data Collection Strategy or Strategies	Importance of Question
Q1. How is the intended cohesive experience of JacketCSP benefiting students as indicated by the value students place on the experience?	Student perspectives regarding the website	Students who have taken the course since the implementation of the website	Student JacketCSP Survey	A primary goal of JacketCSP is to provide a central portal for student engagement. Understanding the student perspective will help determine the perceived helpfulness of this experience.
Q2. Do the integrated checkpoints effectively influence students to follow directions?	Student completion rate of lab assignments. Student perspective on impact of the forms. Student sustained effort duration from teacher observation.	Students who have taken the course since the implementation of the website All CSP Teachers	Student JacketCSP Survey Teacher JacketCSP Survey	Prior to JacketCSP, a perceived need was to reduce the frequency of students skipping instructions. This question helps assess whether this specific feature of JacketCSP is effective in reducing this issue.

Evaluation Question	Information Required to Answer	Source of Information (Audiences to Provide Information)	Data Collection Strategy or Strategies	Importance of Question
Q3. To what extent are the checkpoints influencing teachers to modify and differentiate instruction based upon the effectiveness of the data collected?	Teacher perspectives regarding the checkpoint data collection Teacher modification and differentiations to instruction	All CSP Teachers	Teacher JacketCSP Survey, followed by interviews with all CSP teachers for clarification.	A concern regarding the course was the efficiency of teachers' ability to track student progress. Understanding the specific changes implemented and gathering teacher input will help determine the perceived usefulness of the data for instructional planning.
Q4. How well does the presentation of computational thinking concepts in JacketCSP support student understanding–based upon the (a) value placed by students on the materials and (b) scores on assessments?	Student perspective on presentation of material. Assessment performance	Students who have taken the course since the implementation of the website	Student JacketCSP Survey Extant Data: Practice AP Exam Multiple Choice Questions scores	Students have struggled with concepts in the past. This hopes to evaluate student performance and areas where JacketCSP can improve in material presentation.

Data Sources and Instruments

There were four data sources for the program evaluation. To measure teachers' and students' perceptions of implementation fidelity, two separate surveys were developed and administered. Teachers were then interviewed to complete an understanding of their survey responses. Student assessment scores were pulled from one test administration to analyze student performance by topic.

JacketCSP Implementation Fidelity Survey for Students. (See Appendix A) A survey was administered to all students to gain an understanding on student perspective on their learning experience from JacketCSP. There were a total of four sections composed of a total of nineteen required 5-point Likert scale questions and an optional open-ended written feedback question in each section. Each of the first three sections focus on a specific feature of JacketCSP and ask students to compare the JacketCSP presentation of material to that of pre-JacketCSP presentation of the same type of material. The last section asks students about other general questions about JacketCSP. This instrument is essential to understand the student perspective on JacketCSP.

Of the total pool of 417 students (N = 417), 45 of those students could not be contacted because of the expiration of their district email after graduation. Forty-four students successfully responded to the survey (n = 44).

JacketCSP Implementation Fidelity Survey for Teachers. (See Appendix B) The teacher survey was distributed to the two CSP teachers (n = 2) who have worked with JacketCSP, excluding the author. The survey asks for teacher perception and estimation about how students have kept on task or sustained effort in the class either generally or on part of the influence of the checkpoints.

Teacher Interviews. (See Appendix C) Follow-up interviews with teachers were done so that the evaluator can better understand aspects of their survey responses. During the interviews, teachers were asked to elaborate more on any vague survey responses. Each interview lasted around

25 minutes and the author recorded the data into a written format by summarizing the teachers' responses.

Practice AP Exam Multiple Choice Questions Scores. A "Mock" AP Multiple Choice Exam was administered to students at the end of the 2023-2024 school year with a total enrollment of 229 students (N = 229). The extant assessment scores from the available pool of 223 students (n = 223) were compiled and analyzed to gain an understanding of student understanding on key concepts. There were three different versions of the assessment with no difference between questions besides the order of the questions. There were a total of thirty questions that each student received a score of 1 (as correct) or a score of 0 (as incorrect) on.

Procedures

The student surveys were conducted using Google Forms. Students were sent a link to the voluntary survey by district email and were financially incentivized to participate and enter a card raffle. Multiple reminders and follow-ups were made and resulted in a roughly 11.8% response rate of the contactable students. The survey provided an understanding on the general consensus that students perceived as to how specific features of JacketCSP benefitted them. This included perceptions on the checkpoints, experience on the website, and other questions related to their performance or how well they felt supported by JacketCSP. Some students provided open-ended feedback that elaborated on their responses.

Teacher surveys were sent a Google Form through personal channels and district email. Questions in the survey were centered around learning more about how the data from the checkpoints influenced them to modify and differentiate instruction and how the data informed them or not about student performance.

Teachers were then contacted by the author to schedule an interview. Questions in the teacher interviews were centered around understanding more about the teacher's perceptions about

the relevant evaluation questions regarding the checkpoints, modifying and differentiating instruction, and assessments

The mock AP exam MCQ scores were obtained through Gradescope, a website that the CSP teachers had used to score the common AP aligned assessment. The author manually reviewed each of the 30 MCQ items from the assessment and coded each item with one or more of the following categories: Sequencing, Iteration, Selection, Algorithmic Complexity, Abstraction, Boolean Expressions, Internet Concepts, Data Types, Binary, and Operators. An analysis of these categories reveals whether students generally perform well on the key categories.

Results

The findings from the collected data, discussion of the findings on the evaluation questions, and recommendations are presented.

Findings

The student-facing fidelity survey and multiple choice question scores resulted in a large data set that could be mostly treated as quantitative. Most data sourced from students was aggregated into a segmented bar graph then a paired-t-test between multiple variables was conducted to gain a measure of difference between student perception of different aspects of JacketCSP. There was sparse qualitative data from students that could be incorporated into a visualization context, but they mainly confirmed or provided a small degree of clarification into what students thought of the features.

The teacher-facing fidelity survey and interviews resulted in a data set that could only be treated as qualitative. Data analysis for the teacher perspective did not result in any concrete, observable trend due to the small sample size. However, there was interesting variation in teacher capacity and resulting actions from JacketCSP.

JacketCSP Implementation Fidelity Survey for Students

There is a consistently high proportion of "Agree" and "Strongly Agree" responses across most survey items in the segmented bar graph (Figure 1), often exceeding 60% and in some cases, over 80%. Features like embedded videos (Item 3), clear project specifications (Item 14), and easy content navigation (Item 13) received particularly higher ratings. Conversely, "Strongly Disagree" and "Disagree" responses remain notably low, typically below the 10% threshold.

Certain items received significantly lower ratings on average. Item 10, "I would rarely need a teacher to explain practice to me after I completed it," shows a significant departure from the positive trend, with a higher percentage of "Strongly Disagree" and "Disagree" responses. This observation is strongly reinforced by the heatmap (Figure 2), where Item 10 consistently exhibits statistically significant differences (often with p-values less than 0.001) when compared to a wide array of other positively perceived items, such as Item 3 (embedded videos), Item 8 (checkpoints ensuring proper completion), Item 11 (understanding concepts after practice and teacher explanation), Item 12 (enjoyment of website materials), and Item 13 (easy content finding).

