

Using Student and Teacher Feedback to Modify CS Curriculum

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ABSTRACT

The CS education community has over the years recognized the importance of data science by including it in the seminal K-12 CS Framework. The move is prompted by research that shows data science is a great tool to broaden participation in CS because it offers students an opportunity to apply their computing knowledge to socially relevant problems. Broadening participation, particularly among underrepresented students, is critical to the future health and stability of the field. However, data science is still a relatively new in the context of K-12 schools and few CS teachers are pedagogically trained in data science. In order to test whether or not data science can be a tool to increase student representation in CS and help schools implement more data science curriculum, our project partnered with a local school district to modify an existing data science unit. This work explores the process of how our research practice partnership tackled the development of the new data science unit.

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1 BACKGROUND & OVERVIEW

Our project is a research-practice partnership to help computer science students connect more deeply with CS content and elevate practices that promote inclusion and equitable participation in CS classrooms through data science. One of the goals of the project is to modify the data science unit in the Computer Science Discoveries curriculum from Code.org, which the District uses as an introductory computer science curriculum for grades 6-10. The overall goal is to make data science more relevant and engaging for students, particularly girls, underrepresented minority students, and English learners

This poster will focus on phase one of the project, during which we collected data from two student focus groups, a teacher survey, and two teacher focus groups. This data was used to inform the lesson design process and provided insight into the current practices and beliefs held by students and teachers in regard to the partner district's data science unit. In the current phase of the project, the lesson design team, consisting of the three middle school math

teachers and three middle school CS teachers, are using the collected data to develop a new unit plan and redesign several lessons from the original data science unit.

2 POSTER CONTENT

2.1 Background Information and Context

In this section, we will include our poster title, team members, and background information about our NSF-funded research practice partnership.

2.2 CS Teacher Survey Data

This section will focus on a graphic presentation of the survey instrument and its corresponding results. Through the survey we learned few teachers spent time covering the data science unit and even more believed the content of the unit did not properly engage students.

2.3 Focus Groups

The focus groups were another method used to further understand what students and teachers know about data science and what they perceive as data science. This section will contain a copy of the original protocol as well as the coding schema (based on Lee et al. [1]). The focus groups revealed that teachers believe the data science unit to be disconnected from the rest of the CS curriculum while students strongly associate data science with the act of coding.

2.4 Conclusion & Next Steps

The research team concluded the data science unit lacked content that connected with its audience of teachers and students. For students, the data science unit was "boring" and outside of their lived experience. For teachers, the concepts being taught were nebulous and disconnected from other units in the curriculum. Due to these findings, the research team is modifying three units related to manipulating large data sets and plans to pilot these modules in Fall 2022.

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REFERENCES

- [1] Victor R. Lee, Michelle Hoda Wilkerson, and Kathryn Lanouette. 2021. A Call for a Humanistic Stance Toward K-12 Data Science Education. *Educational Researcher* 50, 9 (2021), 664–672. <https://doi.org/10.3102/0013189X211048810>

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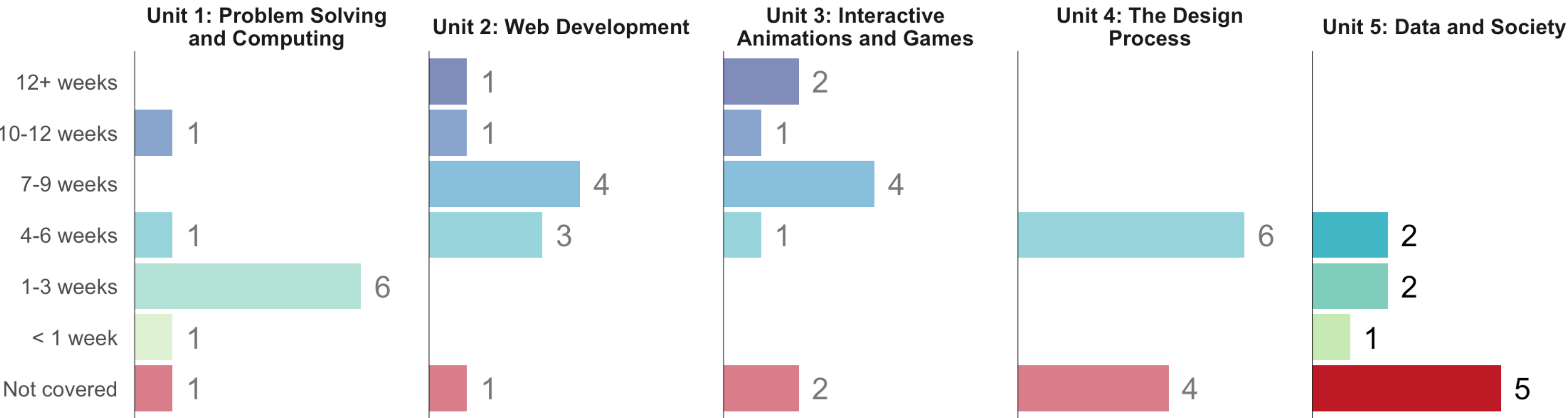
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CS Connections