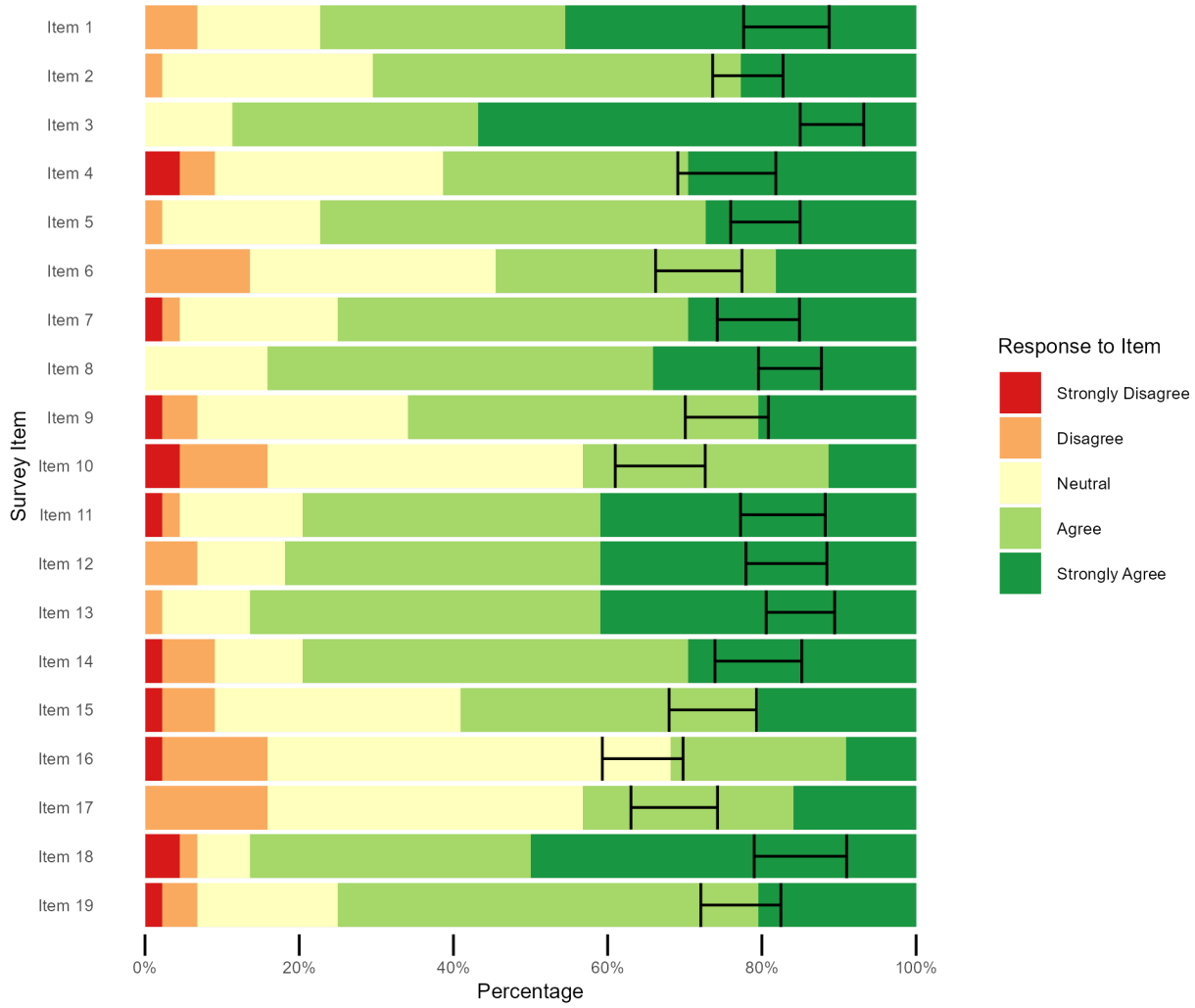
Similarly, Item 16 (helpful towards AP exam studying) and Item 17 (helpful towards AP aligned code) reveal more departures, with a higher proportion of "Neutral" and "Disagree" responses. Figure 2 further highlights these concerns, as Item 16 shows numerous statistically significant differences (p-values often less than 0.001) when compared to many highly-rated items like Item 1 (project on website vs. Google Doc), Item 3, Item 5 (checklist of features), Item 7 (checkpoints ensuring being on track), Item 8, Item 11, Item 12, and Item 13.

Furthermore, while the concept of checkpoints (Items 4, 5, 7, 8, 9) has generally higher ratings , Item 6, "Having multiple checkpoints across multiple pages was convenient," displays a slightly elevated "Neutral" response rate and significant differences with other positively received items in Figure 2 (e.g., Item 3).

In the open-ended feedback, students generally provided positively-aligned responses to the clarity to material that JacketCSP provided them and towards the modularity of the checkpoints (allowing them to check off required implementation items). Student feedback on the last section of the survey also reinforced the lower ratings that Item 16 and Item 17 revealed.

Figure 1

Differences in Student Response per Likert Survey Item from JacketCSP Fidelity Survey for Students



Note. Error bars denote constructed 1-sample z-intervals at 95% confidence.

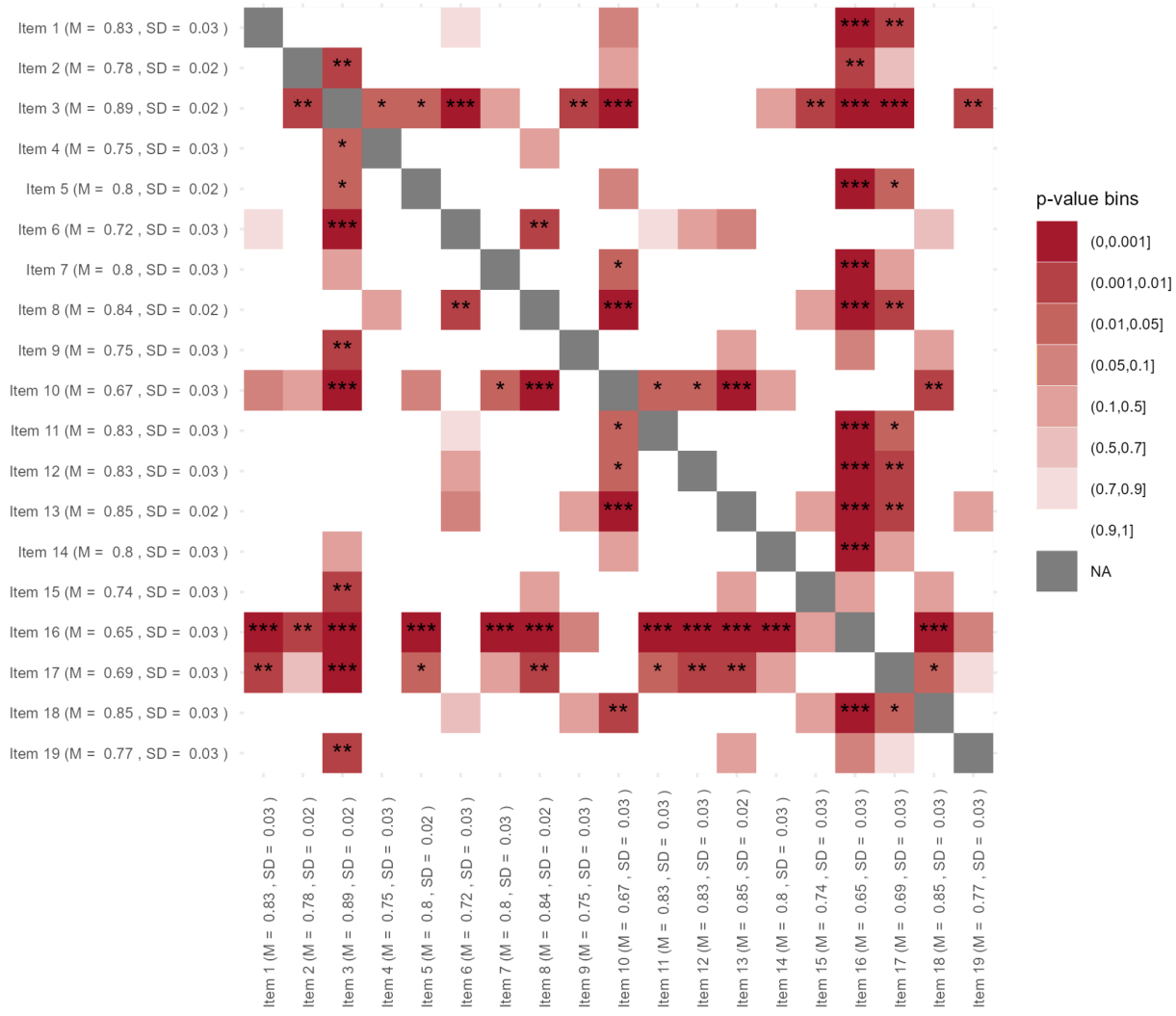
Here is a list of likert scale response items asked in the student survey:

- Item 1: I prefer the project being on the website versus a Google Doc
- Item 2: The styling of the specifications in the NEW version makes it easier to understand the requirements of the project
- Item 3: Having embedded videos makes examples easy to find.
- Item 4: Having checkpoints across multiple pages is more helpful than a single Google Form.
- Item 5: The checklist of features in the checkpoints make your progress through the labs clearer.
- Item 6: Having multiple checkpoints across multiple pages was convenient.
- Item 7: Having multiple checkpoints across multiple pages ensured I was on track to properly complete labs.
- Item 8: Having multiple checkpoints across multiple pages ensured I was able to correctly complete parts of the lab before I moved on.
- Item 9: Having repeated practice like in this checkpoint is helpful.
- Item 10: I would rarely need a teacher to explain practice to me after I completed it.
- Item 11: I would be able to understand the concepts more after the repeated practice AND a teacher explains them to me.
- Item 12: I enjoyed having all material for assignments on the website.
- Item 13: I knew how to find content easily by using the website.
- Item 14: The project specifications were clear.
- Item 15: I enjoyed learning how to use new features of Snap! not introduced on the website.
- Item 16: The website was helpful in studying for the AP exam.
- Item 17: The website was helpful in learning how to understand code the way it is on the AP exam.

- Item 18: Using blocks in Snap! helped me understand concepts like for loops, while loops, if-else statements, etc.
- Item 19: The curriculum and labs supported me in doing better on assessments (i.e. in-class tests/quizzes and the AP exam).

Figure 2

Heat map of Paired t-Test Results Between Likert Survey Items From JacketCSP Fidelity Survey for Students



Note. Asterisks indicate statistical significance at an alpha level of 0.05.

$p < 0.05$ (*), $p < 0.01$ (**), $p < 0.001$ (***)

Test p-values are reported after Holm-Bonferroni adjustment to control for multiple comparisons.

JacketCSP Implementation Fidelity Survey for Teachers

Teacher responses suggest that the checkpoints may function as an effective tier one support for students–supporting the majority of students well and offering some more benefits to students with more needs. A key finding is the high percentage of students teachers believe benefited from the multiple, integrated checkpoints. One teacher reported that 61%-70% of students benefitted, while another estimated 81%-90%. Both teachers noted that a key benefit was that students were required to complete each checkpoint before moving on, which suggests that the design successfully compels students to engage with the material in its intended sequence and complete the assigned directions before moving on to the next steps. On the other hand, the data suggests that there is a mixed perspective on whether checkpoints are highly effective at influencing all students to follow directions. Teachers estimated 41-50% of students improved sustained effort because of the checkpoints while another estimated 51%-60%. Similar mixed opinions are also presented in the other prompts about sustained effort. This may suggest that the checkpoints are effective in supporting some students in following directions or sustained effort.

The data collected by checkpoints seems to encourage teachers to track student progress but are having a rare impact on modifying and differentiating instruction. Both teachers reported that they "rarely" modified or differentiated instruction based on the checkpoint data. In contrast, they both indicated a much higher frequency for reviewing the data and tracking student progress—one teacher did so "Every day," and the other "After every lab." This indicates that while teachers are actively using the data for monitoring, they are not frequently translating these insights into adjusted instructional strategies for the class as a whole or for individual students.

Table 1

Data from JacketCSP Fidelity Survey for Teachers

Prompt	Teacher 1 Response	Teacher 2 Response
What percent of students actively sustained effort throughout the labs?	31%-40%	81%-90%
What percent of students did you think benefitted from having multiple checkpoints on multiple pages (as opposed to the previous practice of using a single Google Form).	61%-70%	81%-90%
In your opinion, most students may have benefitted from the checkpoints because of:	the teacher was able to see their responses., students had to fill out the checkpoint before moving on., it helped them understand what to implement from each lab page.	the modularity of the form they filled out., it was directly built into the website., students had to fill out the checkpoint before moving on.
What percentage of the students do you think the checkpoints helped in improving sustained effort?	41%-50%	51%-60%
In your opinion, the checkpoints may have helped improve most students' sustained effort because of:	the teacher was able to see their responses., students had to fill out the checkpoint before moving on., it helped them understand what to implement from each lab page.	the modularity of the form they filled out., students had to fill out the checkpoint before moving on.
What percentage of the students that would've "given up" or have a learning difficulty did you think benefitted from having multiple checkpoints on multiple pages (as opposed to the previous practice of using a single Google Form).	21%-30%	61%-70%
In your opinion, the checkpoints may have benefitted most of this group of students because of:	the teacher was able to see their responses., students had to fill out the checkpoint before moving on., it helped them understand what to implement from each lab page.	it was directly built into the website., students had to fill out the checkpoint before moving on., it helped them understand what to implement from each lab page.

Prompt	Teacher 1 Response	Teacher 2 Response
What percentage of the students that would've "given up" or have a learning difficulty do you think the checkpoints helped in improving sustained effort?	21%-30%	61%-70%
In your opinion, the checkpoints may have helped improve most of this group of students' sustained effort because of:	the teacher was able to see their responses., students had to fill out the checkpoint before moving on., it helped them understand what to implement from each lab page.	the teacher was able to see their responses., it was directly built into the website., students had to fill out the checkpoint before moving on.

Teacher Interviews

Both teachers found that checkpoints made tracking progress and differentiating instruction easier. Teacher B noted that the data provided a "birds eye view" of student pairs, which allowed them to quickly identify who needed support without having to check in with every single student individually. The system allowed teachers to intervene "at the moment / almost immediately" because that data would indicate which students did not understand a checkpoint item.