An NSF-funded research-practice partnership between WestEd and the Oakland Unified School District (OUSD) to develop data science lessons for middle school computer science classes.

CS Teacher Survey

About how much time do you spend on each unit? (n = 10 teacher responses)



CS teachers in OUSD do not devote significant time to the Data and Society unit, with half of respondents skipping it altogether.

I think this unit needs more digital components that would engage students interactively. I feel the students would relate more if it were more teen topical.

The students are bored with Unit 5. I have had a few ask me what this has to do with computers and I've had to explain my whole lesson plan so they could understand how this piece fits in.

Focus Groups

Middle school students, math teachers, CS teachers

- What does the term *data science* mean to you?
- Have you seen any examples of data science? If so, can you tell me about them?
- Have you [learned/taught] data science in your classes? If so, can you tell me about it?
- Do you know anyone who works in data science? Can you tell me about them?

Students: Do you want to be a data scientist when you get older? Why or why not?

Teachers: Do you have any interest in incorporating data science into your teaching? Why or why not?

Code	Definition
Source of data science information	
Personal	Student thoughts on data science pertaining to student's own personal interests, identity, or experience
Secondary	Student thoughts on data science pertaining to the personal interests, identity, or experience of someone they know (e.g., a parent)
How data science is done	
Disciplinary	Student thoughts on the tools, artifacts, disciplinary practices and cultural practices used in a data science activity
What data science is used for	
Sociocultural	Student thoughts that question or describe how data is used, collected, or interpreted in society.
Affect towards data science	
Data science interest	Moments where students indicate interest or curiosity toward data science projects or concepts
Data science disinterest	Moments where students indicate a lack interest or curiosity toward data science projects or concepts
Confidence	Confidence in being able to do data science
Lack of confidence	Lack of confidence in being able to do data science

Codes adapted from: Lee, V. R., Wilkerson, M. H., & Lanouette, K. (2021). A Call for a Humanistic Stance Toward K–12 Data Science Education. *Educational Researcher*, 50(9), 664-672. <https://doi.org/10.3102/0013189X211048810>.

Students had some intuitive ideas about data science, but may not be fluent with the term “data science”. One group of students equated data science with binary, as they had recently worked on Lesson 3, which focuses on ASCII and binary representations. Other students mentioned COVID graphs, YouTube analytics, and finance as being possibly related to data science.

Teachers and students did not understand the connection between computer science and data science. For most of them, computer science meant coding apps, games, and doing web development while data science meant data collection and data cleaning. The Data & Society unit does not have a lot of coding in it.

The motivation for teaching/learning data science was unclear to students and some teachers. For the CS teachers, the Data and Society unit seemed to be a dramatic shift from the units that focus on coding. Students did not see how data science might connect to their daily lives or desired careers.

Teachers expressed concerns that students did not have sufficient math background or technical skills for data science projects and worried that a lot of time would be taken up teaching the basic skills. Students in middle school are still learning foundational concepts like variability. Not all students will know what a scatterplot is or how to make one. Many students have not been exposed to spreadsheets.



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