Teacher A observed that checkpoints forced students to clarify their thinking and acted as a "catch-all" to reveal what they had finished or missed. Students were observed going back to complete missed instructions after reviewing the checkpoints. Teacher B appreciated that the checkpoints combined "checks for understanding" and assignment submission in one place, serving as a "source of accountability" and providing daily formative data. In regards to student progress towards learning goals, Teacher A noted that students could "reset their mind" regarding their goals; struggling students focused on main learning goals, while others were tasked with more difficult work, providing indirect differentiation.

Teacher B felt the system relieved curricular organizational stress and amply prepared students for assessments. However, Teacher A felt it did not help "in a direct way" but made the class

better by allowing them to add scaffolds to fill gaps in the original concepts. For the AP exam, Teacher A noted that the website only acted as a “central portal” that helped students engage with the AP Create Task which supported students more than original BJC resources. To better support AP exam concepts (which students felt were lacking), Teacher A suggested adding a study guide with a list of concepts and vocabulary cross-referenced to specific labs.

Teacher A actively added supports or their own questions to checkpoints to explicitly underscore specific parts of a lab. For example, they noticed that students especially struggled with being able to implement a specific feature in one of the labs, they added an additional check for students to rethink whether they had met the specifications of the lab.

Table 2

Teacher Interview Questions and Responses

Questions	Teacher A	Teacher B
A main goal of the checkpoints was to track student progress and provide a basis to which we could modify and differentiate instruction. To what extent do you think the checkpoints made these easier to do?	Tracking progress and modifying/differentiated instruction were easier tasks to do. The data allowed a birds eye view of how each pair is doing; it is a challenging task to to check in with each and every student. It allied them to find out who needed support quickly. They checked in with the students at the moment / almost immediately.	It made it easier because it was clear. If a student did not understand a checkpoint thing, then it would be clear that the student needed intervention.
Do you think the checkpoints helped make instruction easier or more effective? How well do you think the checkpoints helped students understand the instruction on each page?	Checkpoints forced students to clarify their thinking and act as a literal checkpoint. It acted as a catch-all to see what they have finished or missed. Students were observed to have behaviors of going back to complete missed instructions	Checkpoints helped with instruction. In just one place, students could: complete checks for understanding and turn in assignments. This functions differently from that since it just makes sure students have not forgotten anything. Students will still ask for help if they need instruction. (When asked about how it helped students understand instructions) The teacher appreciated how it was great to see how well students could do with the checks for understanding and how it gave a good overview of assignment completion.
Do you have any examples of when you suggested or added something to a (future) checkpoint after you reviewed a past / current checkpoint's data?	Added in supports / own question to explicitly underscore a specific part of a lab. (ex. U1L3P4)	No examples, taught the class in a limited context

Questions	Teacher A	Teacher B
Do you think having the website has helped student's performance on in-class assessments?	It has not in a direct way, but has made the class "better." They appreciate the ability to add in specific scaffolds for specific concepts that the original may have a gap in.	Yes. A student would be amply prepared for assessments through the lab. The system seemed to help relieve curricular organizational stress as a first-time teacher.
What about the AP exam (the MCQ and Create Task?)	It acted as a central portal for information that helps students to engage in the Create Task.	N/A (Teacher did teach second semester)
Most student responses indicate that the website was not helpful in understanding concepts for the AP exam, do you think JacketCSP should be improved for that purpose?	Yes, a possible approach is a study guide for a list of concepts and vocabulary all in one place with included cross references to every lab so that they can refer to learning targets.	N/A (Teacher did teach second semester)
Clarification about survey responses (why did you not select other reasons?)	The checkpoints are not being used that much for practice right now, and students are simply following the goals that they have to meet for the lab.	The teacher believes that the modularity of the checkpoints were a helpful way for students to engage in the curriculum. Students did extend their goals and reset their mind towards what to complete from each page. It was a way to indirectly provide differentiated instructions. Students struggling with the content could set their goals to the main learning goals, and students were tasked to more difficult tasks. Check for understanding formatted checkpoints were a great source of accountability for students. It was a "quick" way for students to do and was a source of daily, formative data.

Practice AP Exam Multiple Choice Questions Scores

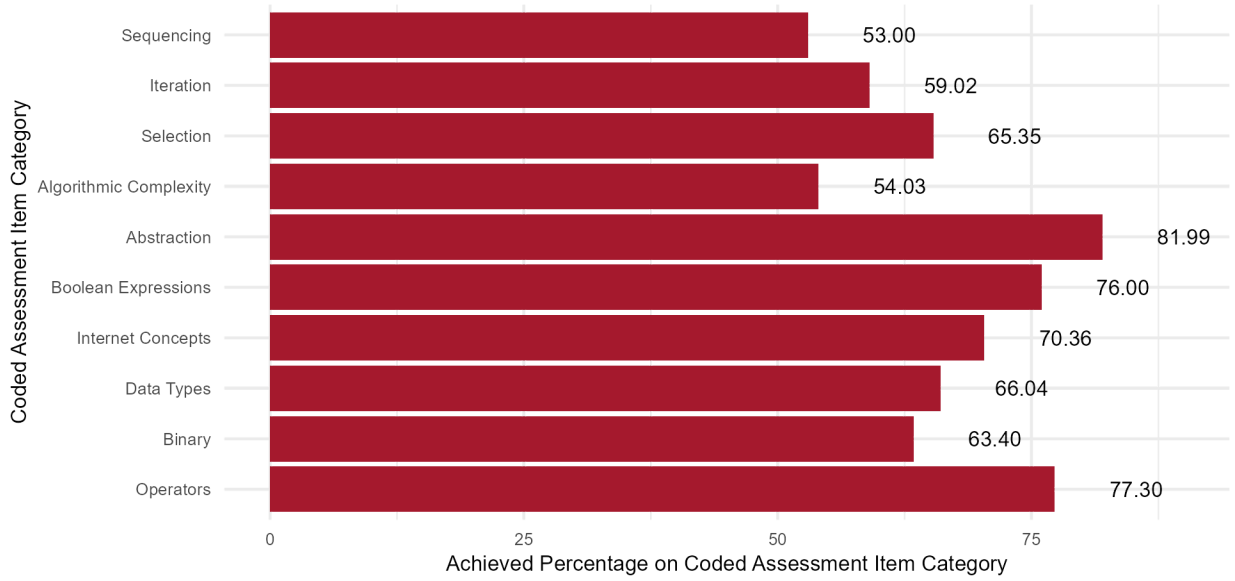
Figure 3 observes student mastery aggregated by topic. Students demonstrated a strong grasp of Abstraction, achieving the highest average percentage at 81.10%. This indicates that the curriculum and instruction effectively prepared students to understand and apply principles of abstraction, which are fundamental to managing complexity in programming. Similarly, performance in Operators (77.30%) and Boolean Expressions (76%) was also notably high, suggesting a solid understanding of logical operations and their application in code. These categories represent areas where students appear to be most proficient.

However, the data also highlights that students still struggle with programming with the fundamental skills of Sequencing, Iteration, and Selection. The data reveals that students are struggling on these individual concepts, earning a 53%, 59.02%, and 65.35% correctness rate (respectively) on average. These low scores may just indicate that these are naturally harder concepts to grasp and master as they are the primary skills involved in programming.

Students seem to also struggle with algorithmic complexity (54.03%) and binary (64.40%) at similar rates. Students are performing well on concepts outside of programming, with a 70.36% on Internet Concepts and Data Types (66.04%). These areas indicate a foundational comprehension, but with room for improvement to elevate more students to higher proficiency levels. The findings collectively point to a varied understanding of different computer science domains, with a clear distinction between highly proficient areas like abstraction and logic, and lesser areas like foundational control flow and algorithmic analysis.

Figure 3

Topic Mastery Percentage on Practice AP Exam Multiple Choice Questions



Limitations of Study

Factors such as the respondents survey, student motivation, teacher recollection, and the non-experiment context contributed to limitations in this study.

The JacketCSP Fidelity Survey for Students did not collect a representative sample of the student population post-JacketCSP implementation. The author was aware of a potential lack of data since the survey was distributed during summer vacation. As a result of that potential risk, she also extended the study to two school years. Of the 417 enrolled students, this survey only collected forty-four student responses (n = 44). At a near ten percent response rate, the data collected by the student survey likely suffers from significant non-response bias. The author speculates that the data may be skewed towards a more positive evaluation of JacketCSP because it may be likely that students who answered the survey are those who are more connected to their academics then the student who did not answer the survey.

In addition, student self-motivation to answer the survey may have affected the proportion of students who decided to answer the optional, free-response questions. With only thirteen out of the forty-four student responses having provided at least one response to one of the optional questions, it is likely that the survey could have uncovered more evidence, clarification, and negative feedback toward specific features of JacketCSP.

Teacher responses were also limited to memory and highly subjective. Teacher A had approximately five years of experience teaching the course versus Teacher B's first year of teaching the course. Teacher A is the teacher that the author had originally collaborated with to improve the curriculum of the course and in the course of that collaboration, had consistently modified practices. Teacher B taught the course in a limited context and was mainly subordinate to Teacher A's practices and classroom structure. In addition, Teacher B only experienced teaching one period of the course for the first semester, leaving them with little insight towards assessments and modifying or differentiating instruction.

Lastly, with the nature of this study being an observational study without comparison to previous years, neither a causal relationship nor linkage could be established in the context of any specific JacketCSP features. Even with comparison to previous years, no specific connection to any one feature of JacketCSP could be drawn to student achievement in specific topic areas or the course in general. With such a large shift in instructional strategy, this could only be expected. This study only has the ability to discuss whether JacketCSP seemed to fit student and teacher needs in these two years.

Discussion

Following the gathering of data and analysis of the data, this section discusses the implications of the data and findings on each of the evaluation questions.

Cohesive Experience

"How is the intended cohesive experience of JacketCSP benefiting students as indicated by the value students place on the experience?" Overall, the student fidelity survey indicates the sentiment towards the platform is largely positive, as evidenced by the consistently high proportion of "Agree" and "Strongly Agree" responses across most survey items. This suggests that features like embedded videos (Item 3), clear project specifications (Item 14), and easy content navigation (Item 13) are particularly well-received and appreciated by students.

The items that received significantly lower ratings stand out as areas for attention. The high percentage of disagreement for Item 10 ("I would rarely need a teacher to explain practice to me after I completed it") indicates that students still feel a strong need for teacher explanation. This suggests a stark contrast between the perceived value of website features and the enduring necessity of teacher involvement.

Item 16 (helpful towards AP exam studying) and Item 17 (helpful towards AP aligned code) suggest more mixed sentiments. Student open-ended feedback on the last section of the survey also confirms the misalignment of JacketCSP from the AP exam. This suggests that while other aspects of the website are highly valued, its direct utility for AP exam preparation is less universally acknowledged.

Lastly, it appears that while the overall idea of checkpoints is appreciated, the specific implementation of having multiple checkpoints across multiple pages might not be entirely convenient for all users. This is supported by the slightly elevated "Neutral" response rate for Item 6 ("Having multiple checkpoints across multiple pages was convenient") versus the positive sentiment towards the utility that checkpoints provide (Items 4, 5, 7, 8, 9)

The open-ended feedback from the student survey echoes the support that JacketCSP provided in terms of clarity of the instruction as well as the sequencing within checkpoints.

Checkpoints

"Do the integrated checkpoints effectively influence students to follow directions?" On the student-facing survey, students indicated on average that the checkpoints influenced their behaviors and were a system that ensured that they completed their labs. Items 5, 7, 8 (related to the student measures of checkpoint efficacy) all measured high average student response and the paired t-test revealed no significant difference between each item ($p > 0.05$). Of the few responses received for the open-ended questions, students provided feedback such as:

- "keep the multiple checkpoints because it really helped guide the procedure"
- "It was really helpful to be able to see how far through an assignment I was"
- "Just better to see if you [are] good to move on and not have to do a big form all at once."

The teacher survey and interviews seem to indicate that the checkpoints serve as a successful structure for self-correction and self-regulation among students. The checkpoints appear to function as a mandatory "pause" that disrupts student tendency to complete assignments quickly. Teacher A noted that checkpoints "forced students to clarify their thinking" and acted as a "catch-all to see what they have finished or missed". Consequently, students were explicitly observed displaying behaviors of "going back to complete missed instructions," suggesting the tool effectively influences students to complete tasks. Beyond only going back to complete instruction, the checkpoints influence how students manage their own workflow. Teacher A mentioned that students would "extend their goals and reset their mind towards what to complete from each page," indicating that the checkpoints help structure the student's engagement with the curriculum. This implies that while the checkpoints might not replace initial instruction, they are effective at ensuring the directions provided in that instruction were actually followed before students moved on.

Based on student and teacher perspectives it appears that there are two primary ways that the checkpoints influence students to follow directions. (a) Students use the checkpoints as a way to

check their progress through a lab–the checkpoints effectively serve as a “guide” for students to complete the labs. If a student has not completed a certain task, then the checkpoint ensures that students “pause” to check if they completed everything before moving on. (b) The checkpoints serve as a point of differentiated instruction for students. Checkpoints typically have questions or items that “forced students to clarify their thinking" and helped students manage workflow. It managed workflow by structuring student engagement and also opened up a point of discussion for students to engage in thinking about whether their tasks were completed.

Instruction Modification and Differentiation

“To what extent are the checkpoints influencing teachers to modify and differentiate instruction based upon the effectiveness of the data collected?” Teachers that have a high commitment to the course generally created and modified scaffolds for students to engage with the curriculum. This includes Teacher A and the author. Teacher B had a unique situation of teaching only one period for one semester, along with other commitments for other classes and another role at the school. The interviews revealed that the teachers consistently reviewed data in order to deliver targeted immediate intervention to students during labs in-class. Meanwhile only Teacher A had directly modified student-facing directions in JacketCSP and the checkpoints.

This demonstrates that while the checkpoints were a useful source of data towards differentiated instruction, the extent to which teachers utilized the data from the checkpoints in modifications to instruction was bottlenecked by teacher commitment and teaching assignment context.

Support for Student Performance

“How well does the presentation of computational thinking concepts in JacketCSP support student understanding–based upon the (a) value placed by students on the materials and (b) scores on assessments?” Student scores reveal curriculum gaps in certain topic areas. Particularly, student

skills in understanding algorithmic processes and control flow (sequencing, selection, and repetition). However, this might be attributed to general difficulty for students to comprehend any and all problems presented to them in these more difficult (but basic) areas. According to the 2025 AP Exam administration's Instructional Planning Report (cannot be disclosed or shared per the terms and conditions), students at the school performed, on average, better than the global average in all topic areas. Regardless, students should and will possibly be more able to close the gap with other topic areas if more support is focused on the topics that students generally perform worse on.

Student responses indicated a disconnect between student support in understanding the Snap*!* led BJC curriculum and assessments. Students generally agreed that the JacketCSP provided great support in understanding concepts and performance (Items 18 and 19). However, they agreed less on average that it was helpful in studying and learning AP-aligned material (Items 16 and 17). So while students generally felt supported to do well in the course, students felt less so when it came to the AP exam.

Recommendations

A general consensus of students and teachers indicate that JacketCSP provides a coherent experience that facilitates a streamlined learning environment. Students can utilize the website as a central portal to find all material for the course, including turning in assignments. Teachers appreciated the organization of the material on the website as well as the ease to which they could monitor student progress as they went through a lab; improving the rate at which they could identify and provide interventions for struggling students. There do not appear to be any recommendations that could be shaped towards improving the medium to which students meet learning objectives from BJC. JacketCSP appears to be an effective platform for students and teachers to engage in the class.

JacketCSP can be improved by improving the frequency of differentiated and diverse checkpoint formats. As a readily editable platform, the teacher should be able to shape the content in the checkpoints. Teachers should engage in effective collaboration to make data-based decisions in regard to this. These decisions should focus on reformatting and designing the checkpoints such that they collect robust data on student performance and understanding through assessment-type questions. The main focus should be in supporting students more in the foundational programming topics surrounding the development and interpretation of algorithms. The school should also provide a dedicated professional development structure that allows for teachers like Teacher B to engage more in collaboration even with a limited attachment to the course. Introducing this new structure should be feasible in practice since the computer science teachers mostly attend math department sessions without collaborating with the math department. Teachers should collaboratively consider adding items to the checkpoints that can indicate student understanding of concepts that parallel in-class assessments as well as AP-aligned questions. This should be combined with the already-existing format for ensuring students follow instructions and submit their assignments through the checkpoints.

Lastly, JacketCSP should provide more supports for student performance and understanding for the AP exam. Teacher A suggested that JacketCSP can add a section to the website dedicated to cross-references between BJC and the AP Exam. The sections should include at the very least:

1. A vocabulary list with definitions.
2. Crossreferences from AP-aligned vocabulary *and* pseudocode snippets to lab pages where the concept was introduced to them using Snap*!*.
3. A list of resources that students can supplement their understanding and effort towards the AP Exam

In addition to the additional section, students should also be supported during learning of the BJC labs through a mechanism that forces students to notice and critically think about the pseudocode and Snap*!* link as well as the vocabulary definitions and Snap*!* Link. Students also need to receive more support on topics that students generally struggle with compared to others. These could be implemented in modifications to the checkpoints or including more prompts in JacketCSP for students more closely related to the AP exam and the topic areas related to control flow.

During the implementation of the recommendations, teachers should monitor student topic mastery. Based on any findings, teachers need to provide more differentiated support by modifying checkpoint contents. After the implementation of the AP-aligned section of JacketCSP, the student survey should be re-administered at the end of the year to all students for the school year. Further research should be conducted to investigate ways to further scaffold and help students relate BJC curriculum to the AP exam.

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Appendices

Appendix A

JacketCSP Implementation Fidelity Survey for Students

This appendix is formatted to better fit this paper.

Introduction

Hi AP CSP alum!!! Please fill out this survey for Ms. Chang's project in her master's program at SDSU.

Filling out this survey will help Ms. O'Keefe, Ms. Chang, and other potential future teachers for AP CSP at Berkeley High make the course as great as possible! Ms. Chang is interested in how well she has implemented specific features within the website that you use and how those may relate to how you do or feel about the course. You'll be able to provide feedback to shape the future of the website and pinpoint specific things that you are concerned about.

We are very interested in making students' experience as pleasant as possible, while dipping into materials that support all students in succeeding! Let Ms. Chang know what is working and / or what could be fixed/improved!

As you fill out this survey and provide feedback, please be aware that there are some parts of the course that are inflexible. Make your feedback count by mentioning how we can change activities or add to support you!

For example, we have to teach you about abstraction and about higher order functions. What you can do is provide feedback on how those are presented or how you feel supported in learning about those concepts.

Even if you don't have useful, written feedback, please at least fill out this survey and provide your ratings for each of the multiple choice items!!!

Comparisons

The following three sections allow students to compare three ways in how material was presented in the past versus how it is presented now in JacketCSP.

Comparison 1.

<table>
<tr><th>Unit 1 Project: eCard -- OLD (2022)</th><th>Unit 1 Project: eCard -- NEW (2024)</th></tr>
<tr><td>
Beauty and Joy of Computing Unit 1 Assessment

Create an eCard that meets all of the following specifications:
1. Has a message for the viewer (such as "Happy New Year," "Happy Birthday," "Get Well Soon," etc.)
2. Has a theme (such as holiday, sports, TV show, a photo, original art, etc.)
3. Has stage and sprite costumes
4. Works properly (is not buggy)
5. Includes a custom block. This can be either:
    ○ A start over block that resets the eCard to the beginning (resets pen, stage, and sprites) OR
    ○ Another custom block containing at least 3 blocks (this could move a sprite, change the background, etc.)
6. Uses repeat until or for
7. Lets the user interact (e.g., by clicking a sprite, pressing a key, or moving the mouse)
8. Includes one additional feature. You can choose either:
    ○ Includes sounds or music (using the play block and/or the "Sounds" tab) OR
    ○ Uses the random block

When you have finished your app, fill in the writeup on the given template. This kind of write-up is part of what you will need to do for the AP Create Task.)
</td><td>
Project: eCard
Unit 1

This is an individual project. This means that all of your work must be your own, indisputable work. If you need help on something, you may ask other people for help, however, the scripts that you create must be your own work. If there's any convincing evidence that the work that you submit is not your own, you will recieve an automatic 0 on this project and any participation grade related to working on the project.

In this project</b, you will apply your current knowledge of computer science towards creating an eCard of your choice following the specifications listed on this page.

In addition, you'll have a Google Form where you will explain why, where, and how you used blocks in your project.

On the last day of this project, we will have a gallery walk to show everyone the progress that you've made!

eCard Specifications

Create an eCard (see what an eCard is) that meets all of the following specifications:
1. Has a message for the viewer (such as "Happy New Year," "Happy Birthday," "Get Well Soon," etc.)
2. Has a theme (such as holiday, sports, TV show, a photo, original art, etc.)
3. Has stage and sprite costumes
4. Works properly (is not buggy)
5. Includes a custom block. This can be either:
    ○ A start over block that resets the eCard to the beginning (resets pen, stage, and sprites) OR
    ○ Another custom block containing at least 3 blocks (this could move a sprite, change the background, etc.)
6. Uses repeat until or for
7. Lets the user interact (e.g., by clicking a sprite, pressing a key, or moving the mouse)
8. Includes one additional feature. You can choose either:
    ○ Includes sounds or music (using the play block and/or the "Sounds" tab) OR
    ○ Uses the random block

Google Form Specifications

When you have finished your app, fill in the given Google Form on Google Classroom.
▸ The Google Form has the following questions for you to answer:

Rubric

The rubric for this project is included in the Google Classroom assignment.

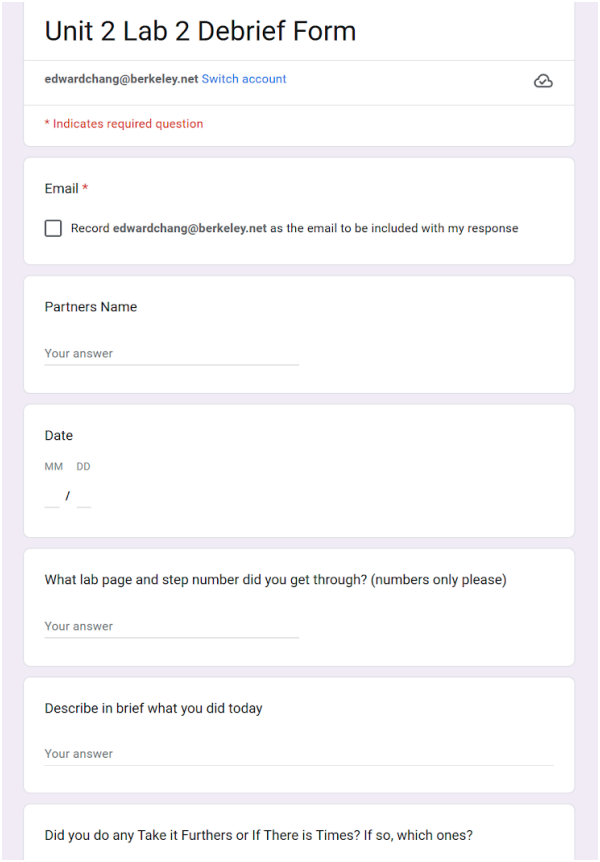
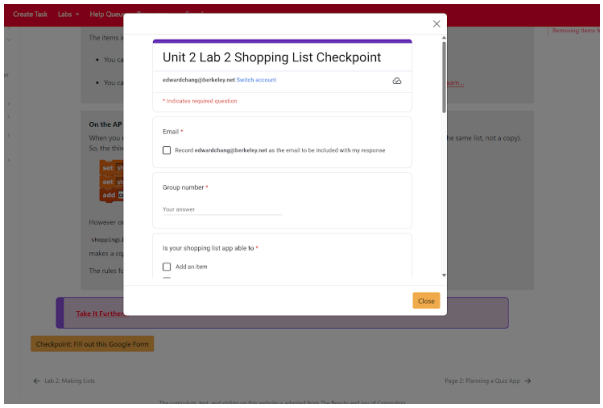
Examples

</td></tr>
<tr><td colspan="2">A closer look</td></tr>
<tr><td>https://docs.google.com/document/d/1yV5JyBOKu2XJBwIIghyIitCgjk3hNiqMGlXPMNszU9U/edit?usp=sharing

In the old version, we still used a website, but the project was posted separately as a Google classroom assignment.</td><td>https://bjc.jacketcs.net/unit-1/project/

In the new version, we now have a website that contains close to all material for the course.</td></tr>
</table>

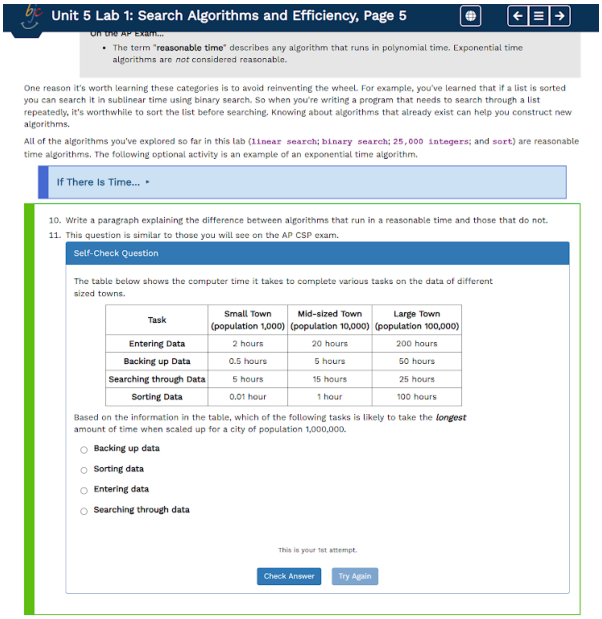
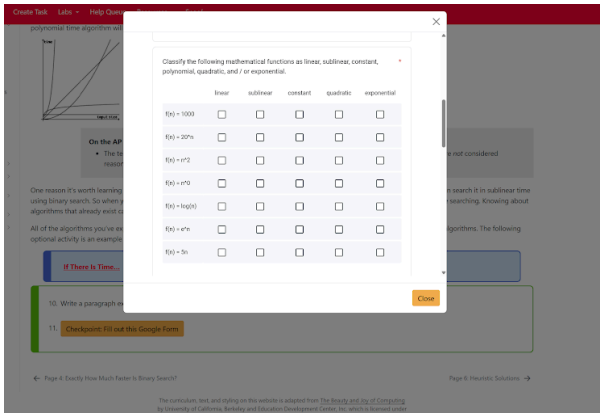
Comparison 2.

<table>
<tr><td>Unit 2 Lab 2: Shopping List First Checkpoint -- OLD (2022)</td><td>Unit 2 Lab 2: Shopping List First Checkpoint -- NEW (2024)</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">A closer look</td></tr>
<tr><td>https://forms.gle/efkdbyWd3V6RFRea9

In the old version, we had a single Google Form for every lab, regardless of page count. The form was required for all students to complete at the end of the period and it kept track of where you ended up on and any difficulties that you ran into.</td><td>https://bjc.jacketcs.net/unit-2/lab-2/1-shopping-list-app.html

In the new version, there are multiple, single checkpoints for you to fill out when you complete a certain part. This is done by embedding a Google Form in the website per checkpoint that we wanted. Checkpoints also ask specific questions and places for you to check off whether you completed key components from that page or following from the last checkpoint.</td></tr>
</table>

Comparison 3.

Unit 5 Lab 1: Algorithms Page 5 Checkpoint -- OLD (2022)	Unit 5 Lab 1: Algorithms Page 5 Checkpoint -- NEW (2024)
	
A closer look	
https://bjc.edc.org/bjc-r/cur/programming/5-algorithms/1-searching-lists/5-categorizing-algorithms.html In the old version, the same kind of Google Form was reused for this lab. The old version introduced the idea of algorithm complexity and provided some examples to you. Students' answers to the question on the website was not viewable by the teachers.	https://bjc.jacketcs.net/unit-5/lab-1/5-categorizing-algorithms.html The new version preserves all of the old version and adds in additional information. Generally, in the new version, some checkpoints serve as more practice for you to do and get used to certain concepts. In this specific checkpoint, multiple questions were asked of you about algorithm complexity and you were asked to submit your own response as to what the "difference between algorithms that run in reasonable time and those that do not."

Questions

Questions were presented after each respective section noted above.

Comparison 1 Questions.

Indicate whether you strongly disagree, disagree, neutral, agree, or strongly agree with the following statements:

1. I prefer the project being on the website versus a Google Doc.
2. The styling of the specifications in the NEW version makes it easier to understand the requirements of the project.
3. Having embedded videos makes examples easy to find.

Any additional questions, feedback on this kind of feature, etc...?

Comparison 2 Questions.

Indicate whether you strongly disagree, disagree, neutral, agree, or strongly agree with the following statements:

1. Having checkpoints across multiple pages is more helpful than a single Google Form.
2. The checklist of features in the checkpoints make your progress through the labs clearer.
3. Having multiple checkpoints across multiple pages was convenient.
4. Having multiple checkpoints across multiple pages ensured I was on track to properly complete labs.
5. Having multiple checkpoints across multiple pages ensured I was able to correctly complete parts of the lab before I moved on.

Any additional questions, feedback on this kind of feature, etc...?

Comparison 3 Questions.

Indicate whether you strongly disagree, disagree, neutral, agree, or strongly agree with the following statements:

1. Having repeated practice like in this checkpoint is helpful.
2. I would rarely need a teacher to explain practice to me after I completed it.
3. I would be able to understand the concepts more after the repeated practice AND a teacher explains them to me.

Any additional questions, feedback on this kind of feature, etc...?

Other Questions.

Indicate whether you strongly disagree, disagree, neutral, agree, or strongly agree with the following statements:

1. I enjoyed having all material for assignments on the website.
2. I knew how to find content easily by using the website.
3. The project specifications were clear.
4. I enjoyed learning how to use new features of Snap! not introduced on the website.
5. The website was helpful in studying for the AP exam.
6. The website was helpful in learning how to understand code the way it is on the AP exam.
7. Using blocks in Snap! helped me understand concepts like for loops, while loops, if-else statements, etc.
8. The curriculum and labs supported me in doing better on assessments (i.e. in-class tests/quizzes and the AP exam)

Any other questions or specific feedback that you weren't able to give in the previous questions?

Appendix B

JacketCSP Implementation Fidelity Survey for Teachers

This appendix is formatted to better suit this evaluation report.

1. What **percent of students** actively sustained effort throughout the labs?

   (Respond with 0%, 1%-10%, 11%-20%, 21%-30%, 31%-40%, 41%-50%, 51%-60%, 61%-70%, 71%-80%, 81%-90%, 91%-99%, or 100%)

2. What **percent of students** did you think benefitted from having multiple checkpoints on multiple pages (as opposed to the previous practice of using a single Google Form).

   (Respond with 0%, 1%-10%, 11%-20%, 21%-30%, 31%-40%, 41%-50%, 51%-60%, 61%-70%, 71%-80%, 81%-90%, 91%-99%, or 100%)

   a. In your opinion, most students may have benefitted from the checkpoints because of:

      (Check all that you believe factored in: the modularity of the form they filled out, the teacher was able to see their responses, it was directly built into the website, students had to fill out the checkpoint before moving on, it helped them understand what to implement from each lab page, it helped students set their own goals as to what to complete from each lab page, it provided students a space for additional practice, other–free response)

3. What **percentage of the students** do you think the checkpoints helped in improving sustained effort?

   (Respond with 0%, 1%-10%, 11%-20%, 21%-30%, 31%-40%, 41%-50%, 51%-60%, 61%-70%, 71%-80%, 81%-90%, 91%-99%, or 100%)

   a. In your opinion, the checkpoints may have helped improve **most students' sustained effort** because of:

      (Check all that you believe factored in: the modularity of the form they filled out, the

teacher was able to see their responses, it was directly built into the website, students had to fill out the checkpoint before moving on, it helped them understand what to implement from each lab page, it helped students set their own goals as to what to complete from each lab page, it provided students a space for additional practice, other–free response)

4. What **percentage of the students that would've "given up" or have a learning difficulty** did you think benefitted from having multiple checkpoints on multiple pages (as opposed to the previous practice of using a single Google Form).
   (Respond with 0%, 1%-10%, 11%-20%, 21%-30%, 31%-40%, 41%-50%, 51%-60%, 61%-70%, 71%-80%, 81%-90%, 91%-99%, or 100%)
   a. In your opinion, the checkpoints may have benefitted **most of this group of students** because of:
      (Check all that you believe factored in: the modularity of the form they filled out, the teacher was able to see their responses, it was directly built into the website, students had to fill out the checkpoint before moving on, it helped them understand what to implement from each lab page, it helped students set their own goals as to what to complete from each lab page, it provided students a space for additional practice, other–free response)
5. What **percentage of the students that would've "given up" or have a learning difficulty** do you think the checkpoints helped in improving sustained effort?
   (Respond with 0%, 1%-10%, 11%-20%, 21%-30%, 31%-40%, 41%-50%, 51%-60%, 61%-70%, 71%-80%, 81%-90%, 91%-99%, or 100%)
   a. In your opinion, the checkpoints may have helped improve **most of this group of students'** sustained effort because of:

(Check all that you believe factored in: the modularity of the form they filled out, the teacher was able to see their responses, it was directly built into the website, students had to fill out the checkpoint before moving on, it helped them understand what to implement from each lab page, it helped students set their own goals as to what to complete from each lab page, it provided students a space for additional practice, other–free response)

6. Differentiation and modification of instruction
    a. Please indicate the average frequency to which you:
        i. Reviewed data from the checkpoints in the spreadsheet that you had.
        ii. Modified instruction by using data from the checkpoints
        iii. Tracked student progress through the labs by using data from the checkpoints
        iv. Differentiated instruction by using data from the checkpoints

    (Respond to each with never, rarely, after every unit, after every 2-3 labs, after every lab, after every checkpoint, every day, or everyday during the period)

    b. Please indicate specific concepts that you may have modified instruction in based on the checkpoint data.

Keep in mind...

That you'll be interviewed about your responses!

It would be great for you to have examples in mind of how you differentiated and modified instruction ahead of time. The interview would likely have to occur after 4 PM PT.

Appendix C

Teacher Interviews Question Guide

The following questions were used to guide the interviews conducted with Teacher A and Teacher B. Not all questions were asked verbatim, but they were asked to obtain analogous data between teachers.

Main questions

1. A main goal of the checkpoints was to track student progress and provide a basis to which we could modify and differentiate instruction. To what extent do you think the checkpoints made these easier to do?
2. Do you think the checkpoints helped make instruction easier or more effective? How well do you think the checkpoints helped students understand the instruction on each page?
3. Do you have any examples of when you suggested or added something to a (future) checkpoint after you reviewed a past / current checkpoint's data?
4. Do you think having the website has helped student's performance on in-class assessments?
5. What about the AP exam (the MCQ and Create Task?)

Check-in about responses

1. You indicated that (low/neutral/high) response to (a question), why did you feel that way?
2. Can you elaborate on some next steps that you took during a lab because of data that you saw from the checkpoint?
3. If you didn't modify / differentiate anything based off the data from the checkpoints, why didn't you? How could the data be more helpful? (Maybe they only did something based off observation of students)

Check-in about student responses

1. Most student responses indicate that the website wasn't helpful in understanding concepts for the AP exam, do you think JacketCSP should be improved for that purpose